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VOLUMES VII-X
PART 2

1958-1961 LITERATURE

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6. BIOLOGICAL, PHYSIOLOGICAL, AND PSYCHOLOGICAL EFFECTS OF ENVIRONMENTAL FACTORS AND STRESSES

f. Environmental Temperature

[*Body temperature under 3-e; Thermal radiation under 6-n*]

10638
Adams, T., 1961
E. J. Heberling, and R. B. Payne
THE EFFECTS OF GLYCINE ADMINISTRATION ON HUMAN RESPONSE TO AN ACUTE STANDARDIZED COLD STRESS.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Report no. 60-19, April 1961. 12 p.

Glycine (amino-acetic acid) and other calorigenic, dietary adjuncts have received considerable attention recently and have been reported to modify whole body responses to cold exposure and hypothermia. In addition to any pharmacological action, the potential value of glycine and similar materials lies in their ability to provide additional calories to the cooling organism via the mechanism of specific dynamic action. Thirty grams of glycine were administered orally to five volunteer, male subjects who were subsequently exposed nude to an environment of 10°C. Measurements of rectal and extremity suface temperatures and whole body metabolic rates failed to show any statistically significant effects that could be attributed to the influence of glycine, as compared to glucose control measurements, throughout a 1-hour cold exposure. At this level of cold stress and drug dosage, glycine could not be seen to affect cold elicited, physiological responses and its values in mitigating human cold exposure is questioned. Reports of glycine effects for more severe cold stresses or during deep hypothermia may possibly be attributed to a more precipitous rate of heat loss, to a greater degree of cooling, or to other factors. (Authors' abstract)

10639
Adams, T., 1958
and E. J. Heberling
HUMAN PHYSIOLOGICAL RESPONSES TO A STANDARDIZED COLD STRESS AS MODIFIED BY PHYSICAL FITNESS.—Jour. Applied Physiol., 13 (2): 226-230. Sept. 1958.

A study was made of the effects of a 3-week period of physical training (calisthenics and sports) on the response of five subjects to cold stress. Skin and rectal temperatures and oxygen consumption were measured in resting, partially-nude subjects during exposure to a temperature of 10° C. before and after the physical training program. Average skin temperature was found to remain approximately 1° warmer during cold exposure after physical training, and extremity temperatures remained 4-5° warmer. Rectal temperatures after training were 0.5° lower during cold exposure, so that total body heat loss was similar under both conditions. The metabolic rate in cold was higher after physical training. It is concluded that the accepted physiological manifestations of cold acclimatization can be produced by an increase in physical fitness alone, and that laboratory and field studies of cold acclimatization require evaluation of comparative physical fitness levels.

10640
Adams, T., 1958
and B. G. Covino
RACIAL VARIATIONS TO A STANDARDIZED COLD STRESS.—Jour. Applied Physiol., 12 (1): 9-12. Jan. 1958.

Skin and rectal temperatures, metabolic rate, and shivering activity were observed in summer in partially nude Negro, Caucasian, and Eskimo subjects under control conditions and during exposure to a temperature of 17° C. for 2 hours. No significant differences were observed in average skin or rectal temperatures between Negroes and Caucasians at control or cold temperatures, while Eskimos exhibited a higher core and shell temperature under both conditions. Metabolic rate was similar in Negroes and Caucasians in the control period, but was significantly higher in Eskimos. During cold exposure, Eskimos and Caucasians showed a similar rise in heat production after 55 minutes, while in Negroes the increase in heat production was lower and occurred only after 85 minutes of exposure. In all groups, the significant increase in metabolic rate occurred simultaneously with the onset of shivering, but it occurred at a considerably higher average skin temperature in Caucasians and Eskimos than in Negroes. It is concluded that a physiological difference in response to cold exists among the racial groups.

10641
Adams-Ray, J. 1961
SOME NEW ASPECTS ON THE VASOCONSTRICTOR MECHANISM.—In: [Recent advances in cryobiology] Progrès récents en cryobiologie, p. 9-11. [1961?]

Certain blood vessel walls contain vasoconstrictors and directly play a role in vasoconstriction due to cold. Preliminary results of incubating skin and adrenal medulla with DOPA (precursor of noradrenalin) revealed the enhancement of reactions of chromaffin granulated cells, which are located close to small vessels, indicating that cells in the human skin contain vasoconstrictor substances.

10642
Armstrong, H. G., 1958
A. C. Burton, and G. E. Hall
THE PHYSIOLOGICAL EFFECTS OF BREATHING COLD ATMOSPHERIC AIR.—Jour. Aviation Med., 29 (8): 593-597. Aug. 1958.

Measurements were made of tracheal, lung, and rectal temperatures in anesthetized dogs breathing air at temperatures of -24° to -62° C. Cold-air breathing was found to produce freezing of the nose for about 1 cm. back from the tip externally, and for a few millimeters inside the nares. No evidence of irritation or injury was observed in the remainder of the respiratory tract. The temperature of the cold inspired air was increased to within 0.05° of the temperature of inspired room air at the level of the cricoid cartilage. No difference was found in the temperature of the lung tissue or pulmonary arterial blood as a result of cold-air breathing. Human subjects breathing air at -40° showed no physiological effects except for vasoconstriction, probably resulting from cold stimulation of the face, and a tendency towards diuresis.

10643
Aron, C., 1958
J. Marescaux, and L. Asch
[THYROTROPIN CONTENT OF THE ANTERIOR PITUITARY IN THE GUINEA PIG EXPOSED TO COLD: CONTRIBUTION TO THE STUDY OF THE RELATIONSHIP BETWEEN SECRETION AND EXCRETION] Contenu thyréotrope de la préhypophyse chez le Cobaye exposé au froid: Contribution à l'étude des rapports entre la sécrétion et l'excrétion.—Comptes rendus de la Société de biologie (Paris), 152 (12): 1794-1796. 1958. In French.

A study was made of the relationship between thyroid activity and the pituitary (pars distalis) concentration of thyrotropin in guinea pigs exposed to a temperature of 3° C. for 2 or 3-4 weeks. Thyroid activity was estimated by histological examination, and pituitary throtropin by observation of the effect of injections of pituitary preparations from cold-exposed animals on the thyroids of control animals. Only a slight increase in thyroid activity was observed in animals exposed to cold for 2 weeks, while animals exposed for 3-4 weeks showed a marked increase. No increase was found in the thyrotropin content of the pituitary. It is concluded that there is no correlation between thyroid activity and the thyrotropin content of the pituitary gland.

10644
Baker, D. G., 1958
and M. A. Ashworth
EFFECT OF EXPOSURE TO COLD ON THE ISLETS OF LANGERHANS IN THE RAT.—Amer. Jour. Physiol., 192 (3): 597-598. March 1958.

Rats exposed to cold (1.5° C.) for 50 days showed an increase in pancreas weight and a decrease in the amount of insulin extractable from the pancreas. Changes in the weight of the islets of Langerhans showed large interindividual variations, but the ratio of islet tissue to body weight remained fairly constant. The concentration of blood lactic acid was unchanged during exposure to cold.

10645
Baker, D. G. 1960
ELECTROLYTE METABOLISM IN THE RAT EXPOSED TO A LOW ENVIRONMENTAL TEMPERATURE. II.—Canad. Jour. Biochem. and Physiol., (Ottawa), 38 (3): 205-211. March 1960.

Rats acclimatized to cold (2° C.) have lower subcutaneous tissue and superficial muscle temperatures than comparable animals living at 25° C. The total water content of the skin is significantly increased after acclimatization to cold. This increase is due to an increase in the chloride space. The total water content of muscle was decreased in the rats acclimatized to cold although the chloride space (extracellular water) was increased. The intracellular sodium of muscle was decreased by exposure to cold. (Author's abstract)

10646
Baker, D. G. 1960
INFLUENCE OF COLD EXPOSURE ON ELECTROLYTE METABOLISM. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 125-130. Dec. 1960 (Part II).

The influence of exposure to cold on electrolyte metabolism has been discussed under two headings: first, the early changes, and second, those responses which are elicited only with prolonged exposure. The early response is characterized by a hemoconcentration of brief duration, and, in man, a pronounced diuresis. The concentrations of plasma electrolytes remain relatively unaltered except for an increase in plasma potassium and probably magnesium. After prolonged exposure to cold there is a disappearance or even a reversal of the early changes. Body water and blood volume increase. The total water content of muscle is decreased while the chloride space is increased. The concentrations of potassium and chloride in the plasma remain in the normal range while the sodium concentration is elevated. (Author's abstract) (45 references)

10647
Barnett, P. W. 1961
SOME EFFECTS OF BODY HEATING PRIOR TO EXTREME COOLING. — Arctic Aeromedical Lab., Fort Wainwright, Alaska. (Project no. 8242-1). Technical Report no. 61-27, Oct. 1961. 16 p.

A study was made of the effect of body heating prior to extreme cooling. Subjects were heated in a 42° C. water bath until heart rates reached 150 beats/minute or rectal temperatures reached 39.5° C. Subjects were exposed, following heating, to ambient air temperatures of 0° C. for 30 minutes and -15° C. for 60 minutes. No significant change in tolerance times was noted. Total body heating prior to exposure is an ineffective means of extending the human body's tolerance to extreme cold. A discussion of the results is presented. (Author's abstract)

10648
Bartlett, R. G. 1958
N. Mantel, G. L. Foster, and P. Bernstein
CORE TO SURFACE THERMAL GRADIENTS IN THE RAT AT SEVERAL ENVIRONMENTAL TEMPERATURES.—Amer. Jour. Physiol., 193 (3): 541-546. June 1958.

Colonic, subcutaneous, and cutaneous temperatures were measured in restrained or unrestrained, clipped or unclipped rats during exposure to various cold environments. Restraint was found to produce hypothermia at low temperatures (0° and 8° C.), and disappearance of the normal subcutaneous-to-skin surface temperature gradient at higher temperatures (16° and 28° C.). Average colonic, subcutaneous, and skin temperatures decreased progressively with decreasing environmental temperatures. In unrestrained rats, colonic and subcutaneous temperatures were maintained at near-normal levels, while skin temperature decreased to a stable below-normal level. Clipping in unrestrained rats produced an effect similar to that of restraint at 1.8° C., and accelerated the hypothermic effects of cold in restrained rats. The pattern of response to stress showed greater interindividual uniformity when the severity of the stress was increased.

10649
Baugh, C. W., 1958
G. S. Bird, G. M. Brown, C. S. Lennox, and R. E. Semple
BLOOD VOLUMES OF ESKIMOS AND WHITE MEN BEFORE AND DURING ACUTE COLD STRESS.—Jour. Physiol. (London), 140 (3): 347-358. March 11, 1958.

Determinations were made of plasma volume, haematocrit, and plasma protein in Eskimos accustomed to living in cold conditions and in Caucasian students before, during, and after immersion of the arm for one hour in water at a temperature of 5°C. Under control conditions (20°), the plasma volume of Eskimos was significantly greater relative to body weight, surface area, and body fat content than that of Caucasians. The haematocrit values of Eskimos were lower, but there was no difference in red cell volume. Protein concentration was significantly higher in Eskimos. In both groups, immersion of the arm in cold water resulted in a decrease in plasma volume and an increase in haematocrit. No significant change was observed in total red cell volume or plasma protein concentration. After immersion, haematocrit values returned to normal more quickly in Eskimos than in Caucasians. It is concluded that repeated exposure to severe cold produces an increase in blood and plasma volume.

10650
Beavers, W. R., 1959
and B. G. Covino
EFFECTS OF ORAL GLYCINE DURING COLD EXPOSURE IN MAN—Jour. Applied Physiol., 14 (3): 390-392. May 1959.

The thermogenic effect of orally administered glycine (30 g.) was evaluated in 6 resting human males subjected to cold stress (75 minutes at -18° C.). Oxygen consumption, rectal temperatures, average skin temperatures, and temperatures of the surface of the right forefinger, ring finger, great toe, and second toe were measured during 30 minutes in a warm room (29° C.) and during cold exposure. Controls were established by administering 30 g. glucose to the same subjects in the same experimental conditions on a separate date. Glycine increased heat production at rest in the warm room and also during exposure to cold. When receiving glycine, the subjects had a slightly higher rectal temperature and higher skin temperatures in areas other than fingers during the cold exposure period. The greatest temperature differences between subjects ingesting glycine and those ingesting glucose during cold stress were seen in the toes.

10651
Bedford, T. 1961
RESEARCHES ON THERMAL COMFORT. —Ergonomics (London), 4 (4): 289-310. Oct. 1961.

An outline is presented of researches on thermal comfort during the past 40 years. It deals mainly with a search for methods of measuring the state of a thermal environment which accords with subjective scales of comfort. Two impressions of comfort, warmth and freshness, are considered separately and recommendations are made on the values of environmental parameters likely to produce optimum comfort in the maximum proportion of a population sample. The experiments emphasize the importance of a large variance of air movement and a correctly chosen humidity as less obvious factors in thermal comfort. Wall temperatures lower than the air temperature of a room are a frequent source of stuffiness. Discomfort is also felt if the air temperature at head level exceeds that of floor level by 5° F. Measurements on the skin temperature of 2500 factory workers indicates that although skin temperature is closely correlated with the sensation of warmth in an individual it is too inconsistent to be used as an index of warmth in a large population. (Author's abstract, modified) (50 references)

10652
Belding, H. S. 1959
PROBLEMS IN DEVELOPING A VALID INDEX OF HEAT STRESS.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 40-49. 1959.

Due to the large number and complex relationships of factors which are involved, the construction of a universally valid heat stress index must rest on the quantitative approach for the assessment of (1) heat load; (2) potential for moving metabolic heat from its source to the skin, via the circulation; (3) potential for dissipation to the environment by evaporation; and (4) tolerance time in the presence of overstress. Currently available knowledge is believed nearly adequate to permit construction of such a heat stress index. Four principal problems of this approach are: (a) how properly to predict skin temperature and make use of it in computing the ambient capacity for evaporation of sweat(E_{max}); (b) how to predict circulatory strain and take it into account; (c) how to predict effects of clothing on radiation, convection, and (E_{max}); and (d) how to predict tolerance time when stress is excessive. (Author's conclusions, modified)

10653
Billingham, J., 1960
and D. M. Kerslake
AN ANALYSIS OF ENVIRONMENTS COMPATIBLE WITH THERMAL COMFORT IN MAN. — RAF Inst. of Aviation Med. (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 134, June 1960. [18] p.

A theoretical analysis is presented of ways in which the various environmental parameters may be combined to produce thermal comfort. Four intermediary variables are introduced which combine the factors influencing the state of thermal comfort. This allows a simplified graphic presentation of the information. Environments resulting in thermal comfort may be described by the equation $T_s = T_g + k\ I_a\ [T_g^4 - (T_s - I_c H)^4] + H\ (I_c + I_a)$, whereby T_s = the mean skin temperature for comfort taken as 33° C., T_g = the globe thermometer temperature, I_a = the insulation of boundary air layer above clothing or exposed skin surface, I_c = insulation of clothing, and H = the total heat flow through the clothing.

10654
Billingham, J., 1960
and T. L. Hughes
PROTECTION OF AIRCREW AGAINST THE HIGH CABIN TEMPERATURES WHICH MAY OCCUR IN PROLONGED SUPERSONIC FLIGHT AFTER FAILURE OF THE CABIN COOLING SYSTEM. — Flying Personnel Research Committee (Gt. Brit.), Farnborough. Report no. FPRC 1109, Feb. 1960. 14+[11] p.

This report describes tests made in a simulated aircraft cockpit under conditions representing high speed flight at low altitude. A subject wearing a specific clothing assembly was cooled by means of an air ventilated suit (A.V.S.), his microclimate temperature (i.e. immediately next to the skin) being accurately measured by an electrical resistance thermometer. There was no supply of cooling air to the cabin. The A.V.S. ventilating air mass flow/temperature combinations necessary to keep the microclimate temperature of the subjects at 32.5°C. were investigated for aircraft skin temperatures of 125°C., 142°C., 165°C. and 183°C. The A.V.S. mass flow/temperature relationship was hyperbolic and closely followed the curve F(32.5-T) = constant, where F = A.V.S. flow and T = inlet temperature in degrees Centigrade. With certain provisos it should be possible to fly an aircraft for lengthy periods under these conditions. Where uninterruped visual attention is essential, as in high-speed low-level flight, the eyes would require some special protection from the heat. The results may be used as a guide to A.V.S. air supply requirements, but only where the practical situation is similar to the experimental one. (Authors' summary)

10655
Birkhead, N. C., 1961
S. M. Horvath, B. Issekutz, M. E. Kelly, and K. Rodahl
EFFECTS OF SHORT-TERM DIET MODIFICATION ON HUMAN RESPONSE TO HEAT STRESS. — Lankenau Hospital. Division of Research, Philadelphia, Pa. (Contract AF 33(616)-7338); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71833). ASD Technical Report no. 61-265, July 1961. iii+17 p.

To evaluate the effects of short-term dietary modifications on tolerance to heat stress, the responses of 9 young, healthy men to repeated exposures for 2 hours at 54° C., 9-18 mm. Hg vapor pressure, were studied. Three or four control exposures at 4- to 7-day intervals on a normal diet for baseline data were followed by exposures after 30, and 50 or 60 days on the experimental diets. Two subjects remained on the normal diet for the entire study period; two were fed a normal Calorie 60% fat diet; two, a 1500-Calorie diet; and five, a normal Calorie 4% protein diet. No systematic differences in respiration rate, heart rate, blood pressure, degree of water loss, or rectal, mean skin, and body temperatures during the heat stress resulted for these dietary modifications. (Authors' abstract)

10656
Blatteis, C. M. 1961
EFFECTS OF DRUG-INDUCED PERIPHERAL VASOCONSTRICTION AND VASODILATATION AND INCREASED HEAT PRODUCTION ON THE THERMAL AND METABOLIC RESPONSES OF DOGS EXPOSED TO COLD.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001). Report no. 520, Nov. 14, 1961. ii+13 p.

Aramine-induced peripheral vasoconstriction in dogs was ineffective in preventing body cooling in the cold; indeed, it was detrimental because of a stimulatory side-reaction of the drug on the respiratory rate which produced a large ventilatory heat loss, and hence an excessive fall in the body temperature. Arfonad-induced cutaneous vasodilatation was also without benefit in the cold because it increased peripheral cooling due to a greater dermal heat flow and it reduced heat production as a result of an inhibitory side-effect on respiratory metabolism. DNP (2-3 dinitrophenol) was beneficial in the cold in that the enhanced metabolism caused an initial pyrexia which slowed the fall in body temperature. (Author's abstract)

10657
Blyth, C. S. 1959
INFLUENCE OF PHYSICAL CHARACTERISTICS, PSYCHOLOGICAL FACTORS AND DRUGS ON THE CAPACITY OF MAN TO WORK IN THE HEAT.— Univ. of North Carolina. Lab. of Applied Physiology. Chapel Hill (Contract DA-49-007-MD-949). [Unnumbered] Progress Report, Nov. 1, 1959. 17 p. AD 229 723

Ninety different experiments were performed on 15 male subjects to determine the effect of caffeine, Dexedrine, dehydration, and superhydration on man's capacity to withstand heat and exercise stress as measured by heat gain, heart rate, sweat loss, and mental, psychomotor, strength, and psychological tests. Heart rate increased and the results of the mental tests were impaired on caffeine, Dexedrine, and dehydration days. The capacity of the men to work in the heat was also tested and showed that the vigorous or masculine trait appears to be the most important single predicting trait for the various reaction tests.

10658
Boatman, J. B., 1959
J. M. Walsh, L. I. Epstein, and M. J. Rabinovitz
FLUID AND ELECTROLYTE CHANGES OF THYROIDECTOMIZED RATS IN A COLD ENVIRONMENT.—Amer. Jour. Physiol., 196 (6): 1214-1217. June 1959.

Groups of adult male albino rats were thyroidectomized or sham-operated, and later subjected to 10-day, 5° C. cold exposure or else maintained at 22° C. room temperature. Tissues were examined for total water, sodium, potassium, Na^{24} and I^{131}-thyroxine distribution. Thyroidectomized animals in the cold showed significantly greater amounts of water and Na^{24} specific activity in muscle and brain. Sham-operated animals in the cold showed significantly reduced brain Na^{24} specific activity. Thyroxine I^{131}/Na^{24} ratios in tissue were greater at room temperature in thyroidectomized animals and were decreased with cold. Sham-operated animals showed no differences in brain thyroxine I^{131}/Na^{24} ratios after equilibration and small differences in muscle ratios, with cold. It is concluded that a cold environment imposed on thyroidectomized animals resulted in changes in the animal's capacity to readjust body fluids and electrolytes when compared with intact animals exposed to cold. These differences are attributable to greater tissue water content and increased sodium flux into the tissues. (Authors' abstract)

10659
Bobrov, N. I. 1960
[CHANGES IN THE FUNCTIONS OF THE SKIN ANALYZER IN SAILORS IN THE ARCTIC] Ob izmeneniakh funktsii kozhnogo analizatora u matrosov na Severe.—Voenno-meditsinskii zhurnal (Moskva), 1960 (1): 71-74. Jan. 1960. In Russian.

English translation in: Military Medical Journal, 1960 (1): 114-118. New York: U. S. Joint Pub. Research Serv., no 1374-N/26, May 31, 1960. (Available at Office of Technical Services, U. S. Dept. Commerce)

The chilling of parts of the body of unacclimatized personnel in the Arctic raised the threshold for cutaneous sensation of touch and lengthened the sensory chronaxy. These changes decreased as acclimatization progressed. In sailors with a prolonged term of service in the Arctic they disappeared completely. This lack of response to cold in acclimatized sailors is associated partly with an increase in the heat metabolism. Furthermore the high work capacity of acclimatized personnel at low outside temperatures is apparently dependent not only on the high metabolic level but also on a lack of disturbances in the cutaneous analyzer function.

10660
Bobrov, N. I. 1958
[THE EFFECT OF TEMPERATURE CONTRASTS ON THE ORGANISM] Kontrastnye temperatury i ikh vliianie na organizm.—Gigiena i sanitariia (Moskva), 23 (12): 26-31. Dec. 1958. In Russian, with English summary, (p. 31).

Three test groups of human adults, of 30 subjects each, were used in the experiment. Groups I and II were conditioned a month and a half, with Group III serving as controls. Group I took showers of alternating temperatures (cold, 10-18° C.; warm, 40-42° C); Group II was repeatedly exposed to cold air. Recordings were made of the skin temperature, gaseous metabolism, and sensory-motor chronaxy. Prolonged exposure to the contrasting temperatures resulted in physiological adaptation of the organism to the thermal stimuli. A decrease in the physiological responses to the applied stimuli should be regarded as an indicator of the attainment by an organism of a stable state of adaptation.

10661
Bobrov, N. I. 1959
[CHARACTERISTICS OF HEAT REGULATION OF SAILORS SAILING IN ARCTIC LATITUDES] Osobennosti termoreguliatsii u matrosov pri plavanii v severnykh shirotakh. —Voenno-meditsinskii zhurnal (Moskva), 1959 (9): 50-52. Sept. 1959. In Russian.

English translation in: Military Medical Journal, 9: 84-88. New York: U. S. Joint Pub. Service, No. 2061-N, Dec. 28, 1959. (Available at Office of Technical Services, U. S. Dept. Commerce)

An investigation of heat regulation during one-and-a-half month voyage in the Arctic Sea disclosed the following adaptive changes at the end of the trip: (1) The basal metabolism was increased in all sailors after regular exposure to cold; it was not changed in those confined to quarters at normal air temperatures. (2) The level of heat production was raised not only after exposure to cold but also before it. (3) The skin temperature of hands and fingers decreased to a lesser degree upon cold exposure.

10662
Booker, W. M. 1960
RELATION OF ASCORBIC ACID TO ADRENOCORTICAL FUNCTION DURING COLD STRESS. —Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 95-96. Dec. 1960 (Part II).

Either the fall in adrenal ascorbic acid in acute cold stress seems to be a "trigger" mechanism for the release of adrenocortical hormone, or ascorbic acid takes part in the formation of the adrenocortical hormone. In adrenal vein effluent the rise of ascorbic acid precedes by several minutes the rise of the adrenocortical hormone. There is no essential change in the whole-body ascorbic acid during cold stress. Ascorbic acid (a) acts to increase the survival of mice in cold, especially in the presence of either the adrenal gland or the administered cortisone; (b) decreases the rate of metabolism of the adrenocortical hormone in incubated liver slices; and (c) facilitates the conversion of C^{14} acetate to cholesterol in the presence of ACTH. (Author's abstract)

10663
Boyer, J. T., 1960
J. R. E. Fraser, and A. E. Doyle
THE HAEMODYNAMIC EFFECTS OF COLD IMMERSION. —Clinical Sci. (London), 19 (4): 539-550. 1960.

The haemodynamic effects of immersion of part of a limb in ice water were studied in 20 subjects. Significant changes in cardiac output were frequently observed. The pressor response to cold immersion was not related to the magnitude or direction of change of either cardiac output or total peripheral resistance alone. The significance of these findings is discussed in relation to the prognostic value of the pressor response to cold and its use as an index of peripheral vascular reactivity. (Authors' summary) (26 references)

10664
Brandis, S. A. 1960
[THE INFLUENCE OF BROMINE AND CAFFEINE ON THE LIGHT SENSITIVITY OF THE EYE AND THERMOREGULATION AT A HIGH ENVIRONMENTAL TEMPERATURE] Vliianie broma i kofeina na svetovuiu chuvstvitel'nost' glaza i termoreguliatsiiu pri vysokoi temperature okruzhaiushchei sredy.—Fiziologicheskii zhurnal SSSR (Leningrad), 46 (4): 489-494. April 1960. In Russian, with English summary (p. 494).

The effect of heat on monocular dark adaptation and thermoregulation was investigated in three subjects in a thermal chamber at 41-44° C. Dark adaptation improved during the first 30 minutes, after which it slowly declined in the next 60-90 min. to 13-15% below the normal. A return to a normal level took place quickly after exit from the thermal chamber. The administration of caffeine prior to heat exposure raised the dark adaptation threshold throughout the exposure recovery period. Bromine lowered the dark adaptation threshold, canceling the effect of heat, and improved thermoregulation by increasing body heat loss. (From the author's summary)

10665
Braun, H. A., 1960
and L. M. Lusky
THE EFFECT OF ACCLIMATIZATION TO COLD ON THE ACTION OF DRUGS IN THE RAT. — Toxicol. and Applied Pharmacol., 2 (4): 458-463. July 1960.

Pentylenetetrazol and sodium amobarbital were less toxic to rats exposed to cold (4°C.) for twenty-four hours than to rats kept at room temperature (24°C.). The median convulsive dose of pentylenetetrazol and the median hypnotic dose of sodium amobarbital in rats exposed to cold temperatures for 5-6 weeks did not differ significantly from those determined at room temperature, and parallelled acclimatization of the rat to its environment. Both drugs were more toxic to clipped acclimatized rats than to unclipped acclimatized animals.

10666
Brebner, D. F., 1961
J. M. Clifford, D. M. Kerslake, J. D. Nelms, and J. L. Waddell
RAPID ACCLIMATIZATION TO HEAT IN MAN.— RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 177, July 1961. 14 p.

Four healthy men aged between 30 and 37 years were selected to investigate the acclimatizing effect of relatively short periods of immersion in hot baths without exercise. The pulse and oral temperatures were less elevated in heat and work stress after immersion in the hot baths for ten days, although there was considerable individual variation. The morale of the subjects was higher following hot-water immersion, and their performance in heat and work stress was not observed to deteriorate as it had preceding immersion.

10667
Brouha, L., 1960
P. E. Smith, and M. E. Maxfield
THE INDUSTRIAL WORKER. — Mechanical Eng., 82 (6): 57-59. June 1960.

Condensed from: HEAT STRESS AND THE INDUSTRIAL WORKER. — ASME Paper no. 59—A-213.

Except under conditions of light work and favorable environments, the efficiency of the body-cooling mechanisms depends on the amount of sweat that can be produced and evaporated. When sweating decreases because of dehydration or when perspiration cannot evaporate adequately because of the high humidity of the atmosphere, heat stress develops rapidly even at comparatively low levels of work. The amount of heat stress can be satisfactorily assessed by measuring pulse-rate and body-temperature variations. When a job has been recognized as producing high reactions either because of the work load, or heat exposure, or both, various improvements can be made. They must be evaluated in terms of physiological values until a satisfactory solution is found. In many industrial operations heat remains the main factors of stress and low productivity. Adequate measures to combat it are now available and should be adopted for the benefit of the workers as well as management. (Authors' summary)

10668
Brüner, H., 1960
and K. E. Klein
EFFECTS OF HIGH TEMPERATURES AND ACCLIMATIZATION ON THE EFFICIENCY OF PILOTS.—Deutsche Versuchanstalt für Luftfahrt (Mülheim, Germany), Report no. 125, p. 21-31. June 1960. In English and German.
Also published in: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part. 1, p. 399-404. Roma, 1961.

A method is proposed for the evaluation of environmental heat stress by reference to a physical index of effective temperature (heat, humidity, and air speed) in combination with a physiological stress index of pulse rate and body temperature. A rectal temperature of 38.3° C. and a pulse rate of 115/minute have been found to be the "characteristic value" for the physiological tolerance limit to heat. Studies of the predictive value of the indices under various environmental conditions have shown that heat tolerance is dependent on the interrelation of rectal temperature and pulse rate, and that acclimatization to heat increases tolerance by 5-6° C. air temperature.

10669
Bundy, R. E., 1961
A. Arendas, and V. O. Erk
ARTIFICIAL COOLING OF MAMMALS IN A HOT ENVIRONMENT. — Advances Astronaut. Sci., 6: 293-301. 1961.

Eight rats were protected from ordinarily lethal temperatures ranging up to 68° C. by circulating ice water through polyethylene tubing inserted subdermally around the neck. All controls died when their body temperature reached 44° to 45° C. All protected rats survived and showed an average body temperature increase between 2° and 3° C. Greater protection was afforded by lower temperature coolant. Defects and possible improvements in method are discussed along with artificial cooling of larger mammals and humans.

10670
Cali, V. 1961
[BEHAVIOR OF KETONEMIA AND KETONURIA IN SUBJECTS EXPOSED TO ENVIRONMENTAL HYPERTHERMIA] Comportamento della chetonemia e della chetonuria in soggetti esposti ad ipertermia ambientale. —— Bolletino della Società italiana di biologia sperimentale (Napoli), 37 (1): 25-28. Jan. 15, 1961. In Italian.

Subjects exposed to a poorly ventilated, hot environment (45° C.) for 150 minutes exhibited varying degrees of both ketonemia and ketonuria. The mechanism by which the heat stimulus produces changes in the metabolism of ketone bodies is not yet clear, however, it is presumably related to the neuro-endocrine system which regulates ketogenesis and ketolysis.

10671
Campbell, J., 1960
G. R. Green, E. Schönbaum, and H. Socol
EFFECTS OF EXPOSURE TO COLD ON COENZYME A LEVELS IN LIVER TISSUE. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 124-125. Dec. 1960 (Part II).

In rats exposed to cold for 24 days, a 60% increase occurs in the concentration and amount of coenzyme A in the liver. Also under these conditions the oxidation of fatty acids is accelerated, while the acetylating capacity of the rat is decreased. (Authors' abstract)

10672
Cannon, P., 1960
and W. R. Keatinge
THE METABOLIC RATE AND HEAT LOSS OF FAT AND THIN MEN IN HEAT BALANCE IN COLD AND WARM WATER. —— Jour. Physiol. (London), 154 (2): 329-344. Dec. 1960.

The metabolic rate of both fat and thin young men in heat balance in water rose when the bath temperature was lowered below 33° C., although the fat men did not achieve their maximal tissue insulation until the water temperature was much lower. The commonly used concept of "critical temperature" was therefore not valid in the case of the fat men and alternative terms are proposed. The metabolic rate rose less in fat than in thin men when the bath temperature was lowered below 33° C.; the stable rectal temperature of the thin men was lower in cold than in warm water, while that of the fattest men was not. It is concluded that the fat men's small metabolic response to cold was due to reflexes from the skin, while in the thin men these were reinforced by a fall in deep temperature and stimulation of deep temperature receptors. The fat men achieved a higher maximal tissue insulation than thin men and could stabilize their body temperature in water down to 10-12° C. In colder water heat loss from their fingers rose in a cyclical manner, their tissue insulation fell by about 50% and their rectal temperatures fell. Work accelerated the fall in rectal temperature of both fat and thin men in water just too cold for them to stabilize their rectal temperature when still. (Authors' summary) (40 references)

10673
Carlson, L. D., 1960
and H. L. Thursh
HUMAN ACCLIMATIZATION TO COLD: A SELECTED, ANNOTATED BIBLIOGRAPHY OF THE CONCEPTS OF ADAPTATION AND ACCLIMATIZATION AS STUDIED IN MAN. —— Univ. of Washington. Department of Physiology and Biophysics, Seattle; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 59-18, Sept. 1960. 133 p.

This compilation contains 64 annotations of papers published prior to Jan. 1, 1960, on physiological changes which occur with chronic exposure to cold, as shown in three investigational approaches: (1) studies of native inhabitants of cold environments or of persons inadequately protected against mild environments, and seasonal studies of inhabitants of temperate zones; (2) studies under field arrangements for groups to be exposed; and (3) studies in controlled-temperature chambers with clothed or unclothed individuals. A subject index is provided which categorizes each reference according to some physiological factor which may be affected by cold exposure, e.g., temperatures, metabolism, circulation, blood, endocrine responses, etc. In summarizing, the authors review human tolerance to cold, and list 12 additional references which are not included in the annotations.

10674
Carlson, L. D. 1961
HUMAN PERFORMANCE UNDER DIFFERENT THERMAL LOADS. —— Univ. of Washington School of Medicine, Seattle; issued by School of Aviation Medicine. Aerospace Medical Center, Brooks Air Force Base, Texas. Report no. 61-43, March 1961. 13 p.

This report outlines a hypothesis concerned with the interaction of physiologic inputs from environmental temperature and low oxygen tension, and psychologic inputs from a vigilance test. Blood flow, pulse rate, rectal temperature, GSR, and vigilance were measured in a normal and in a hot environment. There were marked individual differences in response, some of which appear to be related to physical fitness. Vigilance was impaired in the hot environment at higher levels of input. (Author's summary)

10675
Carlson, L. D., 1958
A. C. L. Hsieh, F. Fullington, and R. W. Elsner
IMMERSION IN COLD WATER AND BODY TISSUE INSULATION.—Jour. Aviation Med., 29 (2): 145-152. Feb. 1958.

A study was made in 9 subjects of the relation of body insulation to oxygen consumption and body temperature during cooling in a water bath at temperatures ranging from 9° to 25° C. after immersion for 1 hour at 33°. Body insulation was calculated from the Burton equation and varied directly with specific gravity of the body, but represented a greater fraction of the body than estimated fat content. Heat input was found to vary inversely with body insulation at low water temperatures. The pattern of rectal temperature changes was also determined by body insulation, varying from a steady decrease with cooling to a rise followed by a decrease. It is concluded that increased insulation increases survival time during

cold-water immersion by reduction of the amount of heat needed to maintain rectal temperature and by a decrease in the amount of body tissue capable of cooling.

10676
Carlson, L. D., and H. L. Thursh 1960
PROTECTION OF THE EXTREMITIES IN EXTREME COLD: A SELECTED, ANNOTATED BIBLIOGRAPHY.—Univ. of Washington, Seattle; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 59-19. Oct. 1960. 60 p.

This selected, annotated bibliography comprises 29 references on the means of protecting the hands and feet from extreme cold. While the major aim in protection of the hands or feet is the prevention of cold injury, it is of value also to preserve neuromuscular function, tactile function, joint function, and comfort while minimizing the heat loss from the body through the extremities. Since there is little tissue capable of increased heat production, heat must generally be supplied to the extremities from the body by circulation. With the best insulative protection for hands and feet consistent with function, three additional countermeasures against cold are suggested: adequate protection of the entire body, the use of topical vasodilators, or a local heat source. Continuous exposure to cold may lead to adaptation, as demonstrated by warmer extremities.

10677
Carlson, L. D. 1958
SYMPOSIUM ON METABOLIC ASPECTS OF ADAPTATION OF WARM-BLOODED ANIMALS TO COLD ENVIRONMENT: INTRODUCTION.—Federation Proceedings, 17 (4): 1044-1045. Dec. 1958.

The concept of physiological adaptation is defined, and a distinction is made between the insulative and metabolic changes associated with adaptation to cold.

10678
Carlson, L. D. 1960
WORK IN COLD ENVIRONMENTS: HUMAN TOLERANCE TO COLD.—Jour. Occupational Med., 2 (3): 129-131. March 1960.

A review is presented of studies on (1) natural adaptation to cold environments such as in the Eskimo, the Arctic Indian, and the Lapp and (2) cold acclimatization and functional response to cold exposure by increased metabolism. (28 references)

10679
Chalopin, H. 1958
G. Sodigné, and M. Nigeon-Dureuil
[EFFECT OF THE SODIUM ION OF SODIUM SALICYLATE ON THE NORMAL OR ADRENALECTOMIZED RAT EXPOSED TO COLD AND STARVATION] Action de l'ion sodium du salicylate de sodium sur le Rat normal ou surrénalectomisé soumis au froid et à l'inanition.—Journal de physiologie (Paris), 50 (2): 209-212. March 1958. In French.

An experiment was conducted to determine the effect of sodium salicylate on the resistance of rats to cold. Intact and adrenalectomized rats were injected subcutaneously with salicylate 15 minutes before and at 90-minute intervals during exposure to a temperature of 2°C. Administration of salicylate decreased survival time in cold in both normal and adrenalectomized rats. Treatment of adrenalectomized rats fasted for 16 hours before exposure resulted in an increase in survival time. Substitution of sodium chloride for sodium salicylate in fasted adrenalectomized rats also increased survival time, indicating the importance of the sodium rather than salicylate ion in increasing resistance to cold. (29 references)

10680
Chevillard, L., H. Giono, and M. C. Guntz-Arnal 1959
[EFFECT OF PROLONGED COLD EXPOSURE ON THE CUTANEOUS VASOMOTOR REACTIONS OF THE GUINEA PIG AND RABBIT] Influence de l'exposition prolongée au froid sur les réactions vasomotrices cutanées du Cobaye et du Lapin.—Comptes rendus de la Société de biologie (Paris), 153 (12): 1922-1925. Dec. 12, 1959. In French.

Guinea pigs and rabbits subjected to prolonged cold exposure (5.2 ± 2.3° C.), in comparison to controls living at 20° C., exhibited significant vasodilation reactions in the ear when placed in a warm environment. When the temperature was abruptly dropped, the cold-adapted animals showed less of a reaction than the controls. The vasodilation reaction observed in the ear during change from one thermal level to a higher level may be explained as a displacement in the temperature scale of the peripheral thermoreceptor sensitivity zone as affected by exposure to cold.

10681
Chiles, W. D. 1958
EFFECTS OF ELEVATED TEMPERATURES ON PERFORMANCE OF A COMPLEX MENTAL TASK.—Ergonomics (London), 2 (1): 89-96. Nov. 1958.

It was attempted to determine heat tolerance limits of human subjects, to ensure adequate performance by crew members of an aircraft operating at supersonic speeds or in space vehicles during reentry. Eleven subjects were tested on a complex mental task during one-hour exposures to four different dry bulb/wet bulb temperature conditions: 85°/75°, 90°/80°, 95°/85°, and 100°/90° F. In a second experiment, ten subjects were tested at 85°/75°, 90°/80°, 110°/90°, and 120°/90° F. In both experiments differences in performance at the various temperatures were small and not significant. However, the results obtained in the second experiment at 120°/105° F. suggest that this may be near the upper temperature limit for adequate performance by an unprotected subject.

10682
Clark, R. E. 1961
THE LIMITING HAND SKIN TEMPERATURE FOR UNAFFECTED MANUAL PERFORMANCE IN THE COLD. —— Jour. Applied Psychol., 45 (3): 193-194. June 1961.

The hands of 12 enlisted men were cooled to 55° F. and 60° F. surface temperature on different experimental days. Performance times to complete a standard knot-tying task were obtained when the subject's hands first reached the appropriate hand skin temperature, after 20 minutes' exposure at the criterion temperature, after 40 minutes' exposure, and after 60 minutes' exposure.

It was found that performance was severely hindered when hand skin temperature fell to 55° F., and that performance decrements at this skin temperature level were increasing exponential functions of duration of exposure, becoming asymptotic after about 40 minutes' exposure. In contrast, performance at 60° F. hand skin temperature remained unaffected throughout the exposure period. (Author's summary)

10683
Clark, R. E., 1960
and A. Cohen
MANUAL PERFORMANCE AS A FUNCTION OF RATE OF CHANGE IN HAND SKIN TEMPERATURE.—Jour. Applied Physiol., 15 (3): 496-498. May 1960.

Manual performance (knot tying) was studied as a function of fast and slow rates of cooling during cold exposure and during subsequent rewarming. It was found that performance decrements accompanying cold exposure were sizeably increased as the rate of cooling decreased. These increased decrements associated with slow cooling persevered even after the hands had been rewarmed to precooling temperatures. In addition, the results indicated a direct relationship between rate of cooling and rate of rewarming. (Authors' abstract)

10684
Clarke, R. S. J., 1958
R. F. Hellon, and A. R. Lind
VASCULAR REACTIONS OF THE HUMAN FOREARM TO COLD.—Clinical Science (London), 17 (1): 165-179. Feb. 1958.

Blood flow in the human forearm was found by strain-gauge plethysmography to decrease after immersion for 30-80 minutes in water at a temperature of 14° C. Blood flow increased at water temperatures below 10° to a level at 2° slightly above that found at 34°. Immersion of the forearm in water at 1° was associated with a sudden rise in systolic and diastolic pressures, followed by a decline to pre-immersion levels. Vasodilatation at 1° was not affected by adrenaline iontophoresis, indicating that the increase in blood flow occurred in muscle rather than skin. The location of increased flow in muscle was also suggested by a greater flow in the upper forearm than in the lower forearm. Subcutaneous temperature fell rapidly for 10 minutes after immersion at 1°, reaching a plateau 6° above water temperature, while muscle temperature fell more slowly. Neither deep nor superficial temperatures increased at the time when blood flow was increasing. The vascular response to cold was similar in subjects with cervical sympathectomy, but was not observed in a subject with sensory and motor denervation of the forearm. It is concluded that vasodilatation in the forearm is mediated by the somatic nerves, and possibly by an axon reflex.

10685
Consolazio, C. F., 1961
R. Shapiro, J. E. Masterson, and P. S. L. McKinzie
ENERGY REQUIREMENTS OF MEN IN EXTREME HEAT. — Jour. Nutrition, 73 (2): 126-134. Feb. 1961.

The effects of solar radiation and extreme heat on the energy requirements of eight healthy young men performing a constant daily activity were studied under the following conditions: (1) ten days in direct sunlight from 7 A.M. to 5 P.M., with temperatures averaging 40.5° C.; (2) ten days in the hot shade from 7 A.M. to 5 P.M., with temperatures averaging 40.3° C.; and (3) ten days in an air-conditioned room at 26.0° C. The data suggest that there is an increased caloric requirement for men working and living in extreme heat. Significant increases were observed in food consumption and the actual caloric requirements were even greater because of changes in the body composition of the men. The differences in energy cost of the various resting and exercise activities, when comparing the hot-sun or hot-shade to the cool-shade phase were significant. Energy requirements averaged 55.5, 56.4, and 36.6 Cal. per kg. of body weight, respectively, for conditions (1), (2), and (3), when corrected for body composition changes. These increased requirements are probably due to the increased heat load imposed on the body by solar radiation and extreme heat. The increased requirements are, in all likelihood, a combination of increased action of the blood in heat transport, increased action of the sweat glands, plus the increased total metabolic rate due to the elevation in body temperature. (From the authors' summary and conclusions)

10686
Cottle, W. H. 1958
METABOLIC ALTERATIONS IN RATS WITH ADAPTATION TO LOW ENVIRONMENTAL TEMPERATURES.—Univ. of Washington, Dept. of Physiology and Biophysics, Seattle (Contract AF 18(600)-1467); issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 57-12, Nov. 1958. v+94 p.

Metabolic alterations which occur during adaptation to cold (5° C.) were studied in male albino rats. Metabolism at 5° C. increased gradually for 2 to 3 weeks, as shown by measurements of heat loss, oxygen consumption, and food intake. After 2 weeks at 5° C., metabolic rate at 28° C. (MR 28°) was 20% greater than that of controls kept at 26° C. In vitro measurements of the metabolism of skeletal muscle, liver, and kidney suggest that the increase in $MR^{28°}$ was not merely a reflection of increased intrinsic metabolism of tissues. Only liver showed an increase in vitro. The difference in metabolism at 30° C. of cold-adapted and nonadapted rats, while completely paralyzed with curare, resembled that of normal rats measured at 28° C. This indicates that the difference in $MR^{28°}$ between the two groups was not due to increased muscular activity or muscular tone. The ability of rats to utilize chemical regulation to offset increased heat loss is increased by adaptation to cold. In response to lowered room temperature, intact cold-adapted rats, which had been paralyzed with curare, were found able to increase heat production and maintain body temperature. The limited increase by nonadapted rats under the same conditions was ineffective. Response of adrenodemedullated cold-adapted rats was slightly less than that of intact cold adapted rats. This suggests that the response was mediated only in part by release of epinephrine from the adrenal medulla. (Author's summary, modified) (162 references)

10687
Cottle, W. H. 1960
ROLE OF THYROID SECRETION IN COLD AC-

CLIMATION. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 59-63. Dec. 1960 (Part II).

Experimental studies designed to evaluate thyroid secretion rate and its control during cold acclimation in small animals are reviewed. The possible role of the hormone in the process of acclimation is discussed. The suggestion that the increased resting metabolism of cold-acclimated animals is a product of the augmented thyroid secretion in the cold is untenable. Evidence is presented against the possibility that augmented thyroid secretion is prerequisite to development of the altered thermogenesis characteristic of cold acclimation. (Author's abstract)

10688
Craig, F. N. 1959
THE PHYSIOLOGICAL STATE AT THE LIMIT OF TOLERANCE.——In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 50-55. 1959.

A survey of the physiological basis for the sensation that the environment has become unbearably hot is presented. Two sets of data are compared: from 6 men walking on a treadmill while wearing protective clothing, and from 12 men at rest at very high temperatures. Each individual's decision to terminate exposure was reached at the time the mean body temperature had increased by a certain amount and was independent of the duration of the experiment. The usefulness of this observation arises from the fact that the rise in mean body temperature is a measure of the heat accumulated in the body.

10689
Crocker, J. F., 1960
and C. R. Waltz
A HEAT PULSE OVEN FOR STUDY OF HUMAN THERMAL TOLERANCE. —— Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADD Technical Report no. 60-733, Dec. 1960. iii+8 p.

A 4-foot cubic chamber with thin aluminum walls has been built to simulate the thermal surroundings of the crew of a hypersonic vehicle re-entering the earth's atmosphere. The walls are heated with quartz tube infrared lamps mounted on reflectors 5 inches from the chamber's external surfaces. The temperature of each wall is controlled independently with manually operated relays. Wall temperatures may be programmed to rise as rapidly as 100° F. per minute. Air temperature within the chamber rises passively as a result of natural convection induced by the chamber walls. Preliminary investigations of tolerance to peak wall temperatures as high as 430° F. are summarized, and a more detailed investigation of human physiological and psychological performance during a 400° peak exposure is described. Results of the latter indicate that rather large changes in cabin temperature of limited length may have small enough effect on pilot performance that they may be included in design of air and space vehicles, particularly, in cases where significant savings in weight may be achieved. (Authors' abstract)

10690
D'Angelo, S. A. 1960
ADENOHYPOPHYSIAL FUNCTION IN THE GUINEA PIG AT LOW ENVIRONMENTAL TEMPERATURE. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 51-56. Dec. 1960 (Part II).

The functional status of the pituitary-thyroid and adrenal systems was assessed in guinea pigs and rats maintained at moderately low temperatures (4-9° C.) for 1-10 weeks by measurement of BMR, serum protein-bound iodine, thyroidal I^{131} release rate, TSH content of blood and hypophysis, S^{35}-methionine tissue uptake, corticoid excretion, adrenal ascorbic acid, and pituitary ACTH, and by evaluation of gland morphology. The relationship of target gland functions to neural mechanisms was studied in cold-exposed animals after electrocautery of the hypothalamus. The results underscore the crucial role of the adenohypophysis in cold acclimation of the rodent. (Author's abstract)

10691
Daniels, F., 1961
and P. T. Baker
RELATIONSHIP BETWEEN BODY FAT AND SHIVERING IN AIR AT 15°C. —— Jour. Applied Physiol., 16 (3): 421-425. May 1961.

Thirty-one men of widely varying body fat content were exposed to air at 15.2° C. for 2 hr. Rectal and skin temperatures and metabolic rates were measured at 10, 40, and 80 min. and at the end of the 2 hr. Shivering was rated on a five-interval scale. Under these conditions thick subcutaneous fat provided insulation as indicated by lower skin temperatures, less shivering, and lower oxygen consumption in the fatter men. The findings rule out simple relationships between measured temperatures and shivering, leading to other possibilities and approaches to the study of shivering. (Authors' abstract)

10692
Davis, T. R. A. 1961
CHAMBER COLD ACCLIMATIZATION IN MAN. —— Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001-01). Report no. 475, May 19, 1961. ii+8 p.

Nude subjects were exposed 8 hr. daily for 31 days to a temperature of 11.8° C. during March. Other subjects were acclimatized similarly to a temperature of 13.5 C. in September. At intervals during the exposures, measurements were made of shivering, O_2 consumption, and rectal and skin temperatures during a 2-hr. cold exposure. Shivering decreased significantly in both groups by the 14th day; heat production was unchanged in the winter group, but decreased significantly in the summer group. BMR did not change in either group. Rectal temperature in both groups was unchanged for 10 days, but decreased after the 14th day. On the basis of shivering and rectal temperature changes, it was concluded that man can be artificially acclimatized. Failure of cold-elevated metabolism to decrease in the face of significant decrease in shivering indicates the presence of nonshivering thermogenesis in man. (Author's abstract) (20 references)

10693
Davis, T. R. A. 1961
THE EFFECT OF HEAT ACCLIMATIZATION ON ARTIFICIAL AND NATURAL COLD ACCLIMATIZATION IN MAN.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64.12.001). Report no. 495, Aug. 25, 1961. ii+7 p.

The seasonal changes in oxygen consumption, rectal temperature, and skin temperature in response to a one-hour nude exposure to 14.1° C. were measured once monthly in six subjects between October and February. The same measurements were obtained in another group nude-exposed 8 hours daily to a chamber temperature of 13.5° C. Shivering decreased as a result of the seasonal and chamber cold exposure. Cold-elevated oxygen consumption also decreased in both groups but never reached basal values remaining at values 30 to 40% above basal. Skin temperature in the seasonal group exhibited no change while a small but significant fall in the skin temperature occurred in the chamber group. Although no rectal temperature change was demonstrated in the seasonal group, there was a significant fall in the rectal temperature in the chamber group. Following the period of chamber and seasonal cold acclimatization, both groups were subjected to 21 days of heat exposure with exercise followed by another measurement of response to cold. In both groups the changes induced by the natural winter exposure and the chamber cold exposure were not influenced by the respective periods of heat exposure. Since previous studies have demonstrated the lack of influence of cold exposure on heat acclimatization, it is concluded that heat and cold acclimatization are not mutually exclusive and can exist simultaneously in man. (Author's abstract)

10694
Davis, T. R. A. 1960
EXPERIMENTAL COLD ACCLIMATIZATION IN MAN. — Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001-08). Report no. 457, Dec. 19, 1960. ii+8 p.

Chronic exposure to cold in man produces a significant reduction in shivering and a less pronounced reduction in cold-induced metabolism. After 10 days of exposure, rectal temperature was reduced but surface temperatures remained unaffected by 31 days of exposure. On the basis of the above results, it is concluded that man can be artificially cold-acclimatized, and that after acclimatization heat production is produced by non-shivering thermogenesis. Extremity temperature alterations do not take place as a result of chronic artificial cold exposure. (Author's abstract)

10695
Davis, T. R. A., 1959
D. R. Johnston, and F. C. Bell
SEASONAL ACCLIMATIZATION TO COLD IN MAN.—Army Medical Research Lab., Fort Knox, Ky. (Project no. 6-64-12-028). Report no. 386, May 25, 1959. ii+7 p.

The decrease in shivering and heat production effected in man by seasonal change indicates that physiological acclimatization to climate takes place in man. Since similar physiological changes in animals are associated with an increase in resistance to cold, it is possible that man's resistance to cold can also be increased in like manner. Moreover the acclimatized man operates in the cold with greater economy as compared to the unacclimatized individual. It is proposed that this economy is achieved in large measure by a decrease in heat loss via the respiratory system. The seasonally acclimatized man shows evidence of the presence of nonshivering thermogenesis. The failure of heat acclimatization to change the criteria of cold acclimatization indicates that the two mechanisms are not mutually exclusive and de-acclimatization is due not to the presence of the other but to the absence of the adequate acclimatizing stimulus. (Authors' abstract)

10696
Davis, T. R. A.,
H. T. Hammel, J. D. Hardy, J. S. Hart, R. J. Hock, D. J. Ingle, C. P. Lyman, C. A. Nichol, K. E. Paschkis, V. R. Potter, P. F. Scholander, and R. E. Smith
SYMPOSIUM ON METABOLIC ASPECTS OF ADAPTATION OF WARM-BLOODED ANIMALS TO COLD ENVIRONMENT: DISCUSSION.—Federation Proceedings, 17 (4): 1066-1073. Dec. 1958.

Various aspects of the metabolic response of animals to cold are discussed, and theories of the mechanism of response are considered. Subjects discussed include the intermediate type of hibernation found in bears and other carnivores; specific stimuli for the initiation of hibernation and for arousal; the phosphorus/oxygen ratio and rate of adenosine triphosphate synthesis during cooling and in hibernation; psychological adaptation to cold in man; adrenal and thyroid function during cold exposure; studies of nonshivering thermogenesis by diathermy; the glutamic-pyruvic transaminase system; and the role of CO_2 in hibernation.

10697
Depocas, F., 1960
and R. Masironi
BODY GLUCOSE AS FUEL FOR THERMOGENESIS IN THE WHITE RAT EXPOSED TO COLD. — Amer. Jour. Physiol., 199 (6): 1051-1055. Dec. 1960.

Various parameters of glucose metabolism were measured with C^{14}-glucose in unanesthetized warm- and cold-acclimated rats at 30° and 6° C. Exposure of warm-acclimated rats to cold was associated with a decrease in turnover time of plasma glucose, no change in glucose pool size and space, an increase in rates of turnover and oxidation rate to the turnover rate, no change in percentage of respiratory CO_2 derived from glucose oxidation, and a decrease in liver glycogen content. Approximately reversed changes were observed in cold-acclimated rats transferred from a cold to a warm environment except in the values of turnover time of plasma glucose and terminal liver glycogen content which underwent smaller changes. It is concluded that cold-induced thermogenesis in white rats, whether acclimated to warm or cold environments, is associated with an increase in carbohydrate catabolism proportionate to the increase in energy metabolism. (Authors' abstract)

10698
Depocas, F. 1960
CALORIGENESIS FROM VARIOUS ORGAN SYSTEMS IN THE WHOLE ANIMAL. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 19-24. Dec. 1960 (Part II).

The capability of cold-acclimated rats to produce heat by means other than shivering is now

well demonstrated. There is, however, disagreement on the site of origin of this thermogenesis. Recent work on the ability of functionally eviscerated, cold-acclimated rats to increase their oxygen consumption on exposure to cold points to extra-abdominal tissues as possible sites for nonshivering thermogenesis. Data on the ability of functionally eviscerated, cold-acclimated rats, as well as sham-operated cold-acclimated rats, to respond to noradrenaline bring additional evidence for the importance of extrahepatic tissues as the site of nonshivering thermogenesis. (Author's abstract)

10699
Depocas, F. 1960
GLUCOSE METABOLISM IN WARM- AND COLD-ACCLIMATED RATS. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 106-109. Dec. 1960 (Part II).

Alterations in carbohydrate metabolism observed in warm- and cold-acclimated animals are reviewed, and recent work on the dynamics of glucose metabolism in warm- and cold-acclimated white rats exposed to warm and cold environments is described. (Author's abstract)

10700
Depocas, F. 1959
THE POOL SIZE, TURNOVER RATE, AND OXIDATION RATE OF BODY GLUCOSE IN ANESTHETIZED WARM- AND COLD-ACCLIMATED RATS EXPOSED TO A WARM ENVIRONMENT.——Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (2): 285-295. Feb. 1959.

The size and space of the body glucose pool along with its turnover and oxidation rates were measured in anesthetized 30° and 6° C. acclimated rats by a method involving continuous intravenous injection of small amounts of D-glucose uniformly labelled with C^{14} and attainment of relatively constant specific activities of plasma glucose and respiratory carbon dioxide. Values of glucose pool space in warm-acclimated rats were in accord with those found in the dog by a similar method. Results obtained on warm-acclimated rats indicated that previous published values of turnover and oxidation rates of glucose for normal rats were high by a factor of approximately 2 to 4. In cold-acclimated rats, average absolute values of glucose pool size were significantly smaller than in warm-acclimated rats but the difference was lost when results were related to body weight. Small, non-significant differences in values of glucose pool size per 100 g. body weight and in plasma glucose concentration combined to give a significantly larger glucose space in cold- than in warm-acclimated rats. Glucose turnover and oxidation rates, the ratio between these two quantities, and the proportion of respiratory carbon dioxide derived from glucose oxidation were not significantly different in the two groups of rats, thus indicating that cold acclimation is not associated with major alterations in glucose metabolism at least when studied on fully fed anesthetized animals at 30° C. (From author's abstract)

10701
Diven, R. H., 1958
H. M. Page, E. S. Erwin, and C. B. Roubicek
EFFECT OF ENVIRONMENTAL TEMPERATURE ON DIURNAL VARIATION OF BLOOD CONSTITUENTS IN THE BOVINE.——Amer. Jour. Physiol., 195 (1): 88-90. Oct. 1958.

The effect of ambient temperature changes on the diurnal variation of blood constituents was determined in five yearling Hereford steers maintained in the open sunlight for three 18-hour periods. Feed was withheld during the sampling periods, and water was restricted during one period. Serum protein levels were found to vary directly with rises in ambient temperature, indicating that thermal stress alters either hemoconcentration or inter- and intracellular water distribution. Blood creatinine, plasma cholesterol, and carotene showed an inverse relationship with temperature. No effect of temperature was seen on blood glucose or plasma uric acid concentration. The differences between the data obtained in this study and observations made under controlled environmental conditions reveal a difference in the response of animals to changing high ambient temperatures and to high temperatures in an environmentally controlled chamber.

10702
Dobrovol'skii, L. A. 1961
[CHANGES IN PROTEIN METABOLISM DURING PROLONGED ACTION OF HIGH TEMPERATURE] Izmeneniia belkovogo obmena pri dlitel'nom vozdeistvii vysokoi temperatury. —— Gigiena i sanitariia (Moskva), 26 (6): 25-28. June 1961. In Russian, with English summary (p. 28).

English translation published by U. S. Joint Publ. Research Serv. (New York), No. 10076 (CSO:6629-N/1), Sept. 8, 1961. 6 p. (Available from Office of Technical Services, U. S. Dept. Commerce)

Ten rabbits were exposed to 40° C. temperature with 25% relative humidity, 3 hours each day for 150 days; five rabbits were used as controls. Body temperature, respiratory rate, and body weight were determined before and after each heat exposure; protein fractions of the blood serum were analyzed once every two weeks; furthermore, a study was made of the S^{35} methionine uptake by serum proteins. Two distinct phases of reaction to heat stress were observed. The first is that of a relative adaptation to heat evidenced by a lability of the heat-regulatory indices and a temporary fall in the globulin concentration. The second phase, characterized by a progressive loss of adaptation, took place in the fourth and fifth month of heat exposure. The associated increase in total serum protein concentration is viewed as part of the hemoconcentration under heat stress hindering the activity of cardiovascular and heat-regulatory systems.

10703
Donhoffer, S., 1959
G. Szegvari, I. Jarai, and M. Farkas
THERMOREGULATORY HEAT PRODUCTION IN THE BRAIN.——Nature (London), 184 (4691): 993-994. Sept. 26, 1959.

Thermocouples were introduced into anesthetized rats into the brain just behind the coronary suture, into the colon, lumbar musculature, and subcutaneous tissue above the cranium and back. The environmental temperature changed abruptly by transfering the respiratory chamber to a water-bath at 18-20° C., and vice versa, several times during the course of the experiment. The stabilization of re-

corded brain temperature coincided with the rise in oxygen consumption, whereas temperatures at other sites continued to decline, colonic temperature falling well below brain temperature. The temperature of arterial blood was always lower than colonic temperature, and an increase in blood flow decreased the temperature difference between the arterial blood and the brain if heat production in the brain remained unaltered. Crossing of brain and colonic temperature curves indicates a local increase in heat production, originating most probably in the neuroglia.

10704
Dorodnitsyna, A. A., 1960
and E. R. Shepelev
[HEAT EXCHANGE IN MAN UNDER CONDITIONS OF HIGH TEMPERATURES] Teploobmen cheloveka v usloviiakh prebyvaniia pri vysokykh temperaturakh. —— Fiziologicheskii zhurnal SSSR (Leningrad), 46(5): 607-612. May 1960. In Russian, with English summary (p. 612).

The heat exchange of man in a state of relative rest was studied under conditions of varying ambient temperatures (40, 50, 70, and 75°C.). The measurements included determination of values for heat production, heat emission, and heat accumulation in the organism, as well as registration of the pulse rate and the body temperature. The data allowed an estimate of the heat load imposed on man in various temperatures and the calculation of the time span for which the studied heat loads may be endured relative to the speed of heat storage and the limiting permissible values of heat accumulated by the organism. (Authors' summary, modified)

10705
Durrer, J. L., 1961
and J. P. Hannon
GLUCOSE TOLERANCE AND INSULIN SENSITIVITY OF THE COLD-EXPOSED BEAGLE DOG.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-33). Technical Report no. 61-32, Oct. 1961. 6 p.

Five male Beagle dogs were obtained from a moderate climate and were immediately subjected to 4-weeks indoor exposure to a warm control environment. This was followed by gradual exposure for ten days to outdoor winter temperatures in the Arctic, after which they were subjected to continuous outdoor exposure. Measurements of insulin sensitivity and glucose tolerance were made during the control and cold-exposed condition. They indicated little, if any, effect of cold acclimatization on insulin sensitivity, although some changes in the shape and the position of the blood glucose curve following insulin injection were noted. Cold acclimatization was associated with an increase in the glucose tolerance. (Authors' abstract)

10706
Eagan, C. J. 1961
THE EFFECT OF DEPTH OF IMMERSION ON THE RESPONSES OF THE FINGER IN ICE WATER.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-60-4, Oct. 1961. 12 p.

The effect of depth of immersion of the finger in ice water on the vascular reactions and pain sensations was investigated. The middle finger served as a control and was immersed to the level of the second joint. Immersion to the level of the first joint of the index finger of one hand, and to the second joint of each were compared with those of its simultaneously immersed, adjacent, middle finger. The results showed that there was a less intense cold-induced vasoconstriction, a tendency towards an earlier reactive vasodilation, and less intense pain sensation in a finger shallowly immersed. It is suggested that disparity between the results of investigators, in studies of the effect on vasodilation of recurrent ice-water immersion of the finger, may possibly be explained by the lack of awareness of the importance of depth of immersion, and of other factors, during tests for cold adaptation. The writer submits that the null hypothesis cannot be rejected unless differences in response are observed when fingers are compared under identical conditions. (Author's summary)

10707
Eagan, C. J. 1961
THE ORIGINS OF HEAT LOST FROM EXTREMITIES IN ICE WATER.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL TN-60-13, April 1961. 12 p.

The origins of heat lost during ice-water calorimetry of the human finger for 30 minutes, and of the rabbit ear for 5 minutes, have been estimated from experimental measurements combined with theoretical calculations. It is estimated that heat convectively transferred to the immersed extremity by the blood stream supplied 97.5% of total heat lost from the finger of normothermal man, 90% from the ear of the normothermal rabbit, and 95% from the ear of the hyperthermal rabbit. Almost all of the remainder of total heat loss was supplied through cooling of the extremity (local heat debt), although a negligible amount was derived from local metabolism. It is concluded that total heat loss is a suitable criterion of the rate of blood flow when the vascular responses to ice-water immersion are compared in the corresponding fingers of man or in the ears of the rabbit. It is implied that surface temperature is a suitable criterion for comparing rates of blood flow in extremities exposed to cold air. (Author's summary)

10708
Edholm, O. G. 1960
POLAR PHYSIOLOGY. —— Federation Proceedings, 19 (4), Supplement no. 5: 3-8. Dec. 1960 (Part II).

This review of studies on the acclimatization of man to cold includes observations in cold chambers, the results of field work on subjects permanently residing in cold places, and studies on men from temperate climates sent on polar expeditions. Conclusions indicate that (1) there is a need for further studies under better controlled conditions; (2) there is no proof so far that man adapts, physiologically, to cold; and (3) the most favorable aspects of polar physiology are not concerned with cold at all, but rather with the study of fundamental human biology.

10709
Elsner, R. W., 1961
K. L. Andersen, and L. Hermansen
THERMAL AND METABOLIC RESPONSES OF ARCTIC INDIANS TO A STANDARD MODERATE COLD EXPOSURE AT THE END OF WINTER.—Arctic Aeromedical Lab., For Wainwright, Alaska (Project no. 8240-16). Technical Report no. 60-4, April 1961. 11 p.

Oxygen consumption, skin temperature and rectal temperature during nights of cold exposure were measured in eight Indian men from a remote arctic village who had been similarly studied the previous fall. The metabolic response of the Indians to cold exposure was similar in the spring to that observed in the fall studies. All subjects showed a general increase of about 30% in O_2 consumption during the night. In addition, the basal metabolic rate of four subjects measured was slightly above the Dubois standards, as in the fall. A decline in rectal and skin temperatures throughout the night was observed to be similar to that of the same subjects in the fall, with the exception that the surface temperatures of arms and legs were slightly cooler in the spring. It was concluded that, except for a tendency toward heat conservation by cooling of extremities, no metabolic or thermal changes of a seasonal nature had taken place in these subjects during the arctic winter. (Authors' abstract)

10710
Euler, U. S. von 1960
EXPOSURE TO COLD AND CATECHOLAMINES. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 79-81. Dec. 1960 (Part II).

Estimations of the chromaffin reaction in the adrenal gland of animals exposed to cold have shown that when the cold stress was moderate and the animals remained in a good state over a prolonged period, a more or less normal picture was observed in the adrenal medulla. Likewise, in cold-adapted animals the catecholamine content in the gland may be normal or even increased. From these observations it is hard to draw conclusions as to the actual release. On the other hand acute cooling, accompanied by a fall of body temperature of several degrees C., is followed by a definite increase in the release of adrenaline and also by its depletion in adrenal glands. The importance of following continuously the catecholamine production over prolonged periods of cold stress and adaptation by measuring the output in urine is emphasized. (Author's abstract)

10711
Evans, M. 1961
THE RESPIRATORY AND CARDIOVASCULAR RESPONSE TO IMMERSION IN COLD AND WARM WATER. —— Quart. Jour. Exper. Physiol. (London), 46 (1): 83-94. Jan. 1961.

During their first few minutes of immersion in stirred water at 5° and 15° C., the pulmonary ventilation of twelve unclothed men was high, and their end-tidal carbon dioxide tension fell. The carbon dioxide tension then returned to or a little above its original level but did not greatly exceed it even in working experiments lasting 20 minutes in water at 5° C. or 40 minutes in water at 15° C. In water at 37.8° C. the men's heart rates rose steadily, in water at 25° C. they fell and remained low, and in water at 5° and 15° C. they rose and then fell. Repeated immersion at 15° C. reduced or abolished the entire respiration and heart rate responses to immersion and the metabolic response, but did not significantly increase the falls in rectal temperature. Clothing also reduced the reflex responses to immersion. A number of ventricular extrasystoles were observed during the first 2 minutes of immersion in water at 15° C., and it is suggested that ventricular fibrillation due to increased venous and arterial pressures, adrenaline, and hyperventilation, may be responsible for some cases of sudden death in cold water. (From the author's summary) (32 references)

10712
Everett, N. B., 1961
and L. Matson
RED CELL AND PLASMA VOLUMES OF THE RAT AND OF TISSUES DURING COLD ACCLIMATION. —— Jour. Applied Physiol., 16 (3): 557-561. May 1961.

Also published as report: THE RED CELLS AND PLASMA VOLUMES OF THE RAT AND ITS INDIVIDUAL TISSUES AND ORGANS DURING ACCLIMATIZATION TO COLD. —— Univ. of Washington. School of Medicine, Seattle; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-26). Technical Report no. 60-35, Oct. 1961. 18 p.

Red cell and plasma volumes of the total rat and of its individual tissues and organs were determined for animals exposed to 5° C. for 4 hr., 2 weeks, and 6 weeks. In addition, the tissue hematocrit ratios were determined. These values were compared with those of rats kept at 24° C. Fe^{59}-labeled erythrocytes and I^{131}-labeled albumin were given intravenously, and after mixing the rats were frozen in liquid nitrogen. The organs and tissues were removed in the frozen state, assayed for radioactivity, and blood cell and plasma volumes were calculated on a unit weight basis. Significant changes in blood cell and plasma volumes were observed for the total rat and for many of the individual organs. There was a significant increase in the red cell content of the total rat within 24 hr. of cold exposure. After 6 weeks, total blood volume was increased by approximately 20% over the control level and the increase in erythrocyte volume was slightly more than the increase in plasma volume. The hematocrit ratio of heart blood was 44.8 after 6 weeks exposure compared with 41.5 for controls. In general, it can be said that the somatic parts of the body showed increases in blood volume whereas the visceral parts had decreased volumes. (Authors' abstract)

10713
Felts, J. M., 1959
and E. J. Masoro
EFFECTS OF COLD ACCLIMATION ON HEPATIC CARBOHYDRATE AND LIPID METABOLISM.—— Amer. Jour. Physiol., 197 (1): 34-36. July 1959.

The acclimation of rats to low environmental temperatures was found to alter the hepatic metabolic response to fasting for 1 day at 0-2° C. Liver glycogen was stabilized, fatty infiltration of the liver did not occur and liver slices were better able to oxidize acetate-1-C^{14} and palmitate-1-C^{14} to $C^{14}O_2$. These results provide an excellent example of an acclimation process occurring at the molecular level. (Authors' abstract)

10714
Ferguson, I. D., 1958
and A. B. Hertzman
REGULATION OF BODY TEMPERATURE DURING CONTINUOUS EXPOSURE TO HEAT.——St. Louis

Univ. School of Medicine (Contract AF 18(600)-3357); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 7155, Task no. 71804). WADC Technical Report no. 57-727, July 1958. iii+17 p. PB 140908

Three lean healthy resting nude young men were exposed twice to dry and wet bulb temperatures of 43.3° and 30.3° C. for 32 hours. Body weight was maintained by food and water. Physiological regulation of body temperature was continuously successful as indicated (after initial thermal equilibration of the subject with the chamber) by essentially constant skin and oral temperatures, rates of water loss, and unweighted averages of regional sweating rates. Fatigue of the subjects did not show in rates of total evaporation or in body temperatures. Forehead sweating rates tended to increase. Small diurnal variations seemed to appear in several of the regional sweating rates but may not have been statistically significant. The regional pattern characteristic of the particular subject at ambient temperature of 43.3° C. was exhibited continuously during the entire exposure and in the repeat experiment. The mean rates of urine formation in the six experiments showed an inverse relation with the mean oral temperatures. (Authors' abstract)

10715
Fine, B. J. 1958
THE COMPARATIVE EFFECTIVENESS OF SOME PSYCHOLOGICAL AND PHYSIOLOGICAL MEASURES IN RANKING THE IMPACT OF DIVERSE ENVIRONMENTAL CONDITIONS. —— Jour. Applied Psychol., 42 (5): 353-356. Oct. 1958.

Two studies are presented which compare the effectiveness of a subjective rating scale with two physiological measures, mean weighted skin temperature and average increase in metabolic rate, in ranking eight environmental conditions (varying in ambient temperature, humidity, and wind speed) from warmest to coldest. The results of both studies indicate a high degree of consistency between individual responses on each measure and a high degree of agreement between the subjective rating method and both mean weighted skin temperature and metabolic rate methods of ranking the conditions. It is noted that the subjective scale might be used instead of the physiological measurements for the purpose of comparing conditions with regard to the relative warmth or coldness of groups of individuals within the conditions, but only for that purpose. (Author's summary)

10716
Fleischner, J. R., and F. Sargent 1959
EFFECTS OF HEAT AND COLD ON THE ALBINO RAT: CROSSED RESISTANCE OR CROSSED SENSITIZATION? —— Jour. Applied Physiol., 14 (5): 789-797. Sept. 1959.

Two experiments were carried out to test whether or not cold-acclimatized rats adjust better to heat and heat-acclimatized rats adjust better to cold than rats not previously exposed to either environmental extreme. In both, groups of rats were exposed to 94.5-96.5° F. (hot), 33-40° F. (cold), and 76-78° F. (control). In the first experiment 45 female Holtzman littermates were used. After 50 days, "hot" rats were abruptly transferred to cold, "cold" rats to heat. Control animals were also placed in each environment. In the second experiment 55 identical rats were similarly treated; the cross, however, was made after 29 days. Rats exposed to 95° F. exhibited sustained hypothermia. Rats exposed to 36° F. developed a transient hypothermia which lasted longer in the first experiment than in the second and was accompanied by more severe cold injury. Heat was not a stress in the sense of Selye, but cold was. There was crossed sensitization rather than crossed resistance. (Authors' abstract)

10717
Fox, R. H., R. Goldsmith, D. J. Kidd, and H. E. Lewis 1961
ACCLIMATIZATION OF THE SWEATING MECHANISM IN MAN [Abstract]. —— Jour. Physiol. (London), 127 (2): 56P-57P. July 1961.

Healthy subjects were exposed to hot environments in which their oral temperature reached 37.3, 37.9, or 38.5° C. for 1/2 to 2 hours daily for 12 days. The effects of this acclimatization on perspiration rate (when performing a controlled physical activity in a standard "hot climate") was studied. The subjects maintained at the lowest body temperature level did not show an increase in sweat rate, whereas those maintained at the highest body temperature level exhibited a progressive increase which was most marked for the subjects with the longest exposure (120%) and least for those with the shortest exposure (50%). It is concluded that small elevations in body temperature, maintained for short periods daily in the manner described, are capable of causing an acclimatization of the sweating mechanism in man.

10718
Fox, R. H., R. Goldsmith, D. J. Kidd, and H. E. Lewis 1961
CHANGES IN PERIPHERAL BLOOD FLOW WITH HEAT ACCLIMATIZATION [Abstract]. —— Jour. Physiol. (London), 127 (2): 57P-58P. July 1961.

Nine male subjects, acclimatized to daily body temperature elevation levels (37.3-38.5° C.) for three different durations (1/2 - 2 hrs.), were tested both before and after acclimatization for peripheral blood-flow response to body heating. For this test the subjects were heated to an oral temperature of 38.5° C. and body temperatures, blood flow in the hand and forearm, and skin changes in the chest and in one ear pinna were measured. Blood flow at the end of the heating period was higher in the forearm, hand, chest, and ear after acclimatization.

10719
Fox, R. H. 1960
HEAT STRESS AND ATHLETICS. —— Ergonomics (London), 3 (4): 307-313. Oct. 1960.

This paper reviews the principal ways in which the human body responds to heat stress and the physiological mechanisms available to the body for combating such stress. A hypothetical case of a marathon runner competing in the 1960 Olympic Games in Rome, Italy, is used to illustrate the value of applying the concepts of thermal exchange analysis to evaluate the severity of a particular heat stress situation.

10720
Fradà, G., 1959
and G. Panno
[EFFECT OF EFFORT AND OF ENVIRONMENTAL HYPERTHERMIA ON RENAL FUNCTION] Influenza dello sforzo e dell'ipertermia ambientale sulla funzionalità renale.—Bolletino della società italiana di biologia sperimentale (Napoli), 35 (23): 1586-1588. Dec. 15, 1959. In Italian.

Twenty subjects between 19-40 years of age were subjected to heat stress (43°-45° C.) for a period of two hours while undergoing alternate periods of physical exercise and rest. The determination of renal plasma flow, glomerular filtration, and other functional indices at rest and at normal temperature showed values within the normal range for all subjects. Physical exercise produced in all subjects a slight decrease in glomerular filtration rate and in plasma flow. Exposure to environmental hyperthermia induced a marked decrease in glomerular filtration rate and plasma flow; these parameters were further decreased with the addition of effort.

10721
Fradà, G., 1959
and G. Mentesana
[MODIFICATIONS OF THE WATER-SALT METABOLISM DUE TO THE EFFECT OF ENVIRONMENTAL HYPERTHERMIA] Modificazioni del ricambio idrosalino per effetto dell'ipertermia ambientale.—Bolletino della Società italiana di biologia sperimentale (Napoli), 35 (23): 1583-1586. Dec. 15, 1959. In Italian.

Seventeen males between 29 and 63 years of age were subjected to heat (45° C.) for three hours. Body fluid examinations were made in the 24-hour period before and after hyperthermia. The following results were obtained: (1) a decrease of total body water; (2) an increase in extracellular fluids; (3) a decrease in plasma mass with an increase in hematocrit values; (4) a decrease of blood sodium values with regard to base values; (5) increased blood potassium; (6) a decrease of urine sodium in twelve cases and an increase in five; (7) an increase in urine chloride in 11 cases and a decrease in 6; and (8) an increase in urine potassium in 15 cases and a decrease in 2. It is concluded that heat stress produces a reduction of total body water and increases extracellular fluids.

10722
Frankel, H. M. 1959
EFFECTS OF RESTRAINT ON RATS EXPOSED TO HIGH TEMPERATURE.—Jour. Applied Physiol., 14 (6): 997-999. Nov. 1959.

Male rats were placed in a cage either 8 x 8 x 10 inches (free), or 2 x 2 x 8 in. (restrained), and exposed to ambient temperatures between 40° and 60° C. Restrained rats died sooner than free animals at all temperatures. There was no significant difference between final rectal temperatures of free and restrained rats at ambient temperatures greater than 40° C.; mean for these groups was 44.6° C. At 40° C. the final rectal temperature was slightly lower in the restrained group (43.4° versus 44.6° C.). Restraint had no significant effect on the constituents of the blood examined. Serum potassium and specific gravity and blood hematocrit were increased and serum sodium was unchanged in heat-exposed rats compared with controls at 26° C. Serum calcium varied irregularly with exposure temperature. (Author's abstract)

10723
Fregly, M. J., 1961
P. F. Iampietro, and A. B. Otis
EFFECT OF PROPYLTHIOURACIL TREATMENT AND ADRENALECTOMY ON HEAT PRODUCTION AND HEAT LOSS DURING ACUTE EXPOSURE TO COLD. — School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 61-46, April 1961. 9 p.

Thyroidectomy (propylthiouracil treatment) and adrenalectomy increased the rate of cooling of rats restrained and subjected to air at 5° C. At the same colonic temperature during cooling, both thyroidectomized and adrenalectomized rats maintained higher skin temperatures than did control rats. Heat production (measured by oxygen consumption) was determined for thyroidectomized and control rats only. At the same colonic temperatures during cooling thyroidectomized rats had the same heat production as controls. Calculation of heat loss at a given colonic temperature during cooling, however, revealed it to be greater for thyroidectomized than for control rats. The inability of thyroidectomized rats to tolerate cold as well as the control rats did under these conditions is due almost entirely to a more rapid loss of body heat. Failure to conserve heat may be related to changes in vascular reactivity induced by the hypothyroid state. (Authors' abstract) (26 references)

10724
Froese, G. 1958
EFFECT OF BREATHING O_2 AT ONE ATMOSPHERE ON THE RESPONSE TO COLD IN HUMAN SUBJECTS.—Jour. Applied Physiol., 13 (1): 66-74. July 1958.

A study was made of the effects of oxygen breathing on the metabolic response of men to cold. Ten partially nude resting subjects exposed to a temperature of 9-12° C. for 20-30 minutes showed a lower increase in oxygen consumption when breathing oxygen, and a lower heart rate, minute respiratory volume, respiratory frequency, and electromyographic activity. Oxygen breathing had no apparent effect on shivering activity.

10725
Gambino, J. J., 1961
M. S. Billings, B. G. Lamson, and L. R. Bennett
EFFECTS OF POSTIRRADIATION CHRONIC COLD STRESS ON IRRADIATED RATS.—Univ. of California. School of Medicine, Los Angeles; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 61-50, Feb. 1961. 6 p.

A comparison was made of the long-term response of rats to chronic, intermittent cold stress administered following whole-body irradiation, adrenal irradiation, and no irradiation. There was no significant difference in longevity or time of appearance of external neoplasms when any of the cold stressed groups were compared with their noncold stressed controls. (Authors' summary)

10726
Garrido, C. M. 1959
ACTION OF DIFFERENT SUBSTANCES ON THE RESISTANCE TO COLD IN NORMAL AND ADRENALEC-

TOMIZED ALBINO RATS [Abstract].—Acta physiologica latino-americana (Buenos Aires), 9 (3): 233-234. 1959.

Survival time of adrenalectomized rats exposed to intense cold was not modified by the administration of glucose, ascorbic acid, ACTH, somatropin, levothyroxine, adrenaline, DOCA, or 19-nor-methyltestosterone. Normal rats were not protected by glucose or somatropin administration. Survival time in intense cold was prolonged in rats receiving cortisone, cortisol, prednisone, 2-methyl-9-chlor-hydrocortisone and dexamethasone. Progesterone had a less protective action. An increased resistance to cold was observed in normal rats treated 7 days previously with ACTH, prednisone, and ascorbic acid.

10727
Garrido, C. M. 1960
[SOME HISTOLOGICAL AND HISTOCHEMICAL MODIFICATIONS OF THE ADRENAL CORTEX OF WHITE RATS EXPOSED TO COLD] Algunas modificaciones de la histología e histoquímica de la corteza suprarrenal de las ratas blancas sometidas al frío. — Revista de la Sociedad argentina de biología (Buenos Aires), 36 (1-2): 9-12. April-May 1960. In Spanish, with English summary (p. 12).

A histological and histochemical study of the adrenal glands of rats exposed to intense cold showed (1) a disappearance of the differential zone between the zona fasciculata and zona reticulata, and sinusoidal dilatation in the zona fasciculata; (2) an intense depletion of lipids and a decrease in ascorbic acid content two hours following exposure, and an almost total depletion of both substances in rats killed by cold; and (3) slight modifications in alkaline phosphatase content. (Author's summary, modified)

10728
Gaydos, H. F. 1958
EFFECT ON COMPLEX MANUAL PERFORMANCE OF COOLING THE BODY WHILE MAINTAINING THE HANDS AT NORMAL TEMPERATURES.—Jour. Applied Physiol., 12 (3): 373-376. May 1958.

Performance on two complex manual tasks (knot tying and block stringing) was tested under conditions in which the body and hands were cooled by exposure to an ambient temperature of 45° F., or in which the body was cooled while the hands were kept warm. With body surface cooling to 78°, a significant decrement in manual proficiency was observed when hand skin temperature fell to 50-55°, but no decrement occurred when hand temperature was maintained at 80° or higher. It is concluded that the body can be cooled to a considerable degree without affecting manual performance, if the surface temperature of the hands is maintained at a normal level.

10729
Gaydos, H. F., 1958
and E. R. Dusek
EFFECTS OF LOCALIZED HAND COOLING VERSUS TOTAL BODY COOLING ON MANUAL PERFORMANCE.—Jour. Applied Physiol., 12 (3): 377-380. May 1958.

Performance on two complex manual tasks (knot tying and block stringing) was tested under conditions in which the body and hands were cooled by exposure to an ambient temperature of 15° F., or in which the hands were cooled in 5° air while the body remained warm. Cooling of the fingers to a temperature of 50-65° produced a similar significant decrement in manual proficiency under both experimental conditions. It is suggested that cooling of the hands has a detrimental effect on manual performance regardless of the temperature of the body.

10730
Geoghegan, B., 1958
D. F. Roberts, and M. R. Sampford
A POSSIBLE CLIMATIC EFFECT ON NAIL GROWTH.—Jour. Applied Physiol., 13 (1): 135-138. July 1958.

The rate of growth of fingernails was measured in 49 naval personnel during 6-week exposures to Arctic and temperate climates. Average nail growth was markedly retarded in the Arctic, but the effect varied considerably from subject to subject. No correlation was observed between nail growth and the extent of environmental exposure or food intake based on group mess consumption. It is suggested that the reduction in nail growth in a cold environment is due to a decrease in peripheral blood flow.

10731
Gladoshchuk, G. V., 1959
M. D. Aksenov, and A. M. Kozhin
[THE EFFECTS OF HIGH AIR TEMPERATURES ON THE FUNCTIONAL CONDITION OF THE CEREBRAL CORTEX] O vliianii vysokikh temperatur vozdukha na funktsional'noe sostoianie kory golovnogo mozga.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 60-62. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 99-103. New York: U.S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U.S. Dept. Commerce)

Eight healthy male subjects were exposed to heat stress in a hermetically sealed chamber. The length of stay was varied, as follows: at 50° C., 85-110 min.; at 60° C., 55-60 min.; and at 70° C., 30-45 min. The functional condition of the cerebral cortex was determined by the degree of excitability as measured by changes in muscular strength of the hands in response to a momentary and a sustained stress, by the speed of sensorimotor reaction to sound and light stimuli, by the frequency and amplitude of tremor of the right arm, and on the basis of subjective reports. In all cases hyperthermia resulted, as indicated by physiological indices: body temperature ranging from 38.3° to 38.6° C.; pulse frequency, 120-130 per min.; systolic blood pressure, 120-132 mm.; diastolic blood pressure, 40-56 mm.; and respiratory volume, 10.5-12.5 liters per min. Muscular strength in response to both momentary and sustained stress decreased, the former by 6-8% and latter by 25.8-47.3%. The reduction was proportional to the duration of the heat stress. The sensorimotor reaction times were increased, and so were the frequency and amplitude of the hand tremor. The subjective feeling of well-being deteriorated markedly toward the end of the heat experiment. It is concluded that a predominance of inhibitory processes takes place in the cerebral cortex in response to high temperatures. The sensitivity of the analyzers exhibits a corresponding decrease.

10732
Glaser, E. M. 1959
THE INFLUENCE OF THE BRAIN ON ACCLIMATIZATION.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 28-31. 1959.

Some of the changes in heat acclimatization which can only be of cerebral origin are considered, e.g., the lack of discomfort in people partly acclimatized to heat, even though skin and rectal temperatures are only slightly lower than before acclimatization; and the rapid, measurable degree of acclimatization which sometimes can be demonstrated after a single day in a hot environment. Temperature regulation and acclimatization appear continuous and interdependent. The distinction must be made between the state of acclimatization and the ability to acclimatize. Frequent changes of temperature enhance the ability to acclimatize.

10733
Glaser, E. M., and R. J. Shephard 1961
SIMULTANEOUS ACCLIMATIZATION TO HEAT AND COLD IN MAN [Abstract]. —Jour. Physiol. (London), 156 (1): 8P-9P. April 1961.

Fifteen men spent 3 hr. every morning in a hot room (35° C.) for eleven days and 3 hr. every afternoon in a cold room (about 3° C.) for the same period. Progressive adaptation to these environments could be seen in diminishing reactions of the skin and mouth temperatures. The decrement of blood pressure and heart rate responses to immersion of a hand at 47° C. and 4° C. (tested before and after the eleven exposures) which was observed at the end of the experiment suggests that warming and cooling of the whole body could inhibit responses to localized warming and cooling. A fall of the mouth temperature on the day after the cessation of the experiments at the time when subjects would have been entering the hot room, and a rise in mouth temperature when they would have been entering the cold room could be further evidence that diurnal rhythms of temperature are influenced by past activities.

10734
Gold, J. 1960
CALORIE NEUTRALIZATION DURING THERMAL STRESS.—Aerospace Med., 31 (11): 933-940. Nov. 1960.

The benefit of calorie neutralization during heat exposure by drinking of ice water is that the body must expend 37 Calories on a liter of ice water, but another benefit is that it provides an additional liter of fluid which can be eventually used for sweating. The latter benefit is reflected in a prolongation of sweating time. Even without the administration of ice water, all subjects could easily have tolerated periods longer than two hours at 130° F. With one liter of ice water, it is estimated that subjects can maintain relative comfort from 75 to 100% longer. Exposure time to 160° F. is limited, especially for older subjects. In the case of one young subject, his effective body heat storage for calorie neutralization was 24.4 Calories per square meter body surface per hour, whereas his control was 47.4. This means that he would have 23 effective Calories more to absorb which would have required at least another 30 minutes. If the liter of ice water were administered over a period of two hours (instead of one hour) it is estimated that the subject could have remained an extra hour. At 160° F., it is probable that a liter of ice water can extend the useful time of exposure at least 50% (and possibly 100%) for young subjects whose circulatory systems show adequate compensatory responses. (Author's summary, modified)

10735
Gold, J. 1959
HEAT TESTS.—In: Project Mercury candidate evaluation program, p. 41-47. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959.

Heart rate and water evaporative loss were determined in 31 subjects in ambient temperature of 130° F. with a relative humidity of 8% and an air motion of 3 to 5 m.p.h. The data were evaluated statistically and each candidate was assigned a score in each of three parameters: body heat storage, Modified Craig Index of Strain, and a new heart index (based on a ratio between theoretical heat absorbed and actual heat absorbed). The three scores were weighed equally, added, and an average was obtained. The best possible score obtained was 9.0; the worst, 0.0. Those who made above 6.0 were considered relatively superior, while those who scored below 3.0 were considered relatively poor. The bulk of the scores ranged between 3.0 and 6.0. Certain cardiocirculatory changes not reported previously were recorded, mainly with electrocardiographic and auscultatory findings.

10736
Gold, J. 1961
A UNIFIED SYSTEM FOR EVALUATION AND SELECTION OF HEAT STRESS CANDIDATES. —Jour. Applied Physiol., 16 (1): 144-152. Jan. 1961.

A system for the evaluation and selection of heat stress candidates has been developed that is concerned not only with the extent to which an individual is capable of dissipating heat, but also the price he must pay for so doing. The former is dealt with through the concept of effective body heat storage (q_e); the latter, through a newly developed index of strain (I_G). Effective body heat storage is defined as that amount of storage obtained if a subject were able to go into a heat chamber already fully equilibrated with it and with all heat-dissipating mechanisms fully operating. The index attempts to express a new concept, accumulative circulatory strain, in terms of heart rate alone. The best subjects (usually in the young age groups) show a low q_e and low I_G; the worst (usually in the older age groups) show a high q_e and low I_G. All subjects were maintained at rest during heat exposure. (Author's abstract)

10737
Goldsmith, R. 1960
USE OF CLOTHING RECORDS TO DEMONSTRATE ACCLIMATIZATION TO COLD IN MAN. —Jour. Applied Physiol., 15 (5): 776-780. Sept. 1960.

Eight men lived for a year under considerable cold stress, doing hard physical outdoor work for much of the time. Observations of clothing worn and records of comfort vote were made, together

with records of environmental conditions. There was a reduction in the number of layers of clothes worn in the last quarter of the period as compared with the first. A comparison between days of equal windchill in the first and second half of the period also showed significant reduction in the clothing assemblies. It is concluded that during a period of prolonged cold stress men do acclimatize to the cold, and this is manifested by a voluntary reduction in the amount of clothing they wear. (Author's abstract)

10738
Good, A. L., 1960
and A. F. Sellers
STUDIES OF SKIN, BLOOD, AND RECTAL TEMPERATURES OF UNANESTHETIZED DOGS EXPOSED TO EXTREME COLD. I. TEMPERATURE CHANGES IN THE BLOOD OF THE PULMONARY ARTERY AND LEFT ATRIUM.—Univ. of Minnesota. School of Veterinary Medicine, St. Paul; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 57-52, Feb. 1960. 17 p.

Polyethylene cannulae were surgically placed in the pulmonary artery and left atrium of dogs; thermistors mounted in polyethylene tubing and hypodermic needles were passed through these cannulae and the temperature changes of the blood and rectum were recorded photographically. Continuous recordings of these temperature changes in unanesthetized dogs were made when the experimental animals were suddenly exposed to an ambient temperature of -35° C. for 30 minutes. Shivering began immediately after exposure to cold; blood and rectal temperatures increased 0.4 to 0.5° C. during the 30 minutes of exposure. It was found that the rectal temperature exceeded the left atrial blood temperatures from 0.2 to 0.3° C., and that in all experiments except one, the left atrial blood temperature exceeded that of the pulmonary artery from 0.01 to 0.15° C. Thermodynamic considerations of carbon dioxide and oxygen exchanges in the lungs and evaporation of water in the upper respiratory tract are cited in interpreting these findings. (Authors' abstract)

10739
Hallwachs, O. 1960
[OXYGEN CONSUMPTION AND TEMPERATURE BEHAVIOR OF UNNARCOTIZED DOGS AT AIR TEMPERATURES FROM -10° C. to +35° C.] Sauerstoffverbrauch und Temperaturverhalten des unnarkotisierten Hundes bei Lufttemperaturen von -10° C. bis +35° C. — Pflügers Archiv für die gesamte Physiologie (Berlin), 271 (7): 748-760. 1960. In German.

The relation between oxygen consumption and body temperature was determined in unanesthetized dogs exposed for 100 to 120 minutes to ambient temperatures ranging from -10° to +35° C. Ambient temperatures above and below 20-24° C. produced increases in oxygen consumption, in rectal temperature, and in heart frequency. Skin temperatures rose and fell with environmental temperature; the decrease in skin temperature with decreasing ambient temperature was greater in the extremities than in the trunk. Breathing frequency was constant from -10° to +24° C. a close correlation was observed between oxygen consumption and the difference between ambient and skin temperature. The relations between environmental, rectal, and skin temperatures, oxygen consumption, and respiratory and cardiac rates are depicted in graphs.

10740
Hammel, H. T., 1959
R. W. Elsner, D. H. LeMessurier, H. T. Andersen, and F. A. Milan
THERMAL AND METABOLIC RESPONSES OF THE AUSTRALIAN ABORIGINE EXPOSED TO MODERATE COLD IN SUMMER.—Jour. Applied Physiol., 14 (4): 605-615. July 1959.

Measurements of thermal and metabolic responses of central Australian aborigines exposed to moderate cold during sleep were repeated during summer and have shown that the small, but important, differences between these natives and control whites exist in summer to the same extent as in winter. The metabolism of the central natives declined continually throughout the night with a Q_{10} of about 2 in summer as in winter. Without metabolic compensation, body temperatures of the central natives fell at a greater rate than those of the whites. Measurements of thermal and metabolic responses of a mixed tribal group of tropical Australian aborigines under identical conditions of cold exposure showed that the average tropical native was intermediate between central natives and control whites. The metabolic rate for tropical natives was 42.8 Cal./m.^{2}/hr. compared with 48.7 Cal./m.^{2}/hr. for whites and 37.0 Cal./m.^{2}/hr. for central natives. It is suggested that the Australian aborigine has an inborn ability to tolerate greater body cooling without metabolic compensation which can be increased by prolonged exposure to cold. (Authors' abstract)

10741
[Hammond, J. F.] 1959
NOISE OF JET ENGINES MAY BE A HAZARD.—Jour. Amer. Med. Assoc., 169 (14): 1629. April 4, 1959.

Aspects of jet engine noises are discussed in relation to hearing and deafness. Dangerous sound intensity levels may be encountered if a passenger or worker goes near the exhaust stream of a jet engine where as much as 120 db. in the 150- to 300-c.p.s. band can be impressed on the unprotected ear. Prolonged exposure to noise (in the 300 to 600- or 600 to 1200-c.p.s. bands) of the order of 85 db. suggests initiation of a noise-exposure control program and tests of hearing for those exposed to this noise.

10742
Hannon, J. P., 1959
A. F. Larson, H. F. Drury, D. A. Vaughan, and L. N. Vaughan
ARCTIC SURVIVAL RATIONS. VII. ALTERATIONS IN SERUM ELECTROLYTES DURING WINTER FIELD TESTS OF SURVIVAL RATIONS.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-25, Sept. 1959. iii+8 p.

The levels of plasma sodium, potassium, calcium, magnesium, chloride, and phosphate, as well as blood hemoglobin and packed cell volume, were determined before and during simulated arctic winter survival. During the 5-day semi-starvation survival situation the following blood changes were noted: (a) an increase in magnesium and a decrease in calcium after the first day with subsequent return toward normal levels over the next 3 or 4

days; (b) a progressive decline in plasma phosphate during the first 4 days; (c) slight decrease in sodium, chloride, hemoglobin, and packed cell volume; (d) no significant change in plasma potassium. (Authors' abstract)

10743
Hannon, J. P., and D. A. Vaughan 1961
EFFECT OF EXPOSURE DURATION ON SELECTED ENZYME INDEXES OF COLD ACCLIMATIZATION. —— Amer. Jour. Physiol., 200 (1): 94-98. Jan. 1961.

Relative liver mass and liver activities of glucokinase, glucose-6-phosphatase, malic dehydrogenase and rate of pyruvate formation from 3-phosphoglycerate were measured in rats exposed to cold (4° ± 1° C.) for periods of 2 days, 4 weeks and 5 months. The resultant data indicated the metabolic, cold-acclimatization process, insofar as the liver was concerned, consisting of three consecutive, but overlapping, stages. The first (as indicated by glucose-6-phosphatase activity) was an increased capacity to form blood sugar. This was evident after 2 days in the cold and persisted throughout all exposures. The second stage was an elevated heat-producing capacity per unit of liver weight. This was reflected in 4-week cold-exposed animals by an increased glucokinase, malic dehydrogenase and pyruvate formation rate. The third stage appeared between 1 and 5 months after entrance into the cold. It consisted of a regression of certain of the elevated activities per unit weight of liver and their replacement, insofar as the animal as a whole was concerned, by an increase in relative liver mass. (Authors' abstract)

10744
Hannon, J. P., and D. W. Young 1959
EFFECT OF PROLONGED COLD EXPOSURE ON THE GROSS BLOOD COMPOSITION OF THE RAT.—— Amer. Jour. Physiol., 197 (5): 1008-1012. Nov. 1959.

One month's cold exposure (5 ± 1° C.) of rats induced a slight, but significant, increase in hemoglobin level but had no effect on the hematocrit. Fasting for 24 hours, although not altering the hemoglobin concentrations of either the control or the cold-exposed animals, did produce a slight lowering of the hematocrit. Cold exposure also resulted in a plasma dilution, as indicated by a significant increase in plasma water and significant decreases in plasma specific gravity and protein levels. Fasting superimposed a further reduction in plasma protein levels under both control and cold-exposed conditions. The levels of blood glucose and total plasma lipids were unaltered by cold exposure but each was significantly reduced by fasting. Significant increases in the nonprotein nitrogen, phospholipid, cholesterol and ketone levels were observed in cold-exposed, nonfasted animals. Superimposed on these changes, fasting produced a decrease in the levels of nonprotein nitrogen and phospholipids and an increase in the level of ketones. It had no effect on the level of cholesterol. Fasting of the cold-exposed animals led to greater reductions in plasma nonprotein nitrogen and phospholipids and a smaller increase in blood ketones as compared with controls. (Authors' abstract) (32 references)

10745
Hannon, J. P. 1959
EFFECT OF PROLONGED COLD EXPOSURE ON OXIDATIVE PHOSPHORYLATION AND ADENOSINE-TRIPHOSPHATASE ACTIVITY OF RAT LIVER TISSUE.——Amer. Jour. Physiol., 196 (4): 890-892. April 1959.

Liver homogenates from control and one-month cold-exposed (5 ± 1° C.) rats were assayed for the phosphate/oxygen ratios (P/O ratio) characteristic of succinate and β-hydroxybutyrate oxidations and for the level of adenosinetriphosphatase activity. With both substrates a significant lowering of the P/O ratio was observed in the cold-exposed group. Measurements of adenosinetriphosphatase activity in water homogenates showed that calcium and magnesium had strong activating effects. Little difference was found between control and experimental preparations except where both ions were used simultaneously. Here, the tissue from the cold-exposed group exhibited a slightly lower activity than the controls. (Author's abstract, modified)

10746
Hannon, J. P., and L. N. Vaughan 1959
GROSS LIVER COMPOSITION OF THE RAT FOLLOWING ONE-MONTH COLD EXPOSURE.—— Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-26, Sept. 1959. 11 p.

The total body weight, the liver weight, and the levels of water, protein, lipid, phospholipid, glycogen, and ash were assayed in male Sprague-Dawley rats exposed to either control conditions (26 ± 1° C.) or to cold (5 ± 1° C.) for 1 month. A statistically significant suppression of total body growth, but an augmentation of relative liver growth, was observed in the cold-exposed group. Cold also led to significant increases in the level of liver lipid and phospholipid, and a decrease in glycogen. No differences were observed in the protein, water, or ash content of the two groups. (Authors' summary)

10747
Hannon, J. P. 1960
INTERMEDIATE GLUCOSE METABOLISM IN THE COLD-ACCLIMATIZED RAT. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 100-105. Dec. 1960 (Part II).

The effects of 3-4 weeks' cold exposure (5° to -1° C.) on the activities of glucokinase, glucose-6-phosphatase, glucose-6-phosphate and 6-phosphogluconic dehydrogenases, total phosphorylase, phosphorylase a and b, phosphoglucomutase and pyruvate formation over the terminal glycolytic span of enzymes were assayed. Various shifts in the pattern of intermediary hexose metabolism as a result of cold exposure are discussed. (Author's abstract)

10748
Hannon, J. P. 1958
RESPIRATION OF RAT LIVER HOMOGENATES FOLLOWING PROLONGED COLD EXPOSURES.—— Proc. Soc. Exper. Biol. and Med., 97 (2): 368-371. Feb. 1958.

Studies were made of the oxygen consumption of liver homogenates from rats exposed to temperatures of 26° or 5° C. for 29-33 days. Endogenous liver metabolism was found to be significantly increased in cold-exposed animals. Oxidation in homogenates from cold-exposed animals was 18-21% higher than that of controls in the presence of the substrates citrate, fumarate, malate, and glutamate, and 28-37% higher with isocitrate, a-ketoglutarate, b-hydroxybutyrate, and succinate. No difference between cold-exposed and control groups was observed when lactate was added to the incubation medium. An effect of cold exposure was also found on the time pattern of oxygen uptake, with experimental tissue generally showing a more pronounced decline in oxidation rate during the incubation period. It is indicated that cold exposure results in a general increase in the activity of enzymes responsible for aerobic oxidations. It is also suggested that dehydrogenases of the tricarboxylic acid cycle may be more affected by cold exposure than other enzymes of the cycle, since substrates associated with dehyrogenase enzymes in their initial breakdown produced a greater increase in oxidation.

10749
Hannon, J. P. 1959
THE RESPIRATION OF RAT LIVER HOMOGENATES FOLLOWING PROLONGED COLD EXPOSURE.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 57-59, Sept. 1959. 11 p.

The respiration of liver homogenates derived from adult male rats exposed to cold for about 1 month was studied. Cold exposure led to increased rates when citrate, isocitrate, α-ketoglutarate, succinate, fumarate, malate, glutamate, and β-hydroxybutyrate were present as substrates. An increased endogenous metabolism was also found but no change in rate was observed when lactate was present as substrate. Differences were also found in both the magnitude and pattern of in vitro oxidations following cold exposure. (Author's summary)

10750
Hannon, J. P. 1960
TISSUE ENERGY METABOLISM IN THE COLD-ACCLIMATIZED RAT. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 139-144. Dec. 1960 (Part II).

Data are given relating the effect of duration of cold exposure on liver slice and whole-body oxygen consumption of laboratory rats. Data are also presented on the effect of cold exposure on various liver oxidase activities, oxidative phosphorylation and adenosine triphosphatase activities. The comparative study of electron transport components in liver and muscle is given. These data are discussed in relation to the development of nonshivering thermogenesis and the cellular metabolic control mechanisms in the cold-acclimatized animals. (Author's abstract) (33 references)

10751
Harris, N. O., 1958
R. B. Mefferd, and S. R. Restivo
DENTAL CHANGES INDUCED IN RATS BY PROLONGED EXPOSURE TO ADVERSE ENVIRONMENTS.—Univ. of Texas, Austin; and School of Aviation Medicine, Randolph Field, Tex. Report no. 59-9, Dec. 1958. 8 p.
Also published as: DENTAL CHANGES INDUCED IN RATS BY CHRONIC EXPOSURE TO ADVERSE ENVIRONMENTS.—Amer. Jour. Physiol., 198 (3): 476-480. March 1960.

The histology and chemical composition of teeth were examined in rats acclimated for 18-24 weeks to cold (3° C.), neutral (24° C.), or heat (36° C.), at barometric pressures of 750 or 380 mm. Hg. Exposure to altitude induced histological changes in the mesenchymal elements of the teeth. The effect was increased by superimposed cold, but was partly counteracted by superimposed heat. In heat-exposed animals, however, ectodermal changes were observed. Chemical studies revealed significantly reduced concentrations of calcium, phosphate, and magnesium in the altitude- and heat-exposed rats; protein and iron content was unchanged. No histological or chemical changes were seen in cold-exposed rats. The basic inorganic composition of the teeth of altitude-acclimated rats may have been changed, since the Ca/PO_4 ratio was low. (Authors' abstract, modified)

10752
Hart, J. S. 1960
ENERGY METABOLISM DURING EXPOSURE TO COLD. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 15-19. Dec. 1960 (Part II).

Exposure of small mammals and birds to constant cold which results in chronic elevation of energy metabolism leads to well-defined alterations in metabolic processes. The most important of these is the development of an enhanced capability to elevate metabolism and maintain it at a high level and by this means to prolong survival at low lethal temperatures. Other associated changes include a gradual disappearance of shivering, an increase in peripheral temperatures (rats), and a decrease in body insulation (most species). Rats and deer mice exposed outdoors during summer and winter also have comparable changes in cold resistance and metabolic capability but differ in having increased pelage insulation (rats and mice) and lower peripheral temperatures (rats) during the cold season. It is concluded that seasonal and temperature-induced changes are not identical in these animals. (Author's abstract)

10753
Hart, J. S. 1958
METABOLIC ALTERATIONS DURING CHRONIC EXPOSURE TO COLD.—Federation Proceedings, 17 (4): 1045-1054. Dec. 1958.

A review of the metabolic changes associated with adaptation to cold is presented. Subjects discussed include the gross alterations in metabolism revealed by increased capability to produce heat; the increase in oxidative metabolism of the tissues; chemical (nonshivering) regulation of heat production; hormonal control of nonshivering thermogenesis, particularly by the thyroid and adrenal glands; and changes in intermediary metabolism (oxidative phosphorylation, carbohydrate metabolism) during cold exposure. (107 references)

10754
Heberling, E. J., 1961
and T. Adams
RELATION OF CHANGING LEVELS OF PHYSICAL FITNESS TO HUMAN COLD ACCLIMATIZATION. —— Jour. Applied Physiol., 16 (2): 226-230. March 1961.

Five nude Caucasian men were exposed for one hour to a temperature of 10° ± 1° C. in a cold chamber after normal activity, after physical training, and after bivouac in the interior of Alaska for 6 weeks during January and February. Body temperatures (hand, foot, trunk, skin, and rectal), recorded during exposure to acute cold, were the criteria by which the effects of the changing levels of physical training and the cold-acclimatizing encampment were compared and judged. After the program of physical training, but before the bivouac, skin and extremity temperatures were statistically higher than those recorded before training; no differences were noted after the bivouac, when the level of physical training remained unchanged and the only variable was exposure to cold. These data confirm an earlier suggestion that commonly accepted indices of acclimatization, (elevated skin temperatures) may also result from chronically elevated levels of physical activity. Additional evidence indicates the limitations of the bivouac or field exercises for "cold exposure," and suggests the questionable value of accepting physiological and thermal readjustments that occur during such programs as being indicative of the effects of cold. (Authors' abstract)

10755
Hellström, B., 1960
and K. L. Andersen
HEAT OUTPUT IN THE COLD FROM HANDS OF ARCTIC FISHERMEN. —— Jour. Applied Physiol., 15 (5): 771-775. Sept. 1960.

Heat output from the hands during local immersion in water at an initial temperature of 4° C. was measured by calorimetry in Arctic fishermen and unacclimatized men exposed to cool or comfortably warm ambient air. Total heat output from the hand during 30 minutes ranged from 1907 cal./100 ml. hand tissue/min. (cold room) to 4886 cal./100 ml. hand tissue/min. (warm room). No significant differences in mean heat output were observed between fishermen and unacclimatized subjects in either condition. Cold urticaria in association with a considerably elevated heat output was observed in one unacclimatized subject. It is concluded that under these experimental conditions, no large differences in circulation rate exist between cold-acclimatized and unacclimatized men.

10756
Hendler, E., 1960
and L. J. Santa Maria
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS: RESPONSE OF SUBJECTS TO SOME CONDITIONS OF A SIMULATED ORBITAL FLIGHT PATTERN. —— Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-1403). Report no. NAMC-ACEL-438, Aug. 24, 1960. iv+[17] p.
Also published in: Aerospace Med., 32 (2): 126-133. Feb. 1961.

The effects of exposure to pressure and thermal conditions postulated as characteristic of extreme conditions of orbital flight patterns were studied using subjects wearing ventilated, full-pressure suits. No significant physiological stress was evidenced in subjects exposed to a modified thermal profile, except for the sweating response of one subject. Exposure of experienced subjects to long-duration thermal loads simulating relatively severe post-landing and full thermal profiles resulted in premature test termination when ventilating air temperature was more than a few degrees above the initial mean skin temperature. The environmental conditions (altitude, wall temperature, dry bulb temperature, and ventilating air temperature) for each experiment are shown in tables and graphs. (Authors' summary, modified)

10757
Héroux, O. 1960
ADJUSTMENTS OF THE ADRENAL CORTEX AND THYROID DURING COLD ACCLIMATION. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 82-85. Dec. 1960 (Part II).

An increased secretion of corticosteroids has been demonstrated by many authors in animals suddenly exposed to cold. In chronic exposure to cold in the laboratory, however, there is increasing evidence in the literature of a return towards the initial normal level in the activity of the adrenal cortex, while the thyroid remains hyperactive. Under the more natural fluctuating environmental conditions prevailing outdoors during the winter, the adrenal cortex of white rats exposed to cold for three months has been found to secrete in vitro at a faster rate than in the summer controls, while the thyroid appeared to be degenerating. In view of the metabolic effects of the thyroid and adrenal hormones, the endocrine adjustments observed under the two different environmental conditions suggest different metabolic pathways leading to similar capacities for heat production. (Author's abstract)

10758
Héroux, O., 1959
F. Depocas, and J. S. Hart
COMPARISON BETWEEN SEASONAL AND THERMAL ACCLIMATION IN WHITE RATS. I. METABOLIC AND INSULATIVE CHANGES. —— Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (3): 473-478. March 1959.

Physiological adjustments to cold temperature were compared in rats exposed either to the outdoor fluctuating environmental conditions or to the indoor constant temperature conditions. While the metabolic adjustments such as increased peak metabolism and decreased shivering were similar in outdoor and indoor rats exposed to cold, the adjustments in insulation and thermoneutral metabolic rates were quite different. The pelage insulation increased in the rats kept in a constant temperature room maintained at 6° C. The resting metabolic rate measured at 30° C. increased in the 6° C. acclimated rats but not in the winter-exposed animals. Over the temperature range + 30° C. to -15° C., while the indoor cold-acclimated rats had a higher metabolic rate than their controls acclimated to 30° C., the winter rats had a lower

metabolism than their summer controls. (Authors' abstract)

10759
Héroux, O. 1959
COMPARISON BETWEEN SEASONAL AND THERMAL ACCLIMATION IN WHITE RATS. II. SURFACE TEMPERATURE, VASCULARIZATION, AND IN VITRO RESPIRATION OF THE SKIN.— Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (11): 1247-1253. Nov. 1959.

Indoor rats acclimated to 18° C. and 6° C. showed the same increase in the number of opened capillaries in the ears over the number observed in controls acclimated to 30° C. Summer and winter outdoor rats showed the same number of capillaries as the 18° C. or 6° C. indoor rats. Signs of injury healing such as thicker epidermis and larger nuclei were found in the ears of all the 6° C. rats but in none of the winter rats. While the skin temperature measured at 6° C. was slightly higher (0.4 to 1.0°C.) in rats acclimated at 6° C. than in those at 30° C., it was lower (1.3 to 2.0° C.) in winter than in summer rats. After 28 days of acclimation, the rate of oxygen uptake of the dorsal skin of the foot was lower in 6° C. than in 30° C. rats but after 84 days it was significantly higher in the cold-acclimated rats. Similarly, after three months, the respiratory rate of the dorsal skin of the foot was higher in winter rats than in summer rats. (From the author's abstract)

10760
Héroux, O., 1959
and E. Schönbaum
COMPARISON BETWEEN SEASONAL AND THERMAL ACCLIMATION IN WHITE RATS. III. STUDIES OF THE ADRENAL CORTEX.— Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (11): 1255-1261. Nov. 1959.

Under the indoor cold conditions (three months at 6° C.), the adrenals of rats hypertrophied within one week and their weight remained constant for the following eleven weeks. The hypertrophy was due to an increase in the number of cells in the zona fasciculata. Relative to adrenal weight, the production of corticosteroids in vitro was less in the 6° C. rats than in the 30° C. controls. Under the outdoor cold conditions (three months during the winter), the adrenal weight as well as the number of fasciculata cells remained normal, but the steroid production in vitro was greater than in the "summer controls". Since both indoor and outdoor cold-exposed rats developed a similar degree of cold resistance as well as a similar capacity for elevating their metabolism through a nonshivering heat production mechanism, it appears that similar degrees of adaptation to cold can exist with different requirements of adrenocortical hormones. (Authors' abstract, modified)

10761
Héroux, O., 1959
and J. S. Campbell
COMPARISON BETWEEN SEASONAL AND THERMAL ACCLIMATION IN WHITE RATS. IV. MORPHOLOGICAL AND PATHOLOGICAL CHANGES. — Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (11): 1263-1269. Nov. 1959.

White rats developed a similar degree of resistance to cold whether exposed individually to a continuous cold temperature or exposed in groups of 10 to the fluctuating environmental conditions prevailing outdoors during the winter. Under these two different types of cold exposure, the rats were observed to have a reduced muscle growth. However the enlargement of the adrenals, thyroids, pituitary, heart, and digestive tract, and the reduction of the mesenteric and subcutaneous fat and of the pelt weight, did not take place in the outdoor winter rats. Increased resistance to cold can be brought about without some of the anatomical changes characteristically associated with acclimation to continuous cold exposure. Cold stimulation outdoors was not sufficiently severe or of sufficient duration to produce renal lesions, hypertension, or cardiac lesions of any importance, although the animals were exposed to an average temperature of -10° C. which would certainly produce these lesions in outdoor individually exposed rats. (From the authors' abstract)

10762
Héroux, O., 1958
and N. T. Gridgeman
THE EFFECT OF COLD ACCLIMATION ON THE SIZE OF ORGANS AND TISSUES OF THE RAT, WITH SPECIAL REFERENCE TO MODES OF EXPRESSION OF RESULTS.—Canad. Jour. Biochem. and Physiol., 36 (2): 209-216. Feb. 1958.

Organ and tissue weights were measured in rats maintained for 4 weeks at 30° or 6° C. The whole-body weight of cold-exposed rats was found to be almost 20% lower than that of rats maintained at 30°. Analyses of organ weights of both groups by absolute weight, fractional weight, or as absolute weights statistically regressed onto constant body weight revealed that only the latter method accurately expressed experimental changes. Cold exposure had no effect on brain, genitals, and lung weights, but reduced the growth of muscle, pelt, fat, skeleton, spleen, and thymus, and hypertrophied the liver, intestine, kidney, heart, and adrenals.

10763
Heroux, O. 1959
HISTOLOGICAL EVIDENCE FOR CELLULAR ADAPTATION TO NON-FREEZING COLD INJURY. —Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (7): 811-819. July 1959.

The development and healing of non-freezing cold injury in rat ears maintained at 6° C. for 118 days and followed at different times of exposure revealed histological changes of a different nature 4-6 mm. away from the edge of the ear when compared to the changes at 1-3 mm. In the first 3 mm., during the first 21 days of exposure there was a continuous drop in the number of mitotic prophases and telophases and a parallel increase in the number of blocked and degenerating metaphases. In the second week, inflammatory reactions appeared; in the third week, the edema and lymphocyte infiltration was severe, and at that time 10% of the epithelium was degenerating. At the end of the fourth week, in the non-necrotic part of the epidermis, the number of prophases and telophases had returned to the initial level and the number of blocked metaphases was back to normal. After 56 to 118 days, no signs of edema, necrosis, or blocked metaphases could be found. Essentially the same picture was observed at the 1-3 mm. location in the ears of rats kept at 15° C. On the assumption that

mitotic blocking is due to a disturbance of the ionic transfer through the cellular membrane, it is suggested that the primary cause of cold injury is a direct thermal damage to the membrane. (Author's abstract, modified) (25 references)

10764
Heroux, O., and J. S. Campbell 1960
A STUDY OF THE PATHOLOGY AND LIFE SPAN OF 6° C.- AND 30° C.-ACCLIMATED RATS.—Laboratory Investigation, 9 (2): 305-315. March-April 1960.

Thirteen male rats living a full life span at 6° C. showed a greater incidence and earlier onset of testicular hypoplasia, glomerulonephritis, myocardial fibrosis, and periarteritis nodosa than 10 rats living at 30° C. Neoplasms and inflammatory pulmonary lesions were not frequent in the latter group. A reduction of 20% in the average life span of cold-acclimated rats was considered to be of little statistical significance. The increased frequency of appearance of lesions in cold-acclimated rats may signify either a modification in the age of onset of naturally occurring diseases, or may represent a cold exposure syndrome.

10765
Héroux, O. 1958
WEIGHTS AND COMPOSITION OF MUSCLES OF WARM- AND COLD-ACCLIMATED RATS.—Canad. Jour. Biochem. and Physiol., 36 (3): 289-293. March 1958.

Measurements were made of the wet and dry weights, protein contents, and lipid contents of the total muscle mass and left gastrocnemius, plantaris, and soleus muscles of rats maintained for 4 weeks at temperatures of 6° or 30° C. All measures were found to be significantly lower in animals exposed to cold. The lower protein content in the muscles of cold-exposed rats accounted for 24% of the difference observed in the entire muscle mass, 18% in the leg muscles, and 15% in the soleus. Examination of sections of the soleus muscle revealed that the proportion of muscle fibers per unit area was essentially the same in animals exposed to 6° or 30°, indicating that the growth (protein deposition) of muscle and connective fibers was equally reduced during cold exposure. No difference was observed in the effects of cold on red or white muscle fibers.

10766
Hertzman, A. B., and I. D. Ferguson 1959
FAILURE IN TEMPERATURE REGULATION DURING PROGRESSIVE DEHYDRATION.—St. Louis Univ. School of Medicine. Dept. of Physiology, Mo. (Contract AF 33(616)-3357); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADC Technical Report 59-398, July 1959. iii+27 p. AD 227 237

During exposure to an ambient temperature of 43.3° C. (110° F.) without food or water, the body weights of young male subjects decreased at the rate of 0.5 per cent per hour of exposure, their body temperatures rose 0.1° C. per hour, but the total sweat production changed little despite the increase in body temperature. Calculations indicated that the latter was due to a slightly inadequate sweating which in turn was attributed to a rising thermal threshold for sweating. Regional sweating rates varied widely during the exposure, particularly on the upper parts of the body. Cutaneous conductances, thermal circulatory indices and the pad pulses in the finger and toe changed very little; there was no evidence of peripheral circulatory failure in these experiments. The theoretical implications are discussed. (Authors' abstract)

10767
Hertzman, A. B. 1961
REGULATION OF CUTANEOUS CIRCULATION DURING BODY HEATING.—St. Louis University, Mo. (Contract AF 33(616)-7077); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). ASD Technical Report no. 61-740, Dec. 1961. iii+23 p.

This report summarizes current information concerning the regional adjustments of cutaneous vascular tone during body heating. Most of the data to which reference is made were obtained in the writer's laboratory. The importance of the local skin temperature in accounting for the cutaneous vasodilatation is emphasized and the role of bradykinin is discounted. The regional differences in the onset, temporal sequence, and extent of the cutaneous vasodilatation are not explained by reference to a central thermostat in the hypothalamus. (Author's abstract) (55 references)

10768
Hirsch, F. G. 1958
TEMPERATURE MEASURING TECHNIQUES FOR AVIATION PHYSIOLOGICAL RESEARCH.—In: Aviation medicine — selected reviews, p. 113-124. Edited by C. S. White and others. London, etc.: Pergamon Press, 1958.

Remarks relevant to the relationship between man and his temperature environment were presented as background information illustrating the utilization which has been made of temperature-measuring techniques in aviation biology; i.e., monitoring the environmental temperature exchange as a function of time, the design of personal equipment and clothing to protect men against high and low temperatures and the importance of understanding the general principles utilized in thermal sensing instruments. Thermocouples, resistance thermometers, including the relatively new thermistors, calorimetry, telemetering, and miscellaneous techniques (temperature tapes and temperature sensitive paints), are briefly discussed. (Summary by C. S. White)

10769
Hoijer, D. J. 1960
METABOLIC FUNCTION OF ASCORBIC ACID IN ACCLIMATION TO COLD. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 90-93. Dec. 1960 (Part II).

The essential role of ascorbic acid in acclimation to cold has been affirmed by numerous experimental studies. The increased need for adrenaline and noradrenaline in the cold can be met in part by the ascorbic acid-stimulated hydroxylation of their aromatic precursors. Likewise, the hydroxylation of corticosteroids is stimulated by ascorbic acid to provide an adequate supply of the hormones necessary for increased substrate utilization and to combat the conditions of stress. Finally, the role

of ascorbic acid in pathways of electron transport has been presented with reference to its possible function in effecting increased oxidation without concurrent increases in phosphorylation. (Author's abstract) (40 references)

10770
Hunter, J. C. 1961
EFFECTS OF ENVIRONMENTAL HYPERTHERMIA ON MAN AND OTHER MAMMALS: A REVIEW. — Military Med., 126 (4): 273-281. April 1961.

A review is presented of studies on heat stress and effective temperature, physiological defenses against heat stress, acclimatization to heat, the effects of environmental hyperthermia, and countermeasures in the treatment of hyperthermia. (46 references)

10771
Iampietro, P. F., 1958
D. E. Bass, and E. R. Buskirk
CALORIC INTAKE DURING PROLONGED COLD EXPOSURE.—Metabolism, 7 (2): 149-153. March 1958.

Measurements were made of caloric intake and resting energy expenditure (oxygen consumption) in five semi-nude men performing minimal activity during exposure for two-week consecutive periods to temperatures of 80°, 60°, and 80° F. The composition of the diet supplied was constant for all periods. Caloric intake averaged 2287 and 2405 Calories/day during the control and recovery periods, respectively, and weight loss averaged 1.75 and 0.90 kilograms. At 60° F., caloric intake was 2870 Calories/day, and there was no weight loss. Resting energy expenditure was increased 140 Calories/12 daytime hours in the cold. The increased caloric intake and energy expenditure in the cold is attributed to nondetectable shivering and occasional frank shivering. No evidence was found that cold exposure imposed additional caloric requirements other than those resulting from increased muscle activity.

10772
Iampietro, P. F., 1961
M. Mager, and E. B. Green
SOME PHYSIOLOGICAL CHANGES ACCOMPANYING TETANY INDUCED BY EXPOSURE TO HOT, WET CONDITIONS. — Jour. Applied Physiol., 16 (3): 409-412. May 1961.

Twenty-seven men were exposed to various hot, wet conditions for a total of 87 experiments. Determinations were made of rectal temperature, heart rate, blood pH, and the concentrations of CO_2, calcium, inorganic phosphorus, and protein in plasma. Symptoms ranging from tingling of extremities to carpopedal spasms were observed. The frequency and severity of symptoms were apparently not related to the absolute change in any of the blood constituents but rather to the rate of change. (Authors' abstract)

10773
Iampietro, P. F. 1961
PREDICTION OF SKIN TEMPERATURE OF MEN IN THE COLD. — Jour. Applied Physiol., 16 (3): 405-408. May 1961.

Skin temperatures of semi-nude men were measured during 2-hr. exposures to various combinations of air temperature (90-25° F.) and wind velocities (<1, 5, 10 m.p.h.). The data were used to derive an expression for the estimation of mean weighted skin temperature as a function of duration of exposure (up to 180 min.), air temperature (90 to -20° F.), and windspeed (0-40 m.p.h.). A chart was also constructed for more rapid estimation of skin temperature. (Author's abstract)

10774
Iampietro, P. F., 1959
R. F. Goldman, E. R. Buskirk, and D. E. Bass
RESPONSE OF NEGRO AND WHITE MALES TO COLD.—Jour. Applied Physiol., 14 (5): 798-800. Sept. 1959.

Heat production and body temperatures were measured in matched groups of U.S. Negro and white soldiers during whole-body cooling, and finger temperatures were measured when only the digits were cooled. Whole-body cooling was accomplished by having the subjects, clad only in shorts, sit for two hours in a chamber at 50° F. with a 5-mi./hr. wind. Digital cooling was accomplished by having the subjects immerse the fingers in a water bath at 32° F. for 45 minutes. During whole-body cooling there were no group differences with respect to heat production, skin, or rectal temperature. During digital cooling, white subjects had higher finger temperatures and the "hunting" reaction was more pronounced than for Negroes. In addition, the white subjects required a shorter period for the onset of the first rewarming of the fingers. The implications of these findings with reference to the reported higher incidence of cold injury among Negro soldiers are discussed. (Authors' abstract)

10775
Ingle, D. J. 1958
ENDOCRINE MECHANISMS IN ADAPTATION TO COLD.—Federation Proceedings, 17 (4): 1064-1065. Dec. 1958.

Studies of the role of the pituitary, adrenal, and thyroid glands in cold adaptation by experimental gland removal and hormone administration are reviewed. It is emphasized that the multiplicity of physiological mechanisms maintaining homeostasis tends to obscure cause-and-effect relationships, so that disappearance of a function in response to removal of an organ may not demonstrate their direct association. It is suggested that heat production and adaptation may be reasonably concluded to be controlled by more than one gland, although the presence or absence of hormones from either the pituitary, thyroid, or adrenal may affect adaptation.

10776
Ivanov, K. P. 1960
[CHEMICAL THERMOREGULATION AND ELECTRICAL ACTIVITY OF THE MUSCLES IN DIFFERENT ANIMALS WHEN AT REST] Khimicheskaia termoreguliatsiia i elektricheskaia aktivnost'myshts pri otnositel'nom pokoe u razlichnykh zhivotnykh. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (5):544-551. May 1960. In Russian, with English summary (p. 550-551).

The gas exchange, body temperature, and the electrical activity of the back and hip muscles were investigated in white mice, white rats and rabbits under various ambient temperatures. The gas exchange and the electrical activity of muscles of the resting animal decreased sharply at critical temperature (28-31° C. for mice and rats, 22-23°

C. for rabbits). As the environmental temperature decreased, the electrical activity increased concomitant with the increase of oxygen consumption. The dissection of the spinal cord at the level of the 1st-3rd thoracic segment elicits strong disturbances in the above responses on the part of muscles lying below the line of dissection. (Author's summary, modified)

10777
Jasper, R. L., 1958
M. E. Denison, M. X. Zarrow, and W. A. Hiestand
COMPARISON OF TISSUE RESPIRATION IN MICE EXPOSED TO HEAT AND COLD.—Amer. Jour. Physiol., 195 (2): 285-287. Nov. 1958.

Oxygen uptake of liver, kidney, and brain slices from mice exposed to temperatures of 2° or 38° C. for 6 to 240 hours was measured in a Warburg constant volume respirometer. Oxygen uptake was increased after 6 hours in all tissues from heat-exposed animals, and in brain tissue from cold-exposed mice. After 48 hours of exposure to either stress, the rate of oxygen uptake was decreased to the lowest values observed. At 72 hours oxygen uptake was increased above control values. Oxygen uptake tended to return to normal after 72 hours of cold exposure, but remained elevated in heat-stressed mice. It is indicated that the oxygen uptake of cells in response to divergent stresses is similar to the pattern of response of the General-Adaptation-Syndrome in intact animals.

10778
JOINT US—CANADIAN CONFERENCE ON ENVIRONMENTAL PHYSIOLOGY HELD ON 9-10 NOVEMBER 1960.—Ed. by H. W. Glascock. Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 1 6X64-12-001). Report no. 474, Sept. 1961. i+135 p.

Report of a conference held at USAMRL, Ft. Knox, Ky., 9-10 November 1960, for the purpose of becoming aware of the most recent accomplishments in the field of environmental physiology, especially accomplishments in cold acclimatization in man. Papers presented by J. R. Beaton, J. R. Blair, T. R. A. Davis, L. P. Dugal, H. W. Glascock, Jr., J. Sanfor Hart, A. Henschel, J. LeBlanc, G. W. Molnar, and L. H. Turl are reproduced. (Editor's abstract)

10779
Kanter, G. S. 1961
RENAL HEMODYNAMICS DURING HYPERTHERMIA CAUSED BY EXPOSURE TO HIGH ENVIRONMENTAL TEMPERATURE. — Albany Medical Coll. Dept. of Physiology, New York; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 61-49, April 1961. 7 p.
Also published in: Amer. Jour. Physiol., 201 (5): 791-794. Nov. 1961.

After an initial increase, the glomerular filtration rate and the renal plasma flow decreased significantly following a 3 to 4 hour exposure of 14 anesthetized dogs to an air temperature of 49° C. Rectal temperature was 43° C. at the conclusion of the experiment. The hematocrit increased 14%. The renal alteration is due to a progressive decrease in mean systemic blood pressure and to a concomitant initial decrease in intrarenal resistance followed by a progressively increasing intrarenal resistance. It is concluded that, while the fall in blood pressure, the increased intrarenal resistance and the decreased plasma flow and filtration rate are the results of hyperthermia, the loss of plasma volume and the increase in hematocrit previously reported in hyperthermia produced with heating pads need not occur. These changes may be ascribed to tissue damage rather than to hyperthermia. (Author's abstract, modified)

10780
Keatinge, W. R., 1960
and M. Evans
EFFECT OF FOOD, ALCOHOL, AND HYOSCINE ON BODY-TEMPERATURE AND REFLEX RESPONSES OF MEN IMMERSED IN COLD WATER. — Lancet (London), 1960, v. 2 (7143): 176-178. July 23, 1960.

Administration of 75 ml. alcohol, a heavy meal, or hyoscine to men 45 minutes before immersion for 30 minutes in water at 15°C. had no significant effect on the rate of fall of rectal temperature during immersion. Finger blood flows fell rapidly to low levels in the water, but fell significantly less rapidly after alcohol. The occurrence of ventricular extrasystoles was increased after hyoscine or a heavy meal; no extrasystoles were observed after alcohol. Both metabolic rate and the increase in heart rate during immersion were reduced by alcohol or hyoscine. Alcohol greatly reduced discomfort and sensation of cold in the water.

10781
Keatinge, W. R. 1961
THE EFFECT OF REPEATED DAILY EXPOSURE TO COLD AND OF IMPROVED PHYSICAL FITNESS ON THE METABOLIC AND VASCULAR RESPONSE TO COLD AIR. — Jour. Physiol. (London), 127 (2): 209-220. July 1961.

Five male subjects wearing only shorts and footwear sat or stood in air at 5-7° C. for 7 1/2 hr. a day for 19 out of 21 days. Another group was given physical training in warm conditions during this time, except on the first and last days, when they kept still in the cold room. The basal metabolic rate did not change in either group, and increased muscle tone and shivering were the only observed means of increasing their heat production. Repeated exposure to cold generally increased the men's immediate metabolic response in the cold room, but it always decreased their metabolic rate by the end of a day in the cold room. Physical training under warm conditions reduced the men's immediate metabolic response in the cold room and caused them to maintain relatively high forearm skin temperatures. (Author's summary, modified)

10782
Keatinge, W. R. 1960
THE EFFECTS OF SUBCUTANEOUS FAT AND OF PREVIOUS EXPOSURE TO COLD ON THE BODY TEMPERATURE, PERIPHERAL BLOOD FLOW AND METABOLIC RATE OF MEN IN COLD WATER. — Jour. Physiol. (London), 153 (1): 166-178. Aug. 1960.

The fall in rectal temperature of ten young men immersed motionless for 30 minutes in stirred water at 15°C. varied little in successive immersions and was closely related to the man's subcutaneous fat thickness. The falls bore relatively little relation to finger blood flow, which was always low during immersions, but both were slightly greater when the men were hot rather than cool

at the time of immersion. Metabolic rates during immersion were substantially lowered by a small increase in body temperature at the time of immersion, and increased by exposure to cold air, though not by moderate exercise several hours before immersion. In the first 10 minutes of immersion the metabolic rates of thin men were slightly higher than those of fat men, with a number of substantial and consistent individual differences not related to fat thickness or fall in rectal temperature. In the last 20 minutes of immersion the metabolic rates of thin men increased but those of fat men did not. (Author's summary, modified)

10783
Keatinge, W. R., and M. Evans 1958
MODIFICATION OF ACUTE REFLEX RESPONSES TO COLD BY BRIEF TRAINING IN COLD CLIMATE. —Lancet (London), 1958 (7055): 1038-1041. Nov. 15, 1958.

An investigation was made in 10 subjects of the effects of a 10-day period of training in cold weather on the response of respiration, finger heat loss, and blood pressure to a cold water shower (5-6° C.). Cold-weather training was found to reduce the average increase in both systolic and diastolic pressures during the shower to less than half that found before training. The rate of finger heat loss during immersion of the finger in water at 17-18° was significantly increased after training. Respiration showed variable changes during the cold shower in both conditions, and was not significantly affected by training. It is concluded that repeated exposure to cold reduces the hazards of immersion in cold water and frostbite, but increases the amount of body heat loss in cold.

10784
Kerslake, D. M. 1959
HUMIDITY AND HEAT STRESS.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 66-68. 1959.

In any satisfactory system for the expression of heat stress, the relative effect of humidity must be recognized. Changes in humidity at low humidity rates have little effect on skin and deep temperatures and on sweat rate; but above a critical humidity (at which the skin becomes completely wet with sweat) changes in humidity cause large changes in these quantities.

10785
Khvoinitskaya, M. A. 1959
THE EFFECT OF HIGH ENVIRONMENTAL TEMPERATURE ON THE WATER DISTRIBUTION IN THE BODY.—Bull. Exper. Biol. and Med., 47 (5): 578-581. May 1959.

Water distribution was studied in rabbits exposed to high environmental temperatures (+43°, +45° C.) by the concurrent determination of the volume of blood and cellular fluid with the aid of radioactive isotopes. The water loss during exposure to heat for three hours in the animal with no water to drink amounted to from 2-2.5% of the body weight. Diuresis decreased or was completely absent. All water losses occurred at the expense of extrarenal losses. The volume of extracellular water increased whereas that of the blood plasma slightly rose. (Author's summary, modified)

10786
Kibler, H. H., and H. D. Johnson 1961
METABOLIC RATE AND AGING IN RATS DURING EXPOSURE TO COLD. — Jour. Gerontol., 16 (1): 13-16. Jan. 1961.

Comparisons of male rats which were exposed continuously to a temperature of 48° F. with controls which lived at 83° F. showed that the cold-exposed group drank significantly more water, increased their oxygen consumption by 40%, and consumed 65% more food, but gained weight more slowly. The lifespan of the cold-exposed rats was not increased by their low growth rates. Deaths among the cold-exposed and control rats were in accord with the hypothesis that a high metabolic rate accelerates aging. (Authors' summary)

10787
Klensch, H., and R. Caspari 1958
[STROKE AND MINUTE VOLUME OF THE HEART DURING EXPOSURE TO HEAT RADIATION] Schlag- und Minutenvolumen des Herzens unter dem Einfluss strahlender Wärme.—Pflügers Archiv für die gesamte Physiologie (Berlin), 267 (6): 591-599. Nov. 14, 1958. In German.

Various circulatory values were measured in 20 subjects during exposure for 40 minutes to infrared radiation. Average air temperature increased during the exposure from 19.8° to 34.9° C., and average skin temperature increased from 31.6° to 35.8°. Ballistocardiographic studies revealed average increases of 46% in heart stroke volume, 71% in minute volume, and 15% in heart frequency. Peripheral resistance decreased, and blood pressure increased slightly. Observations of respiration in one subject showed no significant change in oxygen consumption or overall change in ventilatory frequency and minute volume. It is concluded that thermoregulation during external heating is accomplished by an increase in heart stroke volume.

10788
Knigge, K. M. 1960
TIME STUDY OF ACUTE COLD-INDUCED ACCELERATION OF THYROIDAL I^{131} RELEASE IN THE HAMSTER.—Proc. Soc. Exper. Biol. and Med., 104 (3): 368-371. July 1960.

Analysis of time sequence in pituitary and thyroid phenomena involved during acute response of hamsters to cold exposure (5-6° C.) indicates a rapidly activated neural component. Within 0.5-1 hour after cold, sensory perception of this temperature change generated sufficient input into hypothalamic effector mechanisms to deplete pituitary thyrotropin by 60%. After a latent period of 1.5 hours, accelerated release begins and results in 25-30% decrease of thyroidal I^{131} during 12 hours of cold. Thyroxine (10 micrograms) is capable of inhibiting thyroidal I^{131} release when administered as long as 2-3 hours after exposure to cold. (Author's summary)

10789
Korot'ko, G. F. 1958
[SOME CHARACTERISTICS OF GASTRIC ACTIVITY AT HIGH OUTSIDE TEMPERATURE] Nekotorye osobenosti deiatel'nosti zheludka pri vysokoi vneshnei temperature.—In: Materialy konferentsii fiziologov, biokhimikov i farmakalogov Srednei Azii i Kazakh-

stana, 1 (Tashkent, 1957), p. 148-152. Tashkent: Akademiia Nauk Uzbekskoi SSR, 1958. In Russian.

Dogs of one series were kept in the shade, dogs of another series were exposed to the effect of direct sun rays for two hours. Both groups were fed meat, and the rates of digestion and stomach emptying were observed. The effect was most pronounced in two dogs, one white and one black. As the result of sun exposure the rectal temperature of the black dog rose by 1.2° C.; no change in rectal temperature was observed in the white dog. Rise in temperature in the black dog was accompanied by a lesser meat ingestion and a slower rate of food intake. Stimulability of the nutrition center followed a wavy course and rapidly abated as the point of saturation was approached. Such effects were not noted in the dogs kept in the shade. The above described effects were less pronounced in the white dog. Stomach emptying was slower in the dogs exposed to the sun; on the other hand, water loss was enhanced and exceeded that of alkalies or acids. Results of special experiments in which supplemental HCl was introduced into the stomach of the test dogs indicated that, following a 2-hour exposure to direct sun rays, the evacuation of HCl from the stomach of dogs was impeded by the additional fact that the added HCl elicited a gastric secretion of physiologically active substances which slowed the evacuation of the gastric HCl.

10790
Kreider, M. B., 1959
E. R. Buskirk, P. F. Iampietro, and D. E. Bass
EFFECT OF CONTINUOUS COLD EXPOSURE ON NOCTURNAL BODY TEMPERATURE OF MAN.—Jour. Applied Physiol., 14 (1): 43-45. Jan. 1959.

Also issued as report: Quartermaster and Development Center. Environmental Protection Research Div., Natick, Mass. (Project no. 7-83-01-006). Technical Report no. EP-117, July 1959. iv+6 p. AD 225 850

Twenty-four-hour patterns of body temperature were studied in five men living at 60° F. (15.6° C.) for 14 days, wearing only shorts. Rectal temperatures (T_r) and skin temperatures (T_s) were measured. During sleep T_r fell more rapidly and to lower values during cold exposure than during the control period. During sleep T_s was slightly lower in the cold than in the control period; also T_s did not exhibit the gradual drop characteristic of sleep in the control period. Comparison of T_r and T_s between the first two days and the last two days of the cold period revealed the following differences: (1) nocturnal T_r fell 0.23° C. (0.4° F.) lower on the later cold nights; (2) nocturnal toe temperatures were 15° C. (27° F.) higher on the later cold nights. Temperatures of the arch followed the same pattern as those of the toe. No significant differences were found in daytime temperatures between early and later cold days. The data suggest that evidence for acclimatization to cold in terms of altered body temperature responses may be fruitfully sought in responses during rewarming and/or sleep. (Authors' abstract, modified)

10791
Kreider, M. B. 1961
EFFECT OF DIET ON BODY TEMPERATURE DURING SLEEP IN THE COLD. — Jour. Applied Physiol., 16 (2): 239-242. March 1961.

Thirteen young soldiers were divided into two groups and fed liquid diets of similar caloric content but of different composition. One group was fed a normal, high-fat, high-carbohydrate, and normal diet in the first, second, third and fourth weeks, respectively; the second group was fed a normal, high-carbohydrate, high-fat, and normal diet during the same periods. Three meals were eaten at 8 A.M., 5 P.M., and 10:15 P.M., at which times 30, 30 and 40% of the daily calories were consumed. Measurements of skin (11 points) and rectal temperatures were made at one-half-hour intervals throughout the night when the subjects were in sleeping bags at an ambient temperature of -30° F. Protection against the cold was designed to be inadequate to maintain thermal comfort. Composition of the diet had no effect on rectal, mean weighted skin, or toe temperatures throughout the night with a few exceptions. No physiological significance is ascribed to these exceptions since the differences were very small. It is concluded by comparison with a previous study that caloric content rather than composition of the diet is the important factor in decreasing rates of body cooling of men sleeping in the cold. (Author's abstract)

10792
Ladell, W. 1959
ANIDROTIC HEAT EXHAUSTION.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 79-88. 1959.

The symptoms of the complex disorder of anhidrotic heat exhaustion are listed, and possible explanations are given in terms of the entire body, as a response to non-specific stress, with relation to pituitary function, and to sweat gland fatigue.

10793
Laties, V. G., 1959
and B. Weiss
THYROID STATE AND WORKING FOR HEAT IN THE COLD.—Amer. Jour. Physiol. 197 (5): 1028-1034. Nov. 1959.

Four experiments were conducted in which rats in a cold room were allowed to obtain a burst of heat from a heat lamp by pressing a lever. When working at 2° C., hypothyroid rats began to work for heat at a steady rate earlier in a 16-hour session than did euthyroid rats. This rate itself was both higher and more steady for hypothyroid than for euthyroid rats. Euthyroid and hypothyroid rats working at 5° C. showed a difference only in time required to attain their steady rate. In one experiment, the chronic administration of 1-triiodothyronine to hypothyroid rats led to a significant decrease of lever presses as compared to the performance of normal rats. Discontinuance of 1-triiodothyronine led to a gradual recovery of the high rate. The differences in this kind of behavior between hypothyroid and euthyroid animals were attributed to differences in drive state arising from the tendency of body temperature of hypothyroid animals to decline more rapidly in the cold. (Authors' abstract)

10794
Latysh, V. N. 1959
[CERTAIN PROBLEMS OF ACCLIMATIZATION UNDER CONDITIONS OF A HOT CLIMATE]
Nekotorye voprosy akklimatizatsii v usloviiakh

zharkogo klimata.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 26-30. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 39-45. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

A brief review of the physiological phenomena in adaptation to heat is presented. European, English, and American sources are quoted. The editors note that reduction in the basal metabolism in hot climates has not been confirmed by investigations of the Soviet scientists.

10795
LeBlanc, J. [A.] 1960
EFFECT OF ADRENALINE, NORADRENALINE AND CHLORPROMAZINE ON BLOOD PRESSURE OF NORMAL AND COLD-ADAPTED ANIMALS. — Proc. Soc. Exper. Biol. and Med., 105 (1): 109-111. Oct. 1960.

The blood pressure response to adrenaline, noradrenaline, and chlorpromazine was studied in normal and cold-adapted rats. Exposure to a temperature of 10° C. for six months increased the blood pressure response to noradrenaline, but not to adrenaline. Adrenaline had no effect on the hypotensive response to chlorpromazine in normal and cold-adapted animals, while noradrenaline had an inhibiting effect which was greater in cold-adapted animals. It is concluded that cold adaptation increases both the sensitivity of the cardiovascular system to noradrenaline and the metabolic effects of the drug.

10796
LeBlanc, J. 1959
MORPHOLOGICAL AND PHYSIOLOGICAL CHANGES IN THE SKIN AS A RESULT OF LONG EXPOSURE TO COLD.—Amer. Jour. Physiol., 196 (5): 1042-1044. May 1959.

Goats exposed throughout the year to environmental conditions prevailing in a temperate climate (47, 35, 63 and 73° F.) showed in the winter time an increased thickness of the Malpighian and of the horny layers and a decreased response to a cold-immersion test. A significant increase in number of layers in the stratum corneum was observed with electron microscope techniques in rats exposed to 6° C. for 8 weeks. (Author's abstract, modified)

10797
LeBlanc, J. [A.], J. A. Hildes, and O. Héroux 1960
TOLERANCE OF GASPÉ FISHERMEN TO COLD WATER. — Jour. Applied Physiol., 15 (6): 1031-1034. Nov. 1960.

The physiologic reactions and finger histology of Gaspé fishermen accustomed to cold water immersion were compared with those of a comparable group of men unaccustomed to cold. During immersion of the hand in cold water, the fishermen showed a greater pressor response, a higher mean finger temperature, a lesser sensation of pain, and a higher total heat flow from the hands. Skin biopsies showed no difference in skin thickness or cell size, but revealed a significantly greater number of mast cells in fishermen. It is concluded that the local and systemic vasoconstrictor response to immersion of the hands in cold water was less in the fishermen accustomed to cold.

10798
Leduc, J. 1961
EXCRETION OF CATECHOLAMINES IN RATS EXPOSED TO COLD. — Acta physiologica scandinavica (Stockholm), 51 (1): 94-95. Jan. 1961. In English.

Rats exposed to a temperature of +3° C. for one month showed an increase in noradrenaline excretion four times as high as that found in the control group maintained at room temperature. In the adrenal glands, adrenaline was reduced 25% after 24 hours in the cold, followed by an increase which persisted as long as the rats were kept in the cold. Noradrenaline content showed no significant change. Adrenalectomized rats excreted as much noradrenaline as intact animals on exposure to cold. However, adrenaline output in urine, although significantly increased in the cold, was lower than in the intact group. Since noradrenaline appears to derive from the adrenergic nerve endings, it is inferred that the sympathetic nervous system is involved in the metabolic response to cold exposure through the release of noradrenaline. Adrenaline appears to represent a second line of defense called forth when environmental conditions become more severe.

10799
Leithead, C. S. 1959
NATURAL ACCLIMATISATION TO HEAT.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 22-27. 1959.

The circulatory and subjective responses to heat were studied at Kuwait in 24 men during the first week after their arrival by air from England, and 9 of them were re-investigated 2 weeks later. Sudden postural changes caused giddiness and syncope only in those who had never before been in hot climates. Pulse rate and blood pressure reactions to tilting and to exercise improved steadily throughout the first week, at the end of which all but two of the subjects tested commenced work. A fall in hematocrit and plasma protein levels was demonstrated on the fourth day of exposure, which suggests an increase in plasma volume as a result of simple dilution. (Author's summary)

10800
Lemaire, R. 1959
[INFLUENCE OF HEAT ON RESPONSE OF PERIPHERAL VESSELS] Influence de la chaleur sur le comportement réactionnel des vaisseaux périphériques.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Liston, 1958), vol. 6: 105-111. 1959. In French.

The effect of heat (to 41° rectal temperature) on the vasodilation of peripheral blood vessels was measured in anesthetized dogs. It is shown that heat modifies the regulatory functions in peripheral circulation. During vasoconstriction, heat provokes a decrease in vasomotor responses, and, therefore, a dilation of the peripheral vessels. The dilatation, once provoked, becomes quite permanent and effects a temporary vascular paralysis.

10801
Lemaire, R., 1961
A. Mazer, and C. Benceny
[EFFECT OF HUMIDITY ON SALT CONSUMPTION IN SUBJECTS LIVING IN A TROPICAL CLIMATE] Influence de l'hygrométrie sur la consommation de sel chez les sujets vivant en climat tropical. — Comptes rendus de la Société de biologie (Paris), 155 (2): 389-391. 1961. In French.

The salt consumption of persons living in a tropical country (West Africa) was found to be related not only to temperature, but also to absolute humidity. In climates ranging from 20°-50° C. (Sudan, Sahara) no significant rise in salt consumption was observed.

10802
Lewis, H. E., 1960
J. P. Masterton, and S. Rosenbaum
BODY WEIGHT AND SKINFOLD THICKNESS OF MEN ON A POLAR EXPEDITION. — Clinical Sci. (London), 19 (4): 551-561. 1960.

Body weight and skinfold thickness at six sites (abdomen, chest, back at inferior tip of scapula, back between scapula and iliac crest, outer arm, outer thigh) were measured on members of the British North Greenland Expedition, 1952-1954. The men were taller and heavier and showed a greater gain in weight over two years than a standard British population. Body weights varied over the year, reaching maximal levels in the cold months and minimum in the warm. Skin thickness also varied with these periods, there being a close positive correlation between body weight (adjusted to standard height) and skinfold thickness at each of the six sites. It is suggested that environmental factors of cold (and darkness) in the polar region are influential physiologically in so far as they restrict activity. Increase of weight and skinfold thickness are probably due to excessive nutritional intake during these periods of reduced activity. Only a trivial benefit of insulation was obtained with increases of subcutaneous fat. No evidence was found that fat men were more efficient in the cold than other members of the expedition. (Authors' summary, modified)

10803
Lim, T. P. K. 1960
CARDIOPULMONARY RESPONSE TO THERMAL STRESS. — In: Clinical cardiopulmonary physiology, Second ed., p. 958-960. New York: Grune and Stratton, 1960.

Discussions are given on investigations concerned with cardiovascular, metabolic, and respiratory adjustments to various temperature stresses. In hot environments, excessive heat influx is counterbalanced by the enhanced heat dissipation mechanisms of cutaneous vasodilatation and perspiration, leading to an increased skin temperature and peripheral blood flow. In cold environments, cutaneous vasoconstriction followed by drastically reduced skin temperature and peripheral blood flow reverses the trend observed in hot environments. The effects of temperature stresses on metabolism, total ventilation in normal, resting subjects, O_2 consumption, alveolar CO_2 and O_2 tensions, and arterial blood pH are described.

10804
Lind, A. R. 1959
THE ASSESSMENT OF INTOLERABLY HOT ENVIRONMENTS FOR WORKING MEN.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 62-65. 1959.

When men work in surroundings so hot that they cannot establish bodily thermal equilibrium, the conditions of exposure are often too severe to fall within the range of use of existing heat stress indices. A simple formula, derived from previous work, in which the dry and wet bulb temperatures are weighted to relate climates of similar severity was tested on 16 subjects in each of four climates. It is concluded that the formula may be of some value in assessing and comparing the severity of excessively hot climates, provided that the conditions correspond to those of the experiments.

10805
MacFarlane, W. V. 1959
HUMAN WATER ECONOMY IN THE HEAT.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 19-21. 1959.

In the tropics, man sweats to survive. This involves short- and long-term adjustment of fluid spaces, endocrine and renal changes, and modified cell functions. Urinary excretion of water and sodium is less in the 6 a.m. to 6 p.m. period than in the 12 night hours. The potassium/sodium ratio is high by day and low at night. The 17-ketogenic steroid fraction or urine decreases during heating while urinary aldosterone increases. Fasting body weight is reciprocal to shade temperature, and weight changes proportionally to urinary water and sodium output. In adults at 27° S. latitude, the average urinary output of 17-ketosteroid and 17-ketogenic steroid is 30% higher in winter than in summer, while the urinary potassium/sodium ratio is high in summer and low in winter.

10806
McGraw, J. I. 1959
[STUDY OF THE REGULATORY MECHANISM OF CAPILLARY RESISTANCE. I. EFFECT OF TEMPERATURE ON GROWTH AND CAPILLARY RESISTANCE IN THE GUINEA PIG AND RAT] Etude du mécanisme régulateur de la résistance capillaire. I. Influence de la température sur la croissance et la résistance capillaire du Cobaye et du Rat.—Comptes rendus de la Société de biologie (Paris), 153 (3): 524-528. March 1959. In French.

Guinea pigs and rats were divided into two groups, one maintained at a constant temperature of 25° C. and the other at a constant temperature of 15° C., for 31 days. Animals maintained at 25° C. showed a normal and regular growth pattern with weight gain, whereas those subjected to slight cold revealed irregular growth patterns. The rats reacted more actively to temperature change and recuperated sooner than did the guinea pigs. At 15° C., capillary resistance showed an early and marked rise followed by a sharp drop to values lower than the original normal levels. The elevation of capillary resistance at 15° C. was more pronounced in the rats. Intervention of the pituitary-adrenal system during temperature variations is briefly discussed.

10807
Macpherson, R. K. 1958
ACCLIMATIZATION STATUS OF TEMPERATE-ZONE MAN.—Nature (London), 182 (4644): 1240-1241. Nov. 1, 1958.

Evidence is reviewed to support the hypothesis that the ability of man to adapt easily to ambient heat and his relative inability to adapt to cold is due to the fact that the neutral thermal condition for man is a hot rather than a temperate environment. Physiological evidence to support this view includes man's poor insulation and his great capacity for cutaneous vasodilatation and sweating. It is concluded that man approaches the extreme range of thermal adaptation in a temperate climate, and that little further adaptation is possible during exposure to severe cold.

10808
MacPherson, R. K. 1959
HEAT TOLERANCE.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 34-39. 1959.

Heat comprises not only environmental temperature but radiant heat load, humidity, and air speed. All these variables can be measured by the Effective Temperature Scale, which is in effect a scale of physiological strain. Heat intolerability can be measured by the human's relation to his environment when the heat loss required to maintain equilibrium exceeds that possible in the circumstances. In defining tolerable levels of warmth, it is necessary to consider the three aspects of heat tolerance: the physical limit (syncope); the mental limit (impairment of perception, reasoning, and judgment); and the emotional limit (increasing degree of intolerable discomfort). Conditions which are tolerable for a short span of time may not be so for longer times. The specification of acceptable limits of warmth is made difficult by the variation in tolerability not only between persons but also in the same individual at different times.

10809
MacPherson, R. K. 1960
PHYSIOLOGICAL RESPONSES TO HOT ENVIRONMENTS: AN ACCOUNT OF WORK DONE IN SINGAPORE, 1948-1953, AT THE ROYAL NAVAL TROPICAL RESEARCH UNIT WITH AN APPENDIX ON PRELIMINARY WORK DONE AT THE NATIONAL HOSPITAL FOR NERVOUS DISEASES, LONDON. — Medical Research Council Special Report Series, no. 298. 323 p. London, 1960.

Research on human physiology in hot environments conducted by the Royal Naval Tropical Research Unit is reviewed under the following chapter headings: (1) The Establishment of the Royal Naval Tropical Research Unit; (2) A Preliminary Study in the Tropics of the Effects of Air Temperature, Humidity and Air Speed on Naturally Acclimatized Men; (3) Further Experiments on Naturally Acclimatized Men; (4) The Effects of Environmental Stress: Measurements on Artificially Acclimatized Men; (5) The Nature and Degree of Natural Acclimatization; (6) The Contribution of Radiant Heat to Environmental Stress; (7) Energy Expenditure in Relation to Environmental Stress; (8) The upper Limit of Tolerance of Environmental Stress; (9) Ancillary Investigations in Singapore; (10) Conclusions; (11) Tables to Chapters 2-9; (12) Appendix: Experiments in a Temperate Climate on Men Artificially Acclimatized to Hot Conditions; (13) References; and (14) Conversion Chart. (129 references)

10810
Mahfouz, M., and E. A. Ezz 1958
THE EFFECT OF RESERPINE AND CHLORPROMAZINE ON THE RESPONSE OF THE RAT TO ACUTE STRESS.—Jour. Pharmacol. and Exper. Therapeutics, 123 (1): 39-42. May 1958.

The effect of reserpine and chlorprozmazine on the response of rats to stress was investigated. Rats were subjected to the stresses of continuous ether anesthesia with rapid exsanguination or exposure to temperatures of 38° or 3° C. for 1 hour. The degree of response to stress was estimated from adrenal cortical activity by measurement of adrenal ascorbic acid depletion. Intramuscular injection of 8 micrograms of reserpine/kg. of body weight or 2 mg. of chropromazine/kg. was found to decrease the adrenal depletion of ascorbic acid in response to stress. The depletion of ascorbic acid after administration of adrenocorticotrophic hormone (ACTH) was not affected by reserpine or chlorpromazine. It is suggested that reserpine and chlorpromazine act on the prepituitary phase of response to stress, possibly on the hypothalamus.

10811
Marcus, S., F. Miya, L. J. Phelps, and L. Spencer 1961
EFFECT OF ACUTE AND CHRONIC EXPOSURE TO LOW TEMPERATURES ON SURVIVAL OF MICE CHALLENGED WITH KLEBSIELLA PNEUMONIAE. —Univ. of Utah. Coll. of Medicine, Salt Lake City; issued by Arctic Aero-medical Lab., Fort Wainwright, Alaska (Project no. 8241-32). Technical Report no. 61-37, Oct. 1961. 8 p.

Normal and immunized mice were subjected to acute and chronic stress of 2°C. ambient temperature. Singly caged mice were adversely affected by the acute cold stress, but mice chronically cold-stressed were significantly protected by the immunization whether caged in groups or singly. Chronic cold stress did not decrease the ability of the animals to form agglutinin antibody. (Authors' abstract)

10812
Marcus, S., F. Miya, L. J. Phelps, and L. Spencer 1961
EFFECT OF ACUTE AND CHRONIC LOW TEMPERATURE STRESS ON SURVIVAL OF MICE CHALLENGED WITH STAPHYLOCOCCUS AUREUS. —Univ. of Utah. Coll. of Medicine, Salt Lake City; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-32). Technical Report no. 61-42, Oct. 1961. 10 p.

Normal and immunized mice were subjected to acute and chronic stress of 2° C. ambient temperature. The mice were challenged with varying doses of Staphylococcus aureus, strain Fritchie. Immunization offered significant protection to mice kept at 21° C. and to mice that were immunized, challenged and acutely exposed to 2° C. in groups. No protection was observed in mice that were immunized, challenged and exposed as individuals to 2° C. Also, immunized mice that were chronically cold-exposed at 2° C. were not protected against subsequent challenge and showed equivocal mortality ratios compared to the normal controls challenged under the same conditions. (Authors' abstract)

10813
Marcus, S., 1961
F. Miya, L. J. Phelps, and L. Spencer
EFFECT OF EXPOSURE TO LOW TEMPERATURE ON DEVELOPMENT OF SPIROCHAETE PALLIDA IN THE RABBIT. —— Univ. of Utah. Coll. of Medicine, Salt Lake City; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-32). Technical Report no. 61-43, Oct. 1961. 5 p.

Adult male albino rabbits challenged intratesticularly with viable Spirochaete pallida suspension and kept at 3° C. or 21° C. developed syphilomata at the same rates. Adverse environmental temperatures apparently do not enhance or decrease the rabbit's resistance to the challenge. Rectal temperature measurements during the experimental period showed no gross differences in animals kept at 3° C. or 21° C., and the temperatures remained quite constant throughout the experiment. (Authors' abstract)

10814
Marcus, S., 1961
F. Miya, L. J. Phelps, and L. Spencer
THE INFLUENCE OF LOW AMBIENT TEMPERATURE ON COLD-ACCLIMATIZED MICE CHALLENGED WITH EHRLICH ASCITES TUMOR CELLS. —Univ. of Utah. Coll. of Medicine, Salt Lake City; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-32). Technical Report no. 61-38, Oct. 1961. 10 p.

Ehrlich ascites tumor cells were given to mice acclimatized to low ambient temperatures. The mice were maintained at low ambient temperatures following challenge. The tumor cells were given via the intraperitoneal or subcutaneous route. The viability of the tumor cells was not affected, and the acclimatized mice showed significant delays in the mortality curves compared to the control animals kept at room temperature; however, the final mortalities were similar in the acclimatized and room temperature-exposed mice at all challenge doses employed. (Authors' abstract)

10815
Masoro, E. J. 1960
ALTERATIONS IN HEPATIC LIPID METABOLISM INDUCED BY ACCLIMATION TO LOW ENVIRONMENTAL TEMPERATURES. —— Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 115-119. Dec. 1960 (Part II).

Two distinct kinds of information have been made available by experimentation on hepatic metabolism in the cold-acclimated rat. First, insight has been gained concerning the acclimation process as it occurs at the molecular level of organization; a mechanistic explanation has been presented for two important phenomena: (a) the great capacity of the cold-acclimated rat to resist fatty infiltration of the liver; (b) the ability of the cold-acclimated rat to maintain liver glycogen at surprisingly high levels during fasting. Second, the cold-acclimated animal has been shown to be a powerful tool for studying the physiologic regulators of intermediary metabolism. (Author's abstract)

10816
Masoro, E. J. 1960
DEPRESSED LIPOGENESIS INDUCED BY COLD STRESS. —— Amer. Jour. Physiol., 199 (3): 449-452. Sept. 1960.

Exposure of rats for 24 hours to an ambient temperature of 0-2°C. had no effect on the ability of liver homogenates to synthesize fatty acids from acetate-1-C^{14}. Fasting of animals exposed to cold, however, caused an almost complete elimination of liver fatty acid synthesis. Addition of higher concentrations of TPN or isocitrate, varying concentrations of a TPN-dependent isocitrate dehydrogenase from yeast, TPNH, ATP, glucose-6-phosphate, or fructose-1, 6 diphosphate either had no effect or reduced the lipogenic activity of cold-fasted liver homogenates. It is suggested that the inhibition of lipogenesis in liver slices from cold-fed rats is the result of an unfavorable cofactor environment (a low rate of TPNH generation via the hexose monophosphate pathway of carbohydrate metabolism) rather than of reduced levels of fatty acid-synthesizing enzymes. The failure of lipogenesis in the cold-fasted rats is attributed to a loss of fatty acid-synthesizing enzymes.

10817
Masoro, E. J., 1961
E. Porter, and J. Patkin
EFFECT OF COLD STRESS ON LIPOGENESIS BY ADIPOSE TISSUE. —— Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-38). Technical Report no. 60-20, April 1961. 7 p.

The effect of cold stress on acetate metabolism by adipose tissue was investigated in rats. Cold stress did not affect the ability of the epididymal fat pad to oxidize acetate-1-C^{14} to $C^{14}O_2$. The addition of unlabeled glucose to the incubation medium did not influence the rate of acetate oxidation in the case of adipose tissue obtained from either control or cold-stressed rats. In the absence of unlabeled glucose, more fatty acids from acetate-1-C^{14} were synthesized by the adipose tissue from control rats than by that from cold-stressed rats, although very little was synthesized by either. The addition of unlabeled glucose to the incubation medium at the physiologic concentration of 100 mg./100 ml. caused the adipose tissue from both normal and cold-stressed rats to form fatty acids at high rates. It is a striking finding that cold stress, which almost abolishes hepatic lipogenesis, does not appreciably alter adipose tissue lipogenesis. (Authors' abstract)

10818
Masoro, E. J. 1960
THE EFFECT OF PHYSICAL INJURY ON LIPID METABOLISM. —Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-17, Feb. 1960, 25 p.

Research findings on the effects of cold injury and cold acclimatization on the intermediary metabolism of lipids in rats are reviewed. It seems reasonable to suppose that in liver slices of cold-fasted rats the following metabolic disturbances exist: an uncoupled oxidative phosphorylation, essentially no carbohydrate oxidation via the Embden-Meyerhof and phosphogluconate oxidative pathways, and a high rate of gluconeogenesis which yields vigorous energy acceptors for the available ATP (adenosine triphosphate).

Liver slices from cold-acclimated rats oxidized palmitate at faster rates than liver slices from rats acclimated at room temperature. When cold-acclimated rats were fasted at 0-2°C., the ability of the liver to oxidize acetate was not depressed below that of the fed rat, and hepatic palmitate oxidation was far more rapid. It is clear that none of the defects in hepatic fat oxidation found in the cold-fasted rat acclimated to 25°C. occur in the cold-fasted rat acclimated to 0-2°C. Conflicting results were observed in the effects of cold on lipogenesis, in that respiratory quotient studies suggested an accelerated conversion of sugar into fat while a depression in fatty acid synthesis was noted in studies of liver slices from cold-acclimated rats. (55 references)

10819
Masoro, E. J., 1961
and E. Porter
FATTY ACID OXIDATION BY MITOCHONDRIA FROM COLD-FASTED RATS.—Tufts Univ. of School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-38). Technical Report no. 60-23, April 1961, 11 p.

Mitochondria from "cold-fasted" rats oxidized about as much acetate 1-C^{14} to $C^{14}O_2$ as did motochondria from control rats when the data were expressed on the basis of dry weight of the mitochondria. This was a most surprising result because liver slices (wet weight basis) and liver homogenates (protein content basis) from cold-fasted rats form far less $C^{14}O_2$ from acetate 1-C^{14} than do similar preparations from control rats. The possible reasons for these differences in results with liver slices and liver homogenates on the one hand and liver mitochondria on the other are discussed. Mitochondria from cold-fasted rats were also found to oxidize palmitate 1-C^{14} to $C^{14}O_2$ as rapidly as the motochondria from control rats, thereby confirming the results obtained with liver slices. Carbohydrate metabolism failed to promote palmitate oxidation by mitochondria from cold-fasted rats; just the opposite result is obtained with liver slices. The use of mitochondria to study the regulation of multistep metabolic pathways is discussed. (Authors' abstract)

10820
Masoro, E. J., 1960
C. L. Asuncion, Richard K. Brown, and D. Rapport
LIPOGENESIS FROM CARBOHYDRATE IN THE NEGATIVE CALORIC BALANCE STATE INDUCED BY EXPOSURE TO COLD. I. GLUCOSE LIPOGENESIS IN RATS IN NEGATIVE NITROGEN BALANCE.—Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 57-31, April 1960. iii+8 p.

The ability of rats exposed to 0-2° C. for 1 or 2 days to incorporate dietary glucose isotopic carbon into fatty acids was studied. Under these circumstances, in spite of a large intake of food, there is a loss in body weight and fatty acids. Whether calculated on a percentage or on an absolute basis, there is under the conditions a considerable incorporation of the label into fatty acids. It is concluded that not only in the steady state, but also in a state of negative caloric balance, lipogenesis is one of the obligatory pathways of carbohydrate metabolism. (Authors' abstract)

10821
Masoro, E. J. 1961
A MECHANISTIC STUDY OF THE FAILURE IN LIPOGENESIS INDUCED BY COLD-STRESS.—Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-38). Technical Report no. 60-22, April 1961. 12 p.

Liver homogenates from cold-fed rats synthesized fatty acids about as well as did homogenates from control rats. This finding contrasts with the almost complete absence of lipogenesis in the liver slice prepared from cold-fed rats. The conclusion is drawn that the failure of lipogenesis in the intact liver cell of the cold-fed rats does not result from the lack of fatty acid synthesizing enzymes, but is the result of an unfavorable cofactor environment. Evidence is presented which indicates that lipogenesis fails in the intact liver cell of the cold-fed rat because of a depressed reduced triphosphopyridine nucleotide (TPNH) generation by way of the hexose monophosphate pathway of carbohydrate metabolism. Liver homogenates from cold-fasted rats converted far less acetate-1-C^{14} to fatty acids than homogenates from control and cold-fed rats. This failure in lipogenesis was shown not to be due to lack of TPNH generation or of carbohydrate metabolism over either the hexose monophosphate pathway or the Embden-Meyerhof pathway. It is concluded that either the concentration of the fatty acid synthesizing enzymes is greatly reduced, or a necessary unknown cofactor is not present at adequate levels in the liver of the cold-fasted rat. (Author's abstract)

10822
Massey, P. M. O. 1959
FINGER NUMBNESS AND TEMPERATURE IN ANTARCTICA.—Jour. Applied Physiol., 14 (4): 616-620. July 1959.

Cold reactions (resulting from exposure of a finger in a wind tunnel to a temperature between -2° C. and -11.5° C., windspeed 6-8.5 m.p.h., with atmospheric humidity around 80-90%) in a group of new arrivals in Antarctica were compared with the reactions of men who had already lived and worked in Antarctica for a year and were staying for another year. Both groups were observed through the ensuing Antarctic year, and changes in performance were recorded. First tests revealed a difference in the numbing effect of cold exposure on the newcomers and on the men in their second consecutive year of residence. After 6 weeks in the Antarctic summer, the newcomers showed improved resistance to numbing when exposed to similar conditions of wind and temperature. There was no difference in resting finger temperature between the two groups, but there was a significant fall in temperature over the year. Second-year men showed a greater immunity to frostbite under the experimental conditions, but this was not proved statistically. The addition of drift snow to the cold wind doubled the numbness induced in the finger. Under very cold conditions, drift increased finger numbness over six times. Of 18 cases of frostbite, only four occurred in the second year group.

10823
Mefferd, R. B. 1959
ADAPTIVE CHANGES TO MODERATE SEASONAL HEAT IN HUMAN SUBJECTS.—Jour. Applied Physiol., 14 (6): 995-996. Nov. 1959.

The excretion patterns of 29 members (including children) of 7 south Texas Caucasian families of varying economic status were determined each November (neutral-cool, averaging 68.7°F.) and May (warm, averaging 81.6°F.) for 3 consecutive years, to determine whether heat-adaptive mechanisms were stimulated by a moderate increase in average temperature as contrasted to intense heat. Four timed over-night urine samples from each person were analyzed in each period for five electrolytes, five nitrogenous waste products and thirteen amino acids. Excretion rates of most substances were lower in November than in May. Creatinine and the magnesium/calcium ratio were elevated, however, and the urine volume, magnesium, urea, glutamic acid, arginine, and the sodium/potassium and uric acid/creatinine ratios did not change significantly. The excretion patterns of the heat-adapted human subjects were strikingly similar to those seen in heat-adapted rats. (Author's abstract)

10824
Mefferd, R. B., and H. B. Hale 1958
STUDIES ON CROSS-ADAPTATION: EFFECTS OF ABRUPT TEMPERATURE CHANGES ON EXCRETION CHARACTERISTICS OF RATS ACCLIMATED TO COLD, NEUTRAL, OR HOT ENVIRONMENTS.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-106, Sept. 1956. 18 p.
Also published in: Amer. Jour. Physiol., 195 (3): 726-734. Dec. 1958.

A study was made of the urinary responses of rats acclimated for 3 months to temperatures of 35°, 24°, or 3°C. to a 24-hour fasting period of exposure to different environmental temperatures. Heat exposure of cold-acclimated rats produced elevated values (relative to heat-exposed neutral-acclimated rats) for urine volume, the urine/water ratio, potassium, magnesium, calcium, the calcium/phosphorus and uric acid/creatinine ratios, creatine, taurine, b-alanine, glycine, a-alanine, serine, threonine, tyrosine, lysine, histidine, and the total a-amino acids, and decreases in fasting weight loss, water intake, sodium, the sodium/potassium ratio, phosphate, uric acid, and creatinine. Cold exposure of heat-acclimated rats resulted in increased values for water intake, phosphate, b-alanine, a-alanine, serine, tyrosine, lysine, and arginine, and decreases in fasting weight loss, sodium, potassium, magnesium, the magnesium/calcium and uric acid/creatinine ratios, urea, uric acid, creatinine, threonine, histidine, and the total a-amino acids. Similarities were seen among groups in the pattern of response of most variables to adverse temperature change (independent of acclimative responses already present). Most acclimative changes tended towards reversal during exposure to neutral temperature.

10825
Milan, F. A., R. W. Elsner, and K. Rodahl 1961
THE EFFECT OF A YEAR IN THE ANTARCTIC ON HUMAN THERMAL AND METABOLIC RESPONSES TO AN ACUTE STANDARDIZED COLD STRESS.—Arctic Aeromedical Lab., Fort Wainright, Alaska. Technical Report no. 60-9, March 1961. 21 p.

The metabolic rate and thermal responses of eight healthy subjects exposed nude for 2 hours to a standard cold stress (17° ± 1.0° C. air temperature) were examined in the fall, winter, and spring at Little America V in the Antarctic. Mean body, average skin and foot temperatures increased significantly ($P < 0.05$) over the year. Neither rectal nor finger temperature was altered. There was a decrease ($P < 0.05$) in heat production to meet the same thermal demands after 3 months in the Antarctic. Basal metabolic rates were unchanged. Obvious shivering observed in all subjects in the fall was almost absent in the winter and spring. It is suggested that these changes represent physiological adaptation to low ambient temperatures. (Authors' abstract)

10826
Milan, F. [A.] 1961
NUTRITION AND ENERGY EXPENDITURE AT LITTLE AMERICA V IN THE ANTARCTIC.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Report no. 60-11, March 1961, 17 p.

A detailed survey of nutrition and energy expenditure was undertaken to establish the effects of chronic cold exposure and changing levels of activity upon the nutritional requirements of men living at an Antarctic base. This survey represented 104 subject days (6-day periods) in the Antarctic fall, winter, and spring. In the fall, five scientists averaged a daily expenditure of 3775 Calories and consumed 3400 Calories (42 Cal./kg./diem). In the winter and spring, expenditures for four scientists averaged 3370 and 4175 Calories and intakes were 4396 and 4285 Calories (53 and 54 Cal./kg./diem). Four sailors, engaged in moderate to heavy work outside, expended about 3600 Calories per day and consumed 4925 Calories (61 Cal./kg./diem) when studied in the spring. The percentage of calories furnished by protein, fat, and carbohydrate was not significantly different from those to be found in the diet of U. S. troops eating a garrison ration elsewhere. There was no increased avidity for fat over the year. The scientists gained an average of 1.5 kilograms in body weight, and the sailors an average of 4.6 kilograms over the 11-month period. It is suggested that eating served to alleviate the tedium of long isolation and that psychological, as well as physiological, reasons lay behind the high caloric intakes seen in some subjects. (Author's abstract)

10827
Milan, F. A., R. W. Elsner, and K. Rodahl 1961
THERMAL AND METABOLIC RESPONSES OF MEN IN THE ANTARCTIC TO A STANDARD COLD STRESS. — Jour. Applied Physiol., 16 (3): 401-404. May 1961.

Thermal and metabolic responses of eight male subjects exposed nude for 2 hr. to a standard cold stress (17° ± 1.0° C. air temperature) were examined in the austral fall, winter, and spring at Little America in the Antarctic. Mean body, average skin, and foot temperatures increased significantly after 3 months. Neither rectal nor finger temperatures were changed over the year. Although basal metabolic rates were unchanged, there was a significant decrease in the metabolic responses to the standard cold stress after 3 months in the Antarctic. It is suggested that these changes represent physiological adaptations to chronic cold. (Authors' abstract)

10828
Milan, F. A. 1961
THERMAL STRESS IN THE ANTARCTIC.—Arctic

Aeromedical Lab., Fort Wainwright, Alsaka. Technical Report no. 60-10, March 1961. 19 p.

Five experiments which investigated thermal balance in two clothed men in the cold were carried out at Little America V in the winter months of June and August. Environmental temperatures ranged between -32° and -47° C. and wind velocities ranged between 2 and 17 miles per hour during the experiments. Despite the protective clothing worn and the heat productions of between 3 and 4.8 mets (measured by indirect calorimetry), total heat debt (obtained by measurements of rectal and skin temperatures) ranged between 105 and 126 kilocalories for exposures of 40 to 165 minutes in duration. Finger temperatures ranged between 7° and 18° C. at the end of the experiments. The thermal demand of the environment on these seemingly adequately clothed men was high, and it is suggested that they were moderately cold stressed despite high rectal temperatures. (Author's abstract)

10829
Minard, D., 1959
G. A. Grayeb, R. C. Singer, and J. R. Kingston
HEAT STRESS DURING OPERATION BANYAN TREE. — Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 41 01 00.01.02 (Vol. 17, p. 467-478), July 16, 1959. AD 228 467
Essentially the same issued as: Naval Medical Research Inst., Bethesda, Md. ([Project no.] MR 005.01-0001.01). Report no. 5, July 14, 1961. 9 p.
Also published in: Military Med., 126 (11): 809-817. Nov. 1961.

In Operation Banyan Tree I, 1500 physically fit but unacclimatized young paratroopers were flown from Fort Bragg, North Carolina (where daily maximum temperatures averaged 56.8° F. for the period under consideration) to Panama (where heat stress evaluations in terms of Yaglou's Wet-Bulb-Globe Temperature Index were 80.6 and 77.2 for the two days – 85 being the level at which vigorous training is curtailed in unacclimatized recruits) to engage in a strenuous 2-day combat exercise against seasoned Army units stationed at Panama. The unacclimatized men experienced significant degrees of dehydration accompanied by reduced urinary volume, and depletion of urinary electrolytes, as well as elevation of oral temperature and resting pulse rate. These findings suggest the need of devising methods for enhancing heat tolerance and for preventing dehydration in unacclimatized combat units.

10830
Minard, D. 1961
PREVENTION OF HEAT CASUALTIES IN MARINE CORPS RECRUITS, 1955-1960, WITH COMPARATIVE INCIDENCE RATES AND CLIMATIC HEAT STRESSES IN OTHER TRAINING CATEGORIES.— Naval Medical Research Inst., Bethesda, Md. (Project no. MR005.01-0001.01). Report no. 4, Feb. 21, 1961. 16 p.
Also published in: Military Medicine, 126 (4): 261-272. April 1961.
Extensive abstract also published in: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 103-104. 1959.

The program for preventing heat casualties at the Marine Corps Recruiting Depot, Parris Island, South Carolina, is described. Heat and humidity factors are determined by the wet bulb-globe temperature index of Yaglou. Human factors described include acclimatization of unseasoned trainees, increasing emphasis on physical fitness, proper salt and water intake, altered clothing regulations, and placing of recently-inoculated men on a light-duty status. Environmental factors include a new training schedule, shaded classrooms, no post-prandial exercise, enough restful sleep, and indoctrination of training officers and drill instructors. The incidence rate of heat casualties in recruits at Parris Island dropped significantly in 1956 when the program was first adopted, and has remained lower since then.

10831
Molloy, R., 1959
D. Nicholls, W. Farrington, and R. J. Rossiter
ACCLIMATIZATION TO COLD: IMMEDIATE ADRENAL RESPONSE AND SURVIVAL OF ACCLIMATIZED RATS EXPOSED TO MORE SEVERE COLD.—Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (5): 661-670. May 1959.

Cold-acclimatized and non-acclimatized rats were exposed to more severe cold (two hours at -5° C.). In rats acclimatized to cold by conditioning to 3° C. for four weeks, the immediate pituitary-adrenal response was considerably less than that in non-acclimatized rats maintained at room temperature (22° C.). The reduction in the immediate pituitary-adrenal response took 3 to 4 weeks to develop and persisted for 12 hours, but not for 4 days. Rats which were conditioned to -5° C. by exposures for 2 or 6 hours daily for 4 weeks showed no reduction in the immediate pituitary-adrenal response to more severe cold, but there was a significant decrease in this response in rats conditioned for 6 hours daily for 8 weeks. Rats acclimatized to cold by conditioning to 3° C. for 4 weeks showed greater survival when exposed to an environmental temperature of -15° C. than rats conditioned to 22° C. Rats that were conditioned to -5° C. for brief daily periods (2 hours or 6 hours) for 4 weeks or 8 weeks also survived exposure to severe cold (-22° C.) better than rats maintained at room temperature. Significant increases in adrenal weight were found in those cold-conditioned rats that showed a reduced pituitary-adrenal response. It is concluded that the development of increased survival on exposure to severe cold, by a process of conditioning to less severe cold, is not necessarily accompanied by a reduction in the immediate pituitary-adrenal response to severe cold, or by an increase in weight of the adrenal glands. (Authors' abstract, modified)

10832
Moore, K. E., 1961
D. N. Calvert, and T. M. Brody
TISSUE CATECHOLAMINE CONTENT OF COLD-ACCLIMATED RATS.—Proc. Soc. Exper. Biol. and Med., 106 (4): 816-818. April 1961.

After three to five weeks in a cold room (5 to 7°C.), the liver, kidney, heart, and brain weights of rats were recorded, and the epinephrine and norepinephrine content of the adrenal glands, heart, and brain were determined. Weights of liver, kidney, and heart of the cold-adpated animals were significantly greater than those of the control group (kept at 25 to 27°C.), and showed marked hypertrophy. Brain weights of both groups were nearly identical. The brain content of epinephrine and norepinephrine was similar in both groups, but the heart content was markedly lower in the cold-adpated rats, while the adrenal content was markedly increased. The lack of significant decrease

of weight gain in cold-exposed rats is attributed to sex factors, since all rats used in the study were females.

10833
Morton, R., 1960
and K. A. Provins
FINGER NUMBNESS AFTER ACUTE LOCAL EXPOSURE TO COLD.—Jour. Applied Physiol., 15 (1): 149-154. Jan. 1960.

The index fingers of twenty subjects were exposed to air at -22° C. and a wind speed of 300 ft./min. until the indicated skin temperature fell to -5° C. The fingers were then returned to room temperature conditions (19° C.) and the subjects tested on each of two tasks involving tactile discrimination (two-edge discrimination and reproduction of finger pressure) until the fingers had fully recovered. The degree of impairment on both sensori-motor tasks at a given skin temperature varied appreciably from subject to subject, although most subjects showed little impairment above about 8°C. Suddenness of recovery of two-edge discrimination in those subjects experiencing a marked impairment of tactile discrimination with cold exposure was suggested by the L-shaped curve of the relationship between numbness index and skin temperature. The evidence suggests that while finger numbness as measured by Mackworth's V-test may indicate a corresponding impairment of performance in accuracy of pressure reproduction, testing subjects on either task at normal skin temperature will have little predictive value for their relative performance after cold exposure in the present situation. (Authors' abstract, modified)

10834
Nakamura, M., 1960
and K. A. Tsushima
CARDIAC RESPONSE TO LOCAL COOLING IN MAN.— Tohoku Jour. Exper. Med. (Sendai, Japan), 71 (3):291-304. Feb. 25, 1960.

The central cardiovascular response to immersion of the hand or foot in cold water was investigated in 8 subjects. No change in heart rate or blood pressure was observed at water temperatures above 12°C. Below this level both heart and respiratory rates were accelerated, and systolic and diastolic blood pressures were increased. The increase in heart rate was a linear function of the logarithm of water temperature and was proportional to the area of skin exposed. After several minutes exposure, the sensation of cold experienced at low temperatures tended to subside, skin temperature rose slightly, and heart rate and blood pressure were decreased. The adaptive effect was not observed when the blood supply to the immersed limb was occluded. It is suggested that the cardiovascular changes observed during local immersion at low temperatures represent a reflex response to the sensation of pain produced by cooling.

10835
Nelms, J. D. 1960
ACCLIMATISATION TO COLD IN LAPPS AND ARCTIC INDIANS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1087, Feb. 1960. 12 p.

The effects of night-long cold exposure upon sleep, shivering, body temperature, and metabolism were studied on shepherd Lapps, Arctic Indians, and Caucasian controls. Rectal temperatures in both native groups fell more than in controls; no constant differences in skin temperature were demonstrated; metabolic rates were less raised in Lapps by cold than in controls, but a similar trend in Indians was not statistically significant. Both native groups appeared to sleep better than whites, a supposition which was confirmed by electroencephalograms in Indians. No difference in magnitude of shivering was demonstrated. The effects of acute cold exposure upon the hand blood flow was also studied in the same three groups. Measurements of skin temperature were recorded while water at 0° C. was used to provoke the cold vasodilation reaction of Lewis. Heat output in response to warmer water was measured by calorimetry, and hand plethysmography was performed upon Lapps. The Indians showed clear-cut differences from controls: onset of vasodilation was earlier, skin temperature did not fall as low before vasodilation occurred, temperatures after vasodilation were higher, heat output was higher, and impairment of heat output by general body cooling was less in Indians than in controls. There were similar trends in Lapps. (Author's summary, modified)

10836
Neubeiser, R. E., 1961
W. S. Platner, and J. L. Shields
MAGNESIUM IN BLOOD AND TISSUES DURING COLD ACCLIMATION. — Jour. Applied Physiol., 16 (2): 247-249. March 1961.

Serum, heart, liver, and skeletal muscle Mg was determined on control and cold-exposed rats at 10-day intervals for 6 weeks. Serum Mg was also measured at 1- and 5-day periods. Deep colonic temperatures were measured at 1, 4, 12, 22, and 40 days and footpad temperatures at 1, 2, 3, 5, and 40 days of cold exposure. Heart and skeletal muscle Mg levels were elevated significantly at 10 days, serum Mg at 1, 5, 10, and 20 days, and deep colonic temperatures at 1, 12, and 22 days. The elevated Mg levels of heart and skeletal muscle suggest that the greater amount of serum Mg did not come from these tissues. The loss of liver Mg at 40 days of exposure remains obscure. Footpad temperature decreased from control throughout the acclimation period. The existence of peripheral hypothermia, coupled with increased tissue Mg, suggests that hypothermic peripheral tissues such as skin are the most likely source of the transient rise of serum Mg during cold acclimation. (Authors' abstract)

10837
Nicholls, D., 1959
R. Molloy, K. Stavraky, and R. J. Rossiter
ACCLIMATIZATION TO COLD: OBSERVATIONS ON THE MECHANISM OF THE REDUCED IMMEDIATE ADRENAL RESPONSE.—Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (5): 671-677. May 1959.

The incorporation of inorganic phosphorus labelled with P^{32} into adrenal gland phosphorus was measured in rats acclimatized to cold for four weeks. Previously it was reported that the immediate pituitary-adrenal response to brief cold exposure (two hours at -5° C.) as judged by the increased P32 incorporation was considerably decreased in acclimatized rats. The administration of ACTH, pitressin, or adrenaline caused similar increases

in the adrenal phosphorus metabolism in acclimatized and non-acclimatized control rats. Acclimatization could still be demonstrated in rats after the fur had been removed by clipping. It is concluded that the decreased immediate pituitary-adrenal response to an exposure to more severe cold, observed in acclimatized rats, is not the result of an increased fur thickness, nor is it the result of a decreased sensitivity of the adrenal tissue to ACTH, or to a decreased sensitivity of the pituitary or hypothalamus to a given stimulus. It is suggested that the reduction in the immediate pituitary-adrenal response to a more severe cold stress in acclimatized rats might be due to an alteration in the sensitivity of the peripheral nerve receptors, or in the mechanism, nervous or otherwise, whereby the pituitary is stimulated. (From the authors' abstract)

10838
Panisiak, V. I., and N. B. Kozlov 1960
[TREATMENT OF HEAT STROKE IN EXPERIMENTAL CONDITIONS] O lechenii teplogo udara v eksperimental'nykh usloviiakh. — Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 4 (6): 57-61. Nov.-Dec. 1960. In Russian, with English summary (p. 61).

Dogs and rabbits were exposed to ambient temperatures of 30-45° C. in one series, and 50-60° C. in another series. In the first series, in which the rise of body temperature did not exceed 2° C., the biochemical changes were reduction of reserve alkali, rise in blood pH, reduction of blood sugar, and decrease in ammonia and nitrogen content of the urine. In the second series, in which the body temperatures rose to 43-44° C. (4-6° C. above normal), there was a rise in blood sugar, lactic acid, ammonia, and residual nitrogen in the blood; the ammonia level in the urine and the total amount of urine excreted were reduced with occasional anuria; the blood pH was initially above normal but declined later. In view of the pronounced rise in blood and tissue ammonia and the marked disturbance of the acid-base equilibrium giving rise to the clinical picture of heat stroke, treatment by administration of glutamic acid and carbon dioxide was instituted. These measures succeeded in saving 72 to 82% of the animals.

10839
[Parkes, A. S.] 1958
SOME BIOLOGICAL EFFECTS OF LOW TEMPERATURES.—Nature (London), 182 (4635): 581. Aug. 30, 1958

A summary is given of the presidential address delivered by Dr. A. S. Parkes to the Zoology Section at the British Association meeting held in Glasgow in August 1958. The behavior of body temperature in cold-blooded and warm-blooded animals in response to environmental temperature is discussed, and recent advances in the freezing of mammalian cells and tissues are considered.

10840
Patkin, J. K., and E. J. Masoro 1961
EFFECTS OF COLD ACCLIMATION ON LIPID METABOLISM IN ADIPOSE TISSUE. — Amer. Jour. Physiol., 200 (4): 847-850. April 1961.

Also published as report: Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-38). Technical Report no. 60-41, Oct. 1961. 12 p.

Cold acclimation is known to alter hepatic lipid metabolism. Liver slices from cold-acclimated rats have a greatly depressed capacity to synthesize long-chain fatty acids from acetate-1-C^{14}. Since adipose tissue is the major site of lipogenic activity in the intact animal, its fatty acid synthetic capacity was studied. In contrast to the liver, it was found that adipose tissue from the cold-acclimated rat synthesized three to six times as much long-chain fatty acids per milligram of tissue protein as the adipose tissue from the control rat living at 25° C. Evidence is presented indicating that adipose tissues from cold-acclimated and control rats esterify long-chain fatty acids at the same rate. The ability of adipose tissue to oxidize palmitic acid to CO_2 was found to be unaltered by cold acclimation. The fate of the large amount of fatty acid synthesized in the adipose tissue of cold-acclimated rats is discussed. (Authors' abstract)

10841
Patkin, J. [K.], and E. J. Masoro 1961
EFFECTS OF COLD STRESS ON MITOCHONDRIAL OXIDATIVE PHOSPHORYLATION.—Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-38). Technical Report no. 60-21, April 1961. 6 p.

The P:O ration with succinate as substrate is the same for liver mitochondria from cold-fasted rats as it is for mitochondria from control rats. Glucose-hexokinase acceptor studies using either succinate or glutamate as substrate indicate that the oxidative phosphorylating system is about as tightly coupled in the liver mitochondria from cold-fasted rats as it is in those from control rats. These results are surprising since earlier work with liver homogenates indicated that the efficiency of oxidative phosphorylation is markedly reduced in the homogenate from cold-fasted rats. The possible reasons for these differences in results with homogenates on the one hand and mitochondria on the other are discussed. The use of mitochondrial activities as an index of the efficiency of oxidative phosphorylation in vivo is also discussed. (Authors' abstract)

10842
Payne, R. B. 1959
A PRELIMINARY STUDY OF THE MOTIVATIONAL PROPERTIES OF COLD STRESS.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-9, April 1959. 10 p.

An experiment was conducted for the purpose of noting (a) whether cold exposure can be regarded as having drive properties sufficient for the motivation of a rote learning process, and (b) whether the drive properties of cold exposure are modified by the factor of cold acclimatization. Five male subjects underwent thermophysiological changes characteristic of cold acclimatization by means of rigorous physical training followed by prolonged field exposure to sub-zero temperatures. Near the end of the physical training phase, and again at the end of the bivouac phase, the subjects learned paired-associate lists,

first at 75° F. ambient temperature, and later at 50° F. Five control subjects were treated alike except for the acclimatization regimen. All subjects wore 1 clo of insulation during the learning sessions. The temperature effect was significant at the 5% level, but only for the acclimatized subjects. They learned faster under the lower temperature condition on both occasions. The results agree well with those observed in the operant behavior of rats in low temperatures under radiant heat reinforcement, and they lend themselves to the interpretation that cold exposure generates a more effective drive stimulus for acclimatized subjects because acclimatized subjects actually lose more heat under cold stress than do their nonacclimatized controls. (Author's abstract)

10843
Payne, R. B. 1959
TRACKING PROFICIENCY AS A FUNCTION OF THERMAL BALANCE.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-14, May 1959. 9 p.
Also published in: Jour. Applied Physiol., 14 (3): 387-389. May 1959.

An experiment was conducted for the purpose of learning (a) whether performance decrement in monitoring and controlling a complex visual display (pursuit test) is related to body heat loss, and (b) whether such an impairment can be forestalled by glycine administration. Following extensive training on the experimental task, 72 subjects were independently and randomly assigned to the nine combinations of three ambient temperature conditions (70°, 55°, and 40° F.) and three glycine treatments (0, 20, and 40 g.), then required to execute a performance sequence lasting three hours and twenty minutes. Statistical analyses established that the mathematical function relating performance to temperature was a parabola having a maximum near 55°. No significant glycine effects were observed. (Author's abstract)

10844
Pedoya, C., 1958
and P. Gennesseaux
[CURRENT VIEW OF THE NUTRITION PROBLEM IN A VERY COLD CLIMATE] L'aspect actuel du problème alimentaire en climat très froid.—Annales de la nutrition et de l'alimentation (Paris), 12 (5): 61-96. 1958. In French.

Nutritional data are presented based on observations of four members of the Dumont Expedition to Greenland (August 1956-July 1957) living on a glacial plateau at temperatures between -10° and -54° C. Use of protective clothing and equipment led to a reduction of the advocated 5,000-Calorie diet to one containing 3,500-3,800 Calories. The following average dietary composition for cold climates is recommended: 125 g. of fats (32% of the calories), 100 g. of proteins (11%), and 500 g. of carbohydrates (57%), totaling 3,500 calories. During periods of high energy expenditure the fats should be increased to 170-200 g.; the greater part of the fats should be consumed in the evening meal in a heated shelter. During excursions into very cold regions pemmican fortified with carbohydrate appears to be the best diet. Generally, about 180 g. of lipids (41% of the calories), 100 g. of proteins (10%), and 480 g. of carbohydrates (49%), or a total of 3,900 calories are recommended. Vitamin supplements are essential. Alcohol is not a true thermogenic nutriment, but may be provided in a quantity of 100 cubic cm. per day to subjects who are habitually used to drinking wine under normal conditions.

10845
Pepler, R. D. 1959
EXTREME WARMTH AND SENSORIMOTOR COORDINATION.—Jour. Applied Physiol., 14 (3): 383-386. May 1959.

Six subjects were exposed for 30 minutes on three occasions at 48-hour intervals to a very warm humid climate with a wet bulb temperature of 105° F. (41° C.). During the second and third exposures the subjects worked continuously to keep a pointer aligned with a target mark, as it moved erratically from side to side. Accuracy of alignment was normal at first, but deteriorated rapidly and progressively. Movement of the pointer was greater than usual right from the start and changed little thereafter. Rectal temperature rose steadily during the exposures. Failures to correct progressively greater misalignments of the pointer were thought to indicate a growing inattentiveness to the task and a general deterioration in the organization of performance. (Author's summary)

10846
Pepler, R. D. 1958
WARMTH AND PERFORMANCE: AN INVESTIGATION IN THE TROPICS.—Ergonomics (London), 2 (1): 63-88. Nov. 1958.

An account is given of an experimental investigation at Singapore into the effect of unusual levels of environmental warmth on the performance of skilled tasks by young European men living in the Tropics. Three experiments on manual tracking, one on prolonged visual watch-keeping, and one on high-speed decision making are reported. Broadly speaking, the main findings of previous experiments on artificially heat-acclimatized men were confirmed. Performance first deteriorated somewhere between about 81° and 86° F. on the effective temperature scale, although there was some evidence that the critical region was lower for warm-humid climates than for warm-dry ones. The men at Singapore appeared to be rather more disturbed by unusually cool climates than artificially heat-acclimatized men in England. (Author's abstract)

10847
Perlitsh, M. J., 1961
A. G. Nielsen, and W. R. Stanmeyer
ASCORBIC ACID PLASMA LEVELS AND GINGIVAL HEALTH IN PERSONNEL WINTERING OVER IN ANTARCTICA.—Jour. Dental Res., 40 (4): 789-799. July-Aug. 1961.

In 13 outdoor workers and 13 indoor workers in Antarctica there appeared a significant difference in ascorbic acid plasma levels over an 11-month period. The outdoor group showed a lower level which declined continuously over the months. The gingival tissue health, which was determined by observation of the relative degree of inflammation, did not appear significantly different between the two groups. It is suggested that the lack of correlation between the gingival tissue health and the ascorbic acid plasma level can be explained by faulty technique, or that these factors are not directly related or that no correlation exists at these ascorbic acid plasma levels.

10848
Petrovykh, V. A., 1959
M. N. Kuznetsov, P. P. Lobzin, G. A. Ter-Arutiunov, and IU. F. Udalov
[NUTRITION OF FLIGHT PERSONNEL UNDER THE CONDITIONS OF A HOT CLIMATE] O pitanii letnogo sostava v usloviiakh zharkogo klimata.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 68-70. April 1959. In Russian.

English translation in: Military Medical Journal, 1959 (4): 113-116. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

The nutrition of flight personnel in the southern regions was studied during the years 1955-1956 to work out recommendations for substitute foods during summer and to determine the amount of vitamins needed. The physical conditions and dynamics of body weight during the year were studied; food residues and indices of metabolism of vitamins C, B_1, and B_2 were determined. The quantitative and qualitative aspects of the food rations were investigated by questionnaires. It was found that food residues amounted to 612-702 kilocalories in the presence of a stable body weight. On this basis the following food substitutions were recommended: 30 g. grain by 150 g. fresh vegetable, 20 g. meat by 60 g. curds or 300 g. milk. The effects of the altered diet plus the addition of kvass for drinking on intestinal gas formation in relation to decompression sickness were investigated in 11 fliers in a pressure chamber. No incident of decompression sickness was encountered on ascents to 5,000 and 12,000 m. altitude. It is suggested that the altered rations may be used for pre-flight nutrition in hot climates. Supplementary daily vitaminization required 100 mg. vitamin C and no less than 2 mg. of vitamins B_1 and B_2 per person because of increased requirements for these vitamins at high atmospheric temperatures.

10849
Pichotka, J. 1958
[COMFORT TEMPERATURES AND MINIMAL METABOLISM IN GUINEA PIGS] Behaglichkeitstemperaturen und Minimalumsätze bei Meerschweinchen [Abstract].—Pflügers Archiv für die gesamte Physiologie (Berlin), 268 (1): 9-10. Oct. 15, 1958. In German.

An attempt was made to establish the most comfortable environmental temperature for guinea pigs by determination of the temperature at which metabolism was the lowest. The minimal metabolic rate was observed at a temperature of 29-32° C. When the animals were provided a choice of environmental temperature, they chose a lower temperature which resulted in a rectal temperature of 39.2-39.3° C. The minimal metabolism at higher temperatures was approximately 20% below the basal metabolism at the preferred temperature.

10850
Platner, W. S. 1960
ELECTROLYTES IN ACCLIMATION TO COLD. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 130-131. Dec. 1960 (Part II).

The changes in the electrolyte content of tissues and serum of animals exposed to cold is discussed in terms of the effect of hormones upon the electrolyte balance. The independent variations of concentrations of ions under differing conditions of stress would indicate different mechanism of control. Work by the author has shown that the magnesium content of serum and heart and muscle tissue increased 37% in rats exposed to 4.5° C. for 40 days. (Author's abstract)

10851
Poe, R. H., 1961
E. T. Davidson, and G. Brieger
THE PHYSIOLOGICAL RESPONSES OF MEN WEARING CHEMICALLY IMPREGNATED PROTECTIVE CLOTHING IN A HOT DRY CLIMATE. — Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001). Report no. 507, Sept. 9, 1961. ii+8 p.

The rectal temperature, pulse rate, sweat output, and dermatological status of two groups of subjects, one wearing a protective uniform of Hycar Absorbent Protective Underwear and XXCC3 Impregnated Fatigues and the other standard long underwear and fatigue uniform were contrasted while the subjects engaged in various types of physical activity in a hot dry climate. There was no difference between the groups. (Authors' summary)

10852
Potter, V. R. 1958
POSSIBLE BIOCHEMICAL MECHANISMS UNDERLYING ADAPTATION TO COLD.—Federation Proceedings, 17 (4): 1060-1063. Dec. 1958.

The stress responses of unadapted individuals, consisting of activation or blockade of existing enzyme systems are distinguished from the responses of adapted individuals, which involve the preparation of a revised enzyme pattern utilizing alternative metabolic pathways. Several examples of changes in intermediary metabolism indicative of a hormone-induced revised enzyme pattern are briefly discussed

10853
Provins, K. A., 1960
and R. Morton
TACTILE DISCRIMINATION AND SKIN TEMPERATURE.—Jour. Applied Physiol., 15 (1): 155-160. Jan. 1960.

The index fingers of ten subjects were immersed in water at 0.75° C. for 40 minutes. Two-edge threshold discrimination was tested during cooling of the finger and subsequent spontaneous rewarming due to cold vasodilation. There was a marked deterioration of tactile discrimination at finger skin temperatures below about 8° C., although the curve showing the mean decrease of numbness with increasing skin temperature was displaced relative to the curve showing the mean increase of numbness with decreasing skin temperature. Tactile discrimination was also tested on five subjects at each of six water bath temperatures (2°, 4°, 6°, 8°, 15°, and 30° C.). At each temperature the finger was immersed for 20 minutes and the finger circulation arrested after the first 5 minutes. There was little impairment of two-edge discrimination after 15-20 minutes immersion of the finger at temperatures of 6° C. or higher. At 4° C. there was marked impairment, and at 2° C. all subjects experienced complete numbness at the test site. It is suggested that the possibly differential effect of cold on sensory nerve endings in the human skin may permit impulse conduction until the block is almost complete, at which point the sudden impairment of tactile

discrimination noted is precipitated. (Authors' abstract, modified)

10854
Provins, K. A., 1960
and R. S. J. Clarke
WORK IN COLD ENVIRONMENTS: THE EFFECT OF COLD ON MANUAL PERFORMANCE.—Jour. Occupational Med., 2 (4): 169-176. April 1960.

A review is presented of experimental studies of the effects of cold on reaction time, tracking proficiency, general dexterity, tactile discrimination, and muscle strength. Questions of correlation between performance on different tests of motor ability, of individual differences in susceptibility to impairment, and of the design of equipment for use in cold are briefly discussed.

10855
Putilin, M. I., 1959
and L. M. Staritska
[EFFECT OF HIGH TEMPERATURE ON THE SECRETORY FUNCTION OF THE STOMACH AND PANCREAS] Vplyv vysokoi temperatury na sekretornu funktsiiu shlunka i pidshlunkovoi zalozy.—Fiziologichnyi zhurnal (Kyiv), 5 (3): 315-321. May-June 1959. In Ukrainian, with English summary (p. 321).

The effect of high environmental temperature on the gastric and pancreatic secretory activity was investigated in relation to feeding times and the length of exposure to heat. It was established that high environmental temperature (45° C.) results in a considerably increased latency period, decreased secretion of digestive juices during the reflex phase, a lengthened secretory period, and decreased overall secretion of digestive juice. The digestive activity and acidity of the gastric juice deviated slightly from the normal. The enzymatic activity of the pancreatic juice did not differ from the normal. A different secretion curve was obtained in animals on a bread-and-meat diet during the experiment. In general, the extent to which a high environmental temperature affects gastric and pancreatic secretion depends on the length of stay in such environmentand the interval of time between feeding and the exposure to heat. Feeding immediately before or after exposure to heat resulted in more pronounced changes in the secretory activity.

10856
R-Candela, J. L. 1960
GLUCOSE-UPTAKE AND INSULIN SENSITIVITY OF THE EPIDIDYMAL FAT OF THE RAT AFTER EXPOSURE TO COLD. — Medicina experimentalis (Basel), 3 (1): 84-87. 1960. In English.

Rats exposed to cold (4° C.) for 1-12 days showed a reduced consumption of glucose in the epididymal fat after 1, 3, and 12 days, and an increased consumption after 6 days. The insulin sensitivity of the fat decreased after 1 and 3 days, increased considerably after 6 days, and returned to normal after 12 days. The results suggest the presence of hypophyseal-adrenal responses and inhibitions, which may in turn explain the hypoglycemia previously observed in rats exposed to cold.

10857
Rangneker, P. V., 1958
and L. P. Dugal
A NOTE ON THE EFFECT OF COLD AND VITAMIN C ON THE BLOOD LEVELS OF PHENYLALANINE AND TYROSINE IN RATS.—Canad. Jour. Biochem. and Physiol., 36 (1): 185-186. Jan. 1958.

Rats maintained for 72 hours at a temperature of 0-2° C. showed complete disappearance of plasma phenylalanine and urinary tyrosine and phenylalanine. Plasma tyrosine was present in traces, but was not found after intraperitoneal injection of ascorbic acid for 2 weeks prior to exposure to cold. Tyrosine was also absent from the plasma and urine of rats injected intraperitoneally with 1-tyrosine for 17 days and exposed to cold. Guinea pigs exposed to cold showed a similar absence of phenylalanine and tyrosine from the plasma. It is suggested that the metabolism of phenylalanine and tyrosine is facilitated in a cold environment.

10858
Rawson, R. O., 1961
and W. C. Randall
VASCULAR AND SWEATING RESPONSES TO REGIONAL HEATING OF THE BODY SURFACE. — Jour. Applied Physiol., 16 (6): 1006-1010. Nov. 1961.

Cutaneous, rectal, and tympanic membrane temperatures were recorded along with sudomotor and vasomotor responses in subjects exposed simultaneously to environmental temperatures of 25° and 60° C. Heat stress to the lower half of the body was accompanied by marked differential vasomotor responses and a pronounced caudal-to-rostral recruitment of sweating in spite of an unchanging or declining tympanic membrane temperature. Heating the upper half resulted in essentially the same vasomotor and sudomotor responses but with significant alteration in the time course and intensity of the sweat recruitment pattern. With sudden lowering of the ambient temperature, sweating on all areas disappeared while internal temperatures remained unchanged. It is clearly demonstrated that under the given experimental conditions both cutaneous and internal thermoreceptors play a significant role in human temperature regulation and that the hypothalamus is not the sole moderator of internal temperature control. (Authors' abstract, modified)

10859
Rennie, D. W., 1958
and T. Adams
THE METABOLIC AND BODY TEMPERATURE RESPONSE OF MEN EXPOSED TO AN ACUTE COLD STRESS BEFORE AND FOLLOWING AN ARCTIC BIVOUAC.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical report no. 57-37, July 1958. 27 p.

The metabolism and body temperatures of six subjects were recorded during a standardized cold test before and following a 24-day arctic winter bivouac in order to determine if any changes took place which might be ascribed to living in a cold environment. The body heat debt, total body heat loss, tissue and environmental insulation and vascular reactivity of certain skin areas were estimated from these data. Basal metabolism and thyroid function using iodine-131 uptake were also measured in each subject before and after the bivouac. No significant differences in basal metabolism, iodine-131 uptake, or overall thermal balance were recorded, but there was a significantly higher skin temperature in the extremities. The warmer extremity temperatures are interpreted to mean relatively reduced vascular constriction in

response to cold stress among acclimatized subjects, and this local acclimatization was the only detectible effect of field exposure. (From the authors' summary and conclusions) (36 references)

10860
Reynafarje, B., 1959
and R. R. Chaffee
PYRIDINE NUCLEOTIDE: CYTOCHROME C REDUCTASES IN ACCLIMATIZATION TO COLD.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-7, Dec. 1959. 2 p.

Liver mitochondria and microsomes were extracted from hamsters kept at 5±3° C. for 70 days. The enzymatic activity of reduced diphosphopyridine nucleotide- and reduced triphosphopyridine nucleotide-cytochrome C reductases were not significantly changed in the mitochondria from cold-exposed hamsters as compared with the controls. The activity of the enzymes of the microsomal fraction was noticeably higher in the group of cold-exposed animals. The data presented show an increment in the activity of reduced triphosphopyridine nucleotide-cytochrome C reductase of about 77% over the controls. The increased activity of the reductase enzymes only in the microsomes, not in the mitochondria, may signify that no oxygen is utilized in the process of cold acclimatization.

10861
Robinson, S. 1959
ACCLIMATIZATION OF MEN TO HOT ENVIRONMENTS.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 9-18. 1959.

Man's physiological acclimatization to hot environments is reviewed. With repeated exposures, physically fit men adapt in four to eight days. The acclimatization is characterized by (1) a gradual improvement in the efficiency of evaporative cooling and in the sensitivity and capacity of the sweating mechanisms; (2) rapid compensatory adjustments in the renal output of water and electrolytes; (3) an increase of circulating blood volume during exposure, accompanied by marked improvement in circulatory stability with reduced heart rate; and (4) a gradual improvement in temperature regulation so that by the eighth day of exposure, if the heat is not too intense, men may perform work in heat with increased gradients between rectal and skin temperature, and with no greater elevations of core temperature and metabolism than when they perform the same task in a cool environment.

10862
Rodahl, K. 1960
WORK IN COLD ENVIRONMENTS: NUTRITIONAL FACTORS IN COLD ACCLIMATIZATION.—Jour. Occupational Med., 2 (4): 177-182. April 1960.

Observations of the mechanism of adaptation to cold environments in man are discussed in relation to experimental studies in animals of acclimatization to cold. It is suggested that the acclimatization of the Eskimo to cold is based chiefly on behavioral factors (clothing, activity level, shelter) rather than on the extreme physiological changes (increased metabolism, thyroid activity, food intake) observed in rats exposed without protection to temperatures of 5° C. From consideration of studies of the nutritional habits and requirements of Eskimos and Europeans living in cold environments it is concluded that neither an increase nor a component change in nutritional requirements occurs in men living in cold environments.

10863
Sadykov, A. S. 1958
[THE REGULATION OF SOME PHASES OF WATER-SALT METABOLISM AT HIGH ENVIRONMENTAL TEMPERATURE AND DURING THE WORK OF SKELETAL MUSCLES AT DIFFERENT CONDITIONS OF THEIR MOISTURE CONTENT] O reguliatsii nekototrykh storon vodno-solevogo obmena v usloviiakh vysokoi vneshnei temperatury i rabote skeletnykh myshts pri razlichnom soderzhanii v nikh vlagi.—In: Materialy konferentsii fiziologov, biokhimikov i farmakalogov Srednei Azii i Kazakhstana, 1 (Tashkent, 1957), p. 204-206. Tashkent: Akademiia Nauk Uzbekskoi SSR. 1958. In Russian.

Water-salt metabolism is regulated by the cerebral cortex. Work efficiency of the organism is highest at optimum body moisture content. As the organism becomes gradually dehydrated, its work efficiency progressively abates. Intake of tea, especially green tea was found to be an effective means for the normalization of any type of physical labor under conditions of high temperature. The supplemental administration of ephedrine, especially per os, enhanced the favorable effect of green tea.

10864
Saito, H., 961
and F. Matsuoka
INFLUENCE OF HEAT OR COLD UPON GASTRIC SECRETION AND EVACUATION. —Jour. Sci. and Labour (Tokyo), 37 (6): 268-276. June 1961. In Japanese, with English summary (p. 268).

Heat exposure (35°-40° C.) of humans tends to reduce gastric juice acidity and accelerate gastric evacuation. On the other hand, cold exposure (−15° to −35° C.) causes hyperacidity and a retardation of gastric evacuation. Variation in gastric acidity was closely related to variation of the urinary chloride/sodium ratio. (From the authors' summary)

10865
Salamone, L., 1961
and A. Rizzo
[CHANGES IN SOME RESPIRATORY FUNCTIONAL INDICES CAUSED BY EXPOSURE TO ENVIRONMENTAL HEAT STRESS] Variazioni di alcuni indici della funzionalità respiratoria da esposizione a stress ipertermico ambientale. — Bollettino della Società italiana di biologia sperimentale (Napoli), 37 (23): 1185-1187. Dec. 15, 1961. In Italian.

Blood studies of ten normal subjects, between 18 and 34 years of age, exposed to a heat stress of 45° C. for 12 hours showed a slight increase (3-5%) in the hemoglobin level of arterial or venous blood. Hemoglobin oxygen saturation in arterial blood also increased (1-3%), as did blood oximetric values. Arterial or venous blood oxygen volume varied in proportion with saturation. Regarding pulmonary values there was found a slight increase in pulmonary capacity, an increase in pulmonary ventilation, no significant change in the respiratory mechanism, and an increase in oxygen consumption and carbon dioxide elimination. Hyperthermic stress also produced an increase in cardiac minute volume.

10866
Sargent, F., 1958
R. E. Johnson, E. M. Robbins, and L. M. Sawyer
THE KETOGENIC EFFECT OF EXPOSURE TO COLD AND THE ANTIKETOGENIC EFFECT OF DEHYDRATION [Abstract].—Jour. Lab. and Clinical Med., 52 (6): 943. Dec. 1958.

Urinary excretion of total ketone bodies was measured before, during, and after 10-14 day field tests in summer and winter in which subjects were fed a ketogenic diet (starvation, high-fat, and low-carbohydrate) or a nonketogenic diet (pure carbohydrate and balanced regimen). The rate of ketone-body excretion (ketonuria) was found to be equal in resting and 24-hour specimens during summer, but was greater at rest during winter. In both seasons, ketonuria was greater during cold periods in subjects on nonketogenic diets. With a constant ketogenic-ketolytic ratio, the ketogenicity of ketogenic diets was greater in winter, in men given unlimited water, in men doing light work rather than hard work, and at 1000 calories rather than 2000 calories per day. The onset of ketosis was delayed in summer, especially when water intake was limited. It is suggested that ketonuria may serve as a useful measure of the metabolic effects of cold.

10867
Sayen, A., 1961
and C. Boland
CHANGES IN BLOOD FLOW AND TEMPERATURE OF MUSCLE IN THE CHILLED LIMB OF THE RABBIT. — Clinical Sci. (London), 20 (2): 217-221. April 1961.

Venous occlusion plethysmography with the mercury strain gauge technique demonstrated that immersion of a limb in cold water at 2° C. results in a decrease in blood flow to the chilled muscle. Transient rises in temperature of chilled muscle are associated with motion of the limb and are accompanied by an increase in limb blood flow, probably occurring predominantly in muscle. (Authors' summary)

10868
Schapiro, S., 1958
J. Marmorston, and H. Sobel
MOBILIZATION OF THE ANTIDIURETIC HORMONE AND THE SECRETION OF ACTH FOLLOWING COLD STRESS.—Endocrinol., 62 (3): 278-282. March 1958.

Guinea pigs exposed to a temperature of 0° C. for 6 hours showed an approximately 3-fold increase in the excretion of corticoids. Hydration or dehydration before cold exposure had no effect on the corticoid response, despite a marked decrease in the antidiuretic activity of the hypothalamus and posterior pituitary following dehydration. It is concluded that the pituitary-adrenal response to stress is not dependent on the mobilization of anti-diuretic hormone.

10869
Schönbaum, E. 1960
ADRENOCORTICAL FUNCTION IN RATS EXPOSED TO LOW ENVIRONMENTAL TEMPERATURES. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 85-88. Dec. 1960 (Part II).

Measurements of corticosteroid formation in vitro can be used for the assessment of adrenocortical function in rats subjected to a variety of treatments. Acute exposure to cold causes a transient rise in adrenocortical activity during the first 30 minutes of exposure. If rats are kept in a cold environment for several weeks, an increased activity of the adrenal cortex is first observed but later the adrenocortical activity becomes somewhat reduced. (Author's abstract)

10870
Schönbaum, E., 1959
W. G. B. Casselman, and R. E. Large
STUDIES ON THE TIME COURSE OF THE RESPONSE OF THE ADRENAL CORTEX TO HISTAMINE AND COLD.—Canad. Jour. Biochem. and Physiol. (Ottawa), 37 (3): 399-404. March 1959.

Rats were injected with histamine or exposed to -20° C. for as long as three hours. In both cases there was a transient elevation in the output of corticosteroids by the excised adrenal glands in vitro but a prolonged fall in adrenal ascorbic acid. The return of steroid formation to pre-exposure or even lower rates within three hours was not accompanied by any further change in the concentration of adrenal ascorbic acid. (Authors' abstract, modified)

10871
Scholander, P. F., 1958
H. T. Hammel, J. S. Hart, D. H. LeMessurier, and J. Steen
COLD ADAPTATION IN AUSTRALIAN ABORIGINES. —Jour. Applied Physiol., 13 (2): 211-218. Sept. 1958.

A field study was made of cold adaptation as demonstrated by the ability to rest and sleep at night in members of a desert tribe of Australian aborigines. Oxygen consumption and rectal and skin temperatures were measured throughout the night in natives and whites resting naked on the ground between campfires (native-fashion) or in a sleeping bag shielded by windbreaks providing a known moderate cold stress. Night air temperatures generally fell to 0-5° C. in both cases. Sleeping between campfires allowed both natives and whites to remain in heat balance and to rest under basal conditions. In sleeping-bag tests, whites were unable to rest, and showed a marked shivering associated with an elevation of metabolism, while natives slept soundly with normal resting heat production. Rectal and peripheral skin temperatures fell to similar levels in both races. It is concluded that the aborigines overcome the stress of their cold environment partly through a technological adaptation (campfires) and partly by increased physiological (and perhaps psychological) tolerance to cold.

10872
Scholander, P. F., 1958
H. T. Hammel, K. L. Andersen, and Y. Løyning
METABOLIC ACCLIMATION TO COLD IN MAN.—Jour. Applied Physiol., 12 (1): 1-8. Jan. 1958.

Studies of metabolic acclimation to cold were made in 8 men living under field conditions in the Norwegian mountains. At night the men slept naked in a single-blanket sleeping bag at temperatures of approximately 3-5° C. Comparison of metabolic data obtained at night with those from unacclimated subjects resting under similar conditions revealed a

lesser drop in skin temperature and a slightly higher basal metabolic rate in acclimated subjects. Acclimated subjects were able to sleep comfortably, while unacclimated subjects were kept awake by their cold periphery. Shivering was observed in both groups. Oxygen consumption while exercising naked at 5° was similar in acclimated and unacclimated men, indicating that acclimation did not result in increased insulation by shell cooling. It is concluded that man is capable of developing a metabolic response to cold exposure similar to that observed in other homeotherms.

10873
Scholander, P. F. 1958
STUDIES ON MAN EXPOSED TO COLD.—Federation Proceedings, 17 (4): 1054-1057. Dec. 1958.

Two studies of the physiological response to cold in man are described. Eight subjects were subjected to a cooling stress produced by resting naked in a sleeping bag at an environmental temperature of 0-5° C. every night during exposure for 6 weeks to a natural cold environment. During the first nights of exposure, chilling was severe enough to prevent satisfactory sleep, but with continued exposure subjects were able to sleep through the night, even during periods of shivering. Observations of Australian aborigines under similar conditions revealed that the natives were able to sleep through the night, usually with a sub-basal metabolic rate, and with greater surface cooling than that found in unacclimatized whites. It is concluded that both insensitivity to body cooling and metabolic acclimation have been demonstrated as methods of acclimation to cold in man.

10874
Scott, J. B., 1960
R. A. Hardin, and F. J. Haddy
THE EFFECT OF LOCAL COOLING UPON SMALL AND LARGE VESSEL PRESSURES AND RESISTANCE IN THE DOG FORELIMB.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001). Report no. 430, July 21, 1960. ii+12 p.

Reduction of the temperature of brachial arterial blood to 13° C. increased blood viscosity more than total resistance to flow through the dog foreleg. The resistance increase predominated in either precapillary or postcapillary vessels. Small venous pressure rose or fell. These findings suggest that the local action of cold on precapillary vessels is dilatation and local cooling may decrease or increase filtration pressure. (Authors' abstract)

10875
Sellers, E. A. 1960
WORK IN COLD ENVIRONMENTS: COLD AND ITS INFLUENCE ON THE WORKER.—Jour. Occupational Med., 2 (3): 115-117. March 1960.

The discrepancies observed in the application to man of experimental results obtained with animals in laboratory studies regarding the physiological effects of cold are discussed. The importance of sociological factors such as work requirements, clothing, and nutritional habits on the process of adpatation to cold is stressed.

10876
Senay, L. C., 1961
M. L. Christensen, and A. B. Hertzman
CUTANEOUS BLOOD FLOWS IN CALF, FOREARM, CHEEK AND EAR DURING CHANGING AMBIENT TEMPERATURE.—St. Louis Univ., Mo. (Contract AF 33(616)-7077); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADD Technical Report no. 61-190, March 1961. iii+16 p.

When seminude subjects were exposed to heat, the onset of cutaneous vasodilatation occurred simultaneously in the calf, forearm, cheek, and ear. Progress of vasodilatation in the calf and toe often differed from that in the forearm, cheek and ear. Vasodilatation in the calf was either small or stabilized early while the forearm vessels continued to dilate markedly. One subject, a "poor" sweater with unusually high skin temperatures, repeatedly presented an exception in that vasodilatation in the calf exceeded that in the forearm. The usual failure of skin temperature to rise as much in the calf as in the forearm appeared to be related to the lesser cutaneous vasodilatation. There was no evidence that local sweating elicited local vasodilatation. (Authors' abstract)

10877
Senay, L. C., 1960
M. L. Christensen, and A. B. Hertzman
FINGER AND FOREARM CUTANEOUS BLOOD FLOWS DURING CHANGING AMBIENT TEMPERATURE.—St. Louis Univ. School of Medicine, Missouri (Contract AF 33(616)-3357); issued by Wright Air Development Division. Aerospace Medicial Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7154, Task no. 71830). WADD Technical Report no. 60-15, March 1960. iii+46 p.
Essentially the same: CUTANEOUS VASCULAR RESPONSES IN FINGER AND FOREARM DURING RISING AMBIENT TEMPERATURES.—Jour. Applied Physiol., 15 (4): 611-618. July 1960.

When nude subjects were exposed to a slowly rising ambient temperature, digital vasodilatation preceded that in the forearm skin in the summer but the two proceeded together in the spring. The forearm vasodilatation followed a consistent course in both seasonal groups. The curvilinear relation of local skin temperature to local skin blood flow in the forearm often showed an abrupt inflection, suggesting an additional influencing factor. A consistent relation to local sweating was not apparent: vasodilatation often increased even while local skin temperature had stabilized or fallen slightly. The forearm vascular responses were prevented by local cooling. During repeat cycles of the ambient temperature, complete dissociation of the cutaneous vascular responses in finger and forearm and of forearm vasodilatation and sweating often occurred. Local temperature seemed the most important control factor of the forearm skin circulation. Mecholyl did not augment the maximum vasodilatation in forearm skin. (Authors' abstract)

10878
Sergeev, E. P. 1959
[ACCLIMATIZATION TO HEAT UNDER CONDITIONS OF A SEA VOYAGE IN THE SUBTROPICS] Akklimatizatsiia k teplu v usloviiakh morskogo pokhoda v subtropiki.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 63-64. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 104-107. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available

from Office of Technical Services, U. S. Dept. Commerce)

Acclimatization to heat during a sea voyage in the subtropics is achieved quickly and also disappears quickly after a change in the meteorological conditions. Definite signs of acclimatization to heat appear 10-14 days after arriving in the Subtropics. After acclimatization the subjective feeling of comfortable level changes from 19-20° equivalent temperature (derived from air temperature, relative humidity, and air movement) in the temperate latitudes to 21-23° equivalent temperature in the subtropics.

10879
Shields, J. L., 1960
W. S. Platner, and R. E. Neubeiser
ELECTROPHORESIS OF SERUM PROTEINS AND BODY FLUID VOLUMES DURING COLD ACCLIMATION. — Amer. Jour. Physiol., 199 (5): 942-944. Nov. 1960.

A study was made of electrophoretic changes in serum and soluble muscle protein and of changes in the body fluids of rats during exposure for 10 to 40 days to an ambient temperature of 4° C. Exposure to cold produced a marked decline in the albumin fraction of serum protein after 20 days, increases in alpha-1 and beta fractions as percentages of total serum protein, an increase in the alpha-2 fraction of globulin and protein, and a decrease in the gamma globulin fraction of protein at 20 and 40 days. Hematocrit was unchanged, while plasma volume was increased. Thiocyanate space was increased at 10 and 20 days but approached control values at 40 days. Muscle water was essentially unchanged despite suggestive changes in the electrophoretic patterns of soluble muscle proteins. It is suggested that the changes in plasma volume and osmotically active proteins observed during cold exposure are not complementary and yield a physiological imbalance.

10880
Sidorov, L. M. 1961
[THE EFFECT OF HIGH ENVIRONMENTAL TEMPERATURE ON SIMULTANEOUS COMPLEX CONDITIONED REFLEXES IN DOGS] Vliianie vysokoi temperatury okruzhaiushchei sredy na odnovremennye kompleksnye uslovnye refleksy u sobak. — Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 11 (4): 697-702. 1961. In Russian, with English summary (p. 702).

A study was made of the influence of temperature between 40° and 45° C. on the relationship of components in a complex conditioned reflex elaborated to simultaneous multiple conditional stimuli. The experiments were performed with four dogs in a thermal chamber by the defensive conditioned motor reflex method. During isolated tests of complex stimulus components at a temperature of 18-20° C., the weak components of the complex produced a considerably lesser reflex than the entire complex or its strong component. At a temperature of 40-45° C., inhibition of the effect from the weak component was reduced or even completely eliminated. A diminution of the negative induction between the excited centers was observed at high temperature. (Author's summary, modified)

10881
Simonović, I., 1958
B. Šlat, and K. Kostial
REGENERATION OF HEMOGLOBIN IN RATS EXPOSED TO LOW AMBIENT TEMPERATURE.— Amer. Jour. Physiol., 192 (3): 557-559. March 1958.

Rats exposed to a temperature of 5° C. for 20 days showed slight decreases in blood hemoglobin concentration on the 2nd and 5th days, and a return to normal thereafter. The rate of hemoglobin regeneration after withdrawal of 30% of the total blood volume was the same in rats maintained at room temperature or exposed to cold.

10882
Smirnov, K. M. 1958
and E. L. Skliarchik
SALIVATION IN MAN IN VARIOUS STAGES OF ACCLIMATIZATION TO A HOT CLIMATE.—Sechenov Physiol. Jour. USSR (New York: Pergamon Press), 43 (5/6): 365-368. [1958].
English translation of item no. 7458, vol. VI.

10883
Sohar, E., 1961
R. Adar, T. Gilat, J. Tennenbaum, and M. Nir
[REDUCTION OF VOLUNTARY DEHYDRATION DURING EFFORT IN HOT ENVIRONMENTS] Emtsa'im le-haktanat ha-tseḥiḥut ha-retsonit bi-tena'e ma'amats ve-ḥom. — Harefuah (Jerusalem-Tel Aviv), 60 (10): 319-322. May 15, 1961. In Hebrew, with English summary (p. 322-323).

During an experimental march a positive daily fluid balance was maintained by drinking cold beverages (15-20° C.) during and between meals, at all hours of the day. The type of beverage favored by men under effort in a hot environment was a cold, sweetened, fruit-flavored drink. Gaseous drinks, beer, and milk were not suitable for drinking in large amounts. Voluntary dehydration was also reduced during effort by spacing rest periods of 15-20 minutes following a continuous march of 90-120 minutes. This provided more time for drinking.

10884
Sohar, E., 1961
R. Adar, J. Tennenbaum, and M. Kesten
[INTAKE AND URINARY EXCRETION OF SODIUM CHLORIDE UNDER VARYING CONDITIONS OF EFFORT AND ENVIRONMENTAL HEAT] Tserikhat meah-bishul ve-hafrashato bi-tena'e ma'amats ve-ḥom mishtanim. — Harefuah (Jerusalem-Tel Aviv), 60 (10): 326-332. May 15, 1961. In Hebrew, with English summary (p. 332).

No clinical or laboratory signs of salt depletion were observed in men during an experimental march in August in Israel, even though the men perspired at the rate of 5.5-10.3 liters per 24 hours. The average ad libitum intake of sodium was 6.0 grams daily and the average urinary sodium excretion was 4 grams. The difference between intake and urinary excretion is accounted for by loss of sodium in the sweat and by changes in the volume of extracellular fluid caused by fluctuations of the environmental heat load. On the average, 82.9% of the total sodium intake was derived from food, 12.4% from water and other beverages, and only 4.7% from the salt added as condiment to food. Thirty-five workmen engaged in hard physical labor in August and eating average diets excreted an average of 3.19 grams sodium

in 24 hours. Nine men in ship engine rooms at sea also ate average diets while doing less strenuous work and exposed to extreme external heat loads. Average urinary excretion of sodium was 2.35 grams per day. Ten natives of a village with comfortable weather involved in light to moderate work had an average sodium intake as low as 0.8 gram per day. Half of this, on the average, was excreted in the urine each day. (Authors' summary, modified)

10885
Sohar, E., 1961
R. Adar, and A. Hershco
[VOLUNTARY SODIUM INTAKE DURING EFFORT IN HOT ENVIRONMENTS] Tserikhat natran retsonit bi-tena'e ma'amats ve-hom. —— Harefuah (Jerusalem-Tel Aviv), 60 (10): 334-337. May 15, 1961. In Hebrew, with English summary (p. 337).

The amount of salt added by 10 young men as condiment was measured during an experimental march. The voluntary salt intake contributed an average of 4.7% of the total daily sodium intake in an ordinary Western-type diet. No correlation was found between voluntary sodium intake and total sodium intake, urinary sodium excretion, or environmental heat load. Voluntary salt intake was determined mainly by personal food habits and not equated with salt requirement.

10886
Soliman, F. A., 1958
H. M. Badawi, and Y. S. Ghanem
INFLUENCE OF TEMPERATURE AND LIGHT ON THYROID FUNCTION.—Nature (London), 182 (4627): 57. July 5, 1958.

Measurements were made of thyroid weight, epithelial cell height, and serum levels of thyroid and thyrotropic hormone in rats exposed to temperatures of 18° or 35° C. for 12 days in constant light or darkness. Serum thyroid and thyrotropic hormone levels were determined by measurement of the increase in hind-limb length and thyroid epithelial cell height in tadpoles injected with serum from the experimental animals. Thyroid weight was found to be greater at 18° in rats maintained in darkness, and at 35° in rats maintained in light. Rats exposed to a temperature of 18° had more active thyroids and higher epithelia than animals maintained at 35°. The rates of metamorphosis and epithelial cell heights were greater in tadpoles injected with serum from animals maintained at 18° in darkness than from animals exposed to light, while the effect was reversed with serum from animals exposed to 35°. It is concluded that there is a significant interaction between the effects of temperature and light on thyroid weight and levels of thyroid and thyrotropic hormones.

10887
Solomko, P. A. 1959
[EXPERIENCES IN ACCLIMATIZATION OF TROOPS TO THE DESERT] Iz praktiki akklimatizatsii voisk v pustyne.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 30-35. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 46-54. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

The incidence of heat trauma of newly arrived unacclimatized troops in a hot desert climate is three or four times that of troops stationed in a hot climate. The incidence of heat trauma is two or three times as great among soldiers in the first year of service than among soldiers in the second year of service. The repeated action of climatic factors in combination with physical stress is needed for effective and durable acclimatization to desert conditions. In practice, newly arrived troops who are undergoing active acclimatization are considered to be capable of working with good combat efficiency after 30 days if they arrive in the autumn; after 40 days if they arrive in the early spring; and in 45-50 days after late spring and summer arrivals in the desert. The acclimatization is subsequently reinforced by exercises and maneuvers in the desert. It is recommended that the comprehensive active acclimatization should be repeated each year in abbreviated form with the advent of hot weather.

10888
South, F. E. 1960
THE EFFECTS OF HOT AND COLD ENVIRONMENTS ON MAMMALS.—Proc. Animal Care Panel, 10 (2): 51-56. June 1960.

Homoiothermy has allowed mammals to cope with extremes of heat and cold in a variety of ways. The responses to such environmental stresses involve the generic physiological processes of acclimation, acclimatization, and adaptation. Recent data and current concepts are presented and discussed to illustrate the mechanisms of these responses among mammals subjected to variations in the thermal environment. (Author's abstract)

10889
Stanmeyer, W. R., 1961
and R. J. Adams
ANTARCTIC STRESS AND THE TEETH. —— Jour. Amer. Dental Assoc., 63 (5): 665-670. Nov. 1961.

Close dental observation for 14 months of 104 men stationed at Little America, Antarctica, showed that initial cariogenic activity continues despite the severe cold. A measurable difference exists between those persons whose normal activity confines them to shelters, 3.8 surfaces of initial decay per man, as compared with those persons exposed to extremely low temperatures 12 to 14 hours per day, who showed 3.4 surfaces of initial decay per man. Recurrent decay around the margins of fillings remained the same in both the inside and outside workers. Tooth splitting, amalgam fracturing or amalgam loss occurred infrequently and then only when rapid changes in oral temperature were accompanied by trauma. (Authors' summary, modified)

10890
Steinberger, E., 1959
and W. J. Dixon
SOME OBSERVATIONS ON THE EFFECT OF HEAT ON THE TESTICULAR GERMINAL EPITHELIUM.—Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 01 02 00.03.03 (Vol. 17, p. 311-328), June 19, 1959.
Also published in: Fertility and Sterility, 10 (6): 578-595. Nov.-Dec. 1959.

A method for determination of intratesticular temperatures during an exposure to heat is described. The response of the general epithelium to temperatures ranging from 41° to 45° C. was inves-

tigated. A 15-minute exposure to a temperature of 45° C. produced a progressive destruction of the entire germinal epithelium. The earliest cytological changes were observed in spermatids. A 15-minute exposure to temperatures below 43° C. produced inconsistent tabular damage in some animals. A 15-minute exposure to 43° C. produced testicular damage in the majority of animals. The damage was characterized by a selective destruction of the spermatocytes. Controversial reports in the literature concerning the type of germinal epithelium damage produced by heat are discussed. It is concluded that heat produces a specific type of germinal epithelium damage which is masked when an excessive amount of heat is applied. (Authors' summary)

10891

Streeten, D. H. P., 1960
J. W. Conn, L. H. Louis, S. S. Fajans, H. S. Seltzer, R. D. Johnson, R. D. Gittler, and A. H. Dube

SECONDARY ALDOSTERONISM: METABOLIC AND ADRENOCORTICAL RESPONSES OF NORMAL MEN TO HIGH ENVIRONMENTAL TEMPERATURES. — Metabolism, 9 (12): 1071-1092. Dec. 1960.

Four male subjects exposed to a high environmental temperature during sodium restriction showed the following changes: (1) a negative Na balance for two days followed, in two cases, by an abrupt decrease in the Na concentration of sweat with little weight loss and no change in hematocrit, or, in two other cases, by large losses of Na and body weight, increased hematocrit, and symptoms of heat exhaustion; (2) a negative potassium balance because of losses in sweat, in spite of a slight reduction in urinary K; (3) an increase for 1-3 days in the urinary excretion of 17-hydroxycorticoids and 17-ketosteroids, followed by a return of 17-hydroxycorticoids to control levels, and depression of 17-ketosteroids; (4) an increase in urinary aldosterone; (5) retention of Na, gain in body weight, and a fall in hematocrit after infusion of isotonic saline; and (6) increases in fasting blood sugar and urinary excretion of uric acid, nitrogen, and creatinine, and a decrease in glucose tolerance. It is suggested that the stimulus to increased output of aldosterone is not mediated by greater production of corticotropin, nor initiated by a reduction in total body water or exchangeable Na, but may result from reduced plasma and/or extracellular fluid volume. The responsiveness of the sweat glands to the sodium-saving effects of aldosterone appears to be a critical factor in man's ability to adapt rapidly to a change from a temperate to a hot environment. (Quoted in part)

10892

Sutherland, G., 1958
L. Trapani, and D. H. Campbell

COLD ADAPTED ANIMALS. II. CHANGES IN THE CIRCULATING PLASMA PROTEINS AND FORMED ELEMENTS OF RABBIT BLOOD UNDER VARIOUS DEGREES OF COLD STRESS.—Jour. Applied Physiol., 12 (3): 367-372. May 1958.

Rabbits exposed to temperatures of 4° or -15° C. for 1-10 weeks showed changes in the electrophoretic distribution of plasma proteins and the formed elements of the blood, increases in platelet and erythrocyte counts, hematocrit, plasma protein concentration, beta-globulins, fibrinogen, and whole blood and plasma clotting times, and decreases in the serum albumin concentration and prothrombin time. Many of the changes were observed early during the period of cold exposure (1 week in clipped animals at 4°). The observations suggest that cold exposure altered the entire dynamic pattern of the animals' physiology.

10893

Takano, E., 1959

EFFECT OF LOW TEMPERATURE UPON THE LIPID METABOLISM. — Med. Jour. Shinshu Univ. (Matsumoto, Japan), 4 (2): 185-202. June 1959. In English.

The lipid metabolism of liver, blood serum, and subcutaneous fatty tissue was investigated in rats exposed for 5-7 days to cold of -20° C. Cold exposure caused a slight decrease in total lipid content and increases in cholesterol content, iodine number of fatty acid, and iodine number of phosphatide fatty acid in all tissues examined. Total fatty acid was decreased in liver and in subcutaneous fatty tissue. Incubation of liver homogenates with caproic, oleic, or linoleic acids produced a decrease in the iodine number of fatty acid and phosphatide; the decrease was smaller in cold-exposed animals. The total lipid, total fatty acid, phosphatide, and total cholesterol content of normal rat livers was similar during summer and winter, but the iodine numbers of fatty acid and phosphatide fatty acid were increased in winter.

10894

Thompson, E. M., 1959
M. G. Staley, M. A. Kight, and M. E. Mayfield

THE EFFECT OF HIGH ENVIRONMENTAL TEMPERATURE ON BASAL METABOLISM AND SERUM ASCORBIC ACID CONCENTRATION OF WOMEN.—Jour. Nutrition, 68 (1): 35-47. May 10, 1959.

The rate of depletion of total ascorbic acid in blood serum of women living in southern Arizona (temperatures varying between 68° and 100° F.) was significantly higher in summer than in winter. However, there appears to be a variability characteristic of the individual which is consistent over both seasons, no interaction appearing between genetic ability to retain ascorbic acid and the environment. Six subjects studied over periods of several weeks in both seasons received a constant but minimum amount of ascorbic acid. Basal metabolism diminished to a significantly lower level in summer in the majority of subjects. Under the condition induced by climatic stress with a diminished rate of energy exchange, ascorbic acid metabolism was altered in some manner due to increased requirement or destruction. Differences among subjects may have been due to age or degree of activity and exposure to the direct sun with increased fatigue. Dermal losses may have been of significance due to the border-line of adequacy in serum ascorbic acid maintained during most of the experimental period. (Authors' summary, modified)

10895

Thron, H. L., 1958
K. D. Scheppokat, A. Heyden, and O. H. Gauer

[THE RELATION OF THE CAPACITY AND RESISTANCE VESSELS OF THE HUMAN HAND UNDER THERMAL INFLUENCES] Das Verhalten der kapazitiven und der Widerstandsgefässe der menschlichen Hand in Abhängigkeit von thermischen Ein-

flüssen.—Pflügers Archiv für die gesamte Physiologie (Berlin), 266 (2): 150-166. Feb. 12, 1958. In German.

Venous elasticity and blood flow in the hand were determined by direct measurements of venous pressure and by plethysmography in 6 subjects. Pressure-volume relationships were obtained for hand temperatures of 18-45° C., with ambient temperature constant at 27-29°, and for ambient temperatures of 20-32°, with hand temperature constant at 31-33°. Decreases in plethysmographic temperature resulted in a shift in the pressure-volume curve, with the volume elasticity coefficient E' (Δ venous pressure/Δ volume) during vasoconstriction lower than during dilatation with higher venous pressures, and higher than during dilatation with lower venous pressures. E' at a venous pressure of 10 mm. Hg (E'_{10}) rapidly decreased with increasing hand temperatures up to 31°, and was slightly decreased at higher temperatures. Blood flow (Δ volume/Δ time) at the same venous pressure (i_{10}) showed its greatest rate of increase at higher temperatures. A significant relationship was found between E'_{10} and i_{10} during changes in hand temperature, but not during ambient temperature changes. It is concluded that the tone of the capacity vessels (veins) of the hand can be independent of the tone of the resistance vessels (arteries), and that capacity vessel tone can be directly influenced by local temperature changes.

10896
Toor, M., 1959
E. Wertheimer, S. Massry, and J. B. Rosenfeld
THE EFFECT OF THE PHYSICAL EFFORT IN THE DEAD SEA AREA.—In: Proceedings of the International Congresses on Tropical Medicine and Malaria, VIth (Lisbon, 1958), vol. 6: 95-102. 1959.

The influence of varied amounts of water intake during walking for two hours at 6 km./hr. at 42° C. was investigated in 8 healthy subjects. It was determined that, in such hot climates, even natives quickly develop hypernatremia after a two-hour hike which is not prevented by drinking only according to thirst urge. Excessive forced drinking can correct and prevent hypernatremia despite the effort. The hypernatremia is accompanied by signs which resemble secondary hyperaldosteronism. (Authors' summary, modified)

10897
Traks, E., 1959
and S. M. Sancetta
THE EFFECTS OF "DRY" HEAT ON THE CIRCULATION OF MAN. II. SPLANCHNIC HEMODYNAMICS.—Amer. Heart Jour., 57 (3): 438-448. March 1959.
Abstracted in: Jour. Clinical Investigation, 37 (6): 936. June 1958.

Persons with normal hearts or heart disease were subjected for two hours to an ambient temperature of 98° F. and a comfortable relative humidity of 40%. Additional control patients who were studied only in a comfortable environment of 73° F. and a relative humidity of 40% showed no significant changes in hepatic venous outflow and splanchnic vascular resistance. Exposure to the warm environment caused in a significant decrease in the brachial artery pressure and in the splanchnic vascular resistance. There was no significant change in the estimated hepatic blood flow and in the calculated splanchnic oxygen consumption. The responses to heat were similar in patients with normal hearts and in those with enlarged hearts, regardless of the state of compensation of the left ventricle. (Authors' summary, modified)

10898
Treadwell, C. R. 1961
EFFECT OF LIPOTROPIC FACTORS ON COLD PHYSIOLOGY.—George Washington Univ. Dept. of Biochemistry, Washington, D. C.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Report no. 60-18, April 1961. 37 p.

Several experiments were carried out to study the lipotropic effect of cold upon fatty livers produced by deficiencies of methyl donors. It was found that at 1° C., diets containing as little as 5% protein and as much as 40% fat did not produce the fatty livers characteristic of these diets when fed at 25° C. It was also found that when animals with fatty livers were maintained at 1° C., there was a marked lipotropic effect without any change in diet composition. Cold also has both curative and preventive liptropic effects of the triglyceride fraction of the livers of animals receiving diets which will produce "cholesterol" fatty livers. Other experiments suggest than animals at 1° C. undergo an adjustment such that either larger amounts of ketone bodies can be metabolized or fewer ketone bodies are produced. (Author's abstract)

10899
Udalov, IU. F., 1959
M. I. Kuznetsov, and N. P. Lazutiatskii
[EXPERIENCE IN LARGE-SCALE VITAMINIZATION OF FLIGHT PERSONNEL UNDER ARCTIC CONDITIONS] Opyt massovoi vitaminizatsii letnogo sostava v usloviiakh severa.—Voenno-meditsinskii zhurnal (Moskva), 1959 (1): 69-71. Jan. 1959. In Russian.
English translation in: Military Medical Journal, 1959 (1): 105-108. New York: U.S. Joint Pub. Research Serv., No. 1555-N, May 14, 1959. (Available from Office of Technical Services, U.S. Dept. Commerce.)

A study of vitamins in the nutrition of flight personnel in the Arctic regions was carried out as part of a general program of prophylaxis of vitamin insufficiency among personnel stationed in the Arctic. First, the actual vitamin content in the daily food ration was determined. Then, in conformance with vitamin standards recommended for the Arctic, the following vitamins were added daily to the food before serving: A, 5.0-6.0 mg.; B_1, 5.0 mg.; B_2, 2.4 mg.; C, 100.0-150.0 mg.; and PP (pellagra preventive or nicotinic acid), 30.0-40.0 mg. The effectiveness of this supplement was checked by medical examinations with special attention to signs of avitaminosis. No clinical signs of insufficiency were found. A study of vitamin provision in the body by known biochemical methods showed the vitamin supply to be satisfactory. In tests conducted in flight personnel of one of the garrisons before and after vitaminization, no increase was noted in the alkaline phosphatase amount in blood therefore, the supply of Vitamin D in food was presumed to be adequate. Studies of the excretion of 4-pyridoxic acid showed that the administration of vitamins C, B_1, B_2, and PP also normalized the vitamin B_6 metabolism in the body. It is concluded that supplementary vitaminization of food is beneficial and that the daily dosages selected are adequate.

10900
Vaughan, D. A., 1958
J. P. Hannon, and L. N. Vaughan
ASSOCIATED EFFECTS OF DIET, ENVIRONMENTAL TEMPERATURE AND DURATION OF EXPOSURE ON THE MAJOR CONSTITUENTS OF THE LIVERS OF RATS.—Amer. Jour. Physiol., 194 (3): 441-445. Sept. 1958

The effects of feeding pemmican or a stock diet, and of exposure to an environment of 5° C. for 1 or 5 months on liver composition were studied in rats. Feeding with pemmican at 27° C. caused a reduction in percentage glycogen and percentage water, and increases in percentage total fat and phospholipid. Cold exposure produced a reduction in percentage glycogen, an increase in phospholipid (percentage of total fat), and an increase in percentage water in both dietary groups, and a reduction in percentage total fat in the pemmican-fed group. Protein content of the liver was lower in the pemmican-fed group after 1 month of cold exposure, but not after 5 months. At 5 months the percentage of protein was decreased in animals exposed to cold.

10901
Vaughan, D. A., 1960
and L. N. Vaughan
THE EFFECT OF COLD ON THE WEIGHT, FOOD INTAKE, AND ACETYLATING ACTIVITY OF PANTOTHENIC ACID-DEFICIENT RATS.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 59-23, April 1960. 13 p.

Growth, food intake, and acetylating activity were measured in rats kept at 5° C. and 25° C. while receiving a pantothenic acid-deficient diet supplemented with 0.5, 1.5, and 5.0 μg calcium pantothenate per gram of food. Respective mean weight changes at these levels of calcium pantothenate were +13, +30, and +100 g. for the warm rats and +2, +14, and +83 g. for the cold rats. Food intake increased as the level of calcium pantothenate increased, but the difference in food intake between the warm and cold rats remained constant at all levels of calcium pantothenate. Acetylating activity was not affected by exposure to cold, although it decreased with decreasing dietary levels of calcium pantothenate. (Authors' abstract)

10902
Vaughan, D. A., 1961
and L. A. Vaughan
THE EFFECT OF A PYRIDOXINE DEFICIENCY ON COLD-ADJUSTED RATS. — Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-10). Technical Report no. 61-2, Oct. 1961. 8 p.

Ninety-one rats, of which 49 were kept at 25° C. and 42 at 5° C., were fed a pyridoxine-free diet until growth ceased. Following this, graded levels of pyridoxine were fed for 28 days at both temperatures. Food intake and growth were measured. It was found that the pyridoxine requirement, expressed as micrograms per gram of food, was slightly greater in the cold. Growth rate appeared to be more dependent upon appetite than on efficiency of food utilization. Food intake in the cold rats was characteristically depressed by the vitamin deficiency, while being simultaneously stimulated by the low environmental temperatures. (Authors' abstract)

10903
Vaughan, D. A., 1961
J. P. Hannon, and L. N. Vaughan
INTERRELATIONSHIPS OF DIET AND COLD EXPOSURE ON SELECTED LIVER GLYCOLYTIC ENZYMES. — Amer. Jour. Physiol., 201 (1): 33-36. July 1961.
Also published as report: Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-18). Technical Report no. 61-1, Oct. 1961. 12 p.

The effect of a 28-day cold exposure (4 ± 1° C.) on selected glycolytic enzymes of the liver was studied in rats subsisting on carbohydrate free diets high in fat or protein and on a 65% glucose diet. Cold exposure increased glucose-6-phosphatase activity on all diets, but had an appreciable effect on glucokinase activity only in the rats fed high carbohydrate diets. The activity of phosphorylase was not affected by cold. "Pyruvate formation," like glucose-6-phosphatase activity, was increased significantly in all dietary groups by cold exposure. The extremely low activity of glucose-6-phosphate dehydrogenase in the rats fed high fat diets was unaffected by cold exposure. These results are interpreted to mean that, on a carbohydrate free diet, imposition of cold leads to increased reversal of pyruvate formation which is reflected in increased production of free glucose, whereas hexose monophosphate shunt activity and glycogenesis remain unaffected. Even on a high carbohydrate diet, the capacity for hepatic glucose production appears to be increased, possibly as a result of increased periodic demands on the part of extrahepatic tissues. (Authors' abstract)

10904
Veghte, J. H., 1961
and P. Webb
BODY COOLING AND RESPONSE TO HEAT. — Jour. Applied Physiol., 16 (2): 235-238. March 1961.

Prior body cooling with cold air or water immersion increased human tolerance to a high level of heat stress. The lower the body temperature at the onset of the heat exposure, the greater the increase in tolerance times over the control values. Mean body temperature was the only discriminating criterion which sucessfully correlated with tolerance time in these experiments. Sudomotor activity in heat was inhibited by prior body cooling. It is postulated that the onset of sweating is due to a gradient effect, not to either peripheral or central control. (Authors' abstract)

10905
Veghte, J. H., 1958
and P. Webb
EXTENDING HUMAN TOLERANCE TO HEAT BY PRIOR BODY COOLING.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADC Technical Report no. 58-412, Sept. 1958. iii+16 p. AD-205 544 PB 151 469

A preliminary study was completed to determine the effect of prior body cooling on tolerance to a high level of heat stress. Subjects were exposed to three levels of precooling (30-, 60-, and 90-minute exposures in a 60° F. water bath) prior to entering the heat chamber of 160° F. As the time of precooling increases, the average tolerance time in heat is

correspondingly greater. At tolerance, a narrow spread of terminal rectal temperatures is observed. Recruitment of sweating in heat is inhibited by prior body cooling. The causative factors for this phenomenon are discussed. (Authors' abstract)

10906
Veghte, J. H. 1961
HUMAN PHYSIOLOGICAL RESPONSE TO EXTREMITY AND BODY COOLING. — Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8242-2). Technical Report no. 61-26, Oct. 1961. 10 p.

Five subjects at rest were exposed to a temperature of -18° C. in an environmental chamber while wearing three different clothing configurations: (1) thermistor underwear, (2) approximately 10 clo insulation on the body with the exception of only the hands and feet, which were left bare, and (3) approximately 10 clo insulation on the extremities with the rest of the body bare or covered with the thermistor underwear. The average tolerance time — defined as when any skin site reached 4° or 0° C. — while wearing only the thermistor underwear and having the body heavily insulated while the extremities were bare was 8 minutes. The average tolerance time with the extremities heavily insulated and wearing only the thermistor underwear was 83 minutes. The results illustrate the temperature sensitivity of the extremities and their tolerance limitations in extreme cold environments. (From the author's abstract)

10907
Veghte, J. H., 1959
and P. Webb
INFLUENCE OF PRIOR BODY COOLING WITH AIR ON HUMAN HEAT TOLERANCE.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADC Technical Report no. 59-350, Sept. 1959. iii+13 p. AD 233 461

This study was conducted with three experienced subjects to determine the feasibility of using a ventilating suit as a vehicle for body cooling prior to heat exposures. Various ventilating air temperatures, flows, and time durations were explored. The results confirm the applicability of this approach for prior body cooling and extension of tolerance times to a heat stress. Optimal air temperature for air cooling in terms of subjective comfort appears to be approximately 45° F. for 60 minutes or longer. Maximum airflow rate recommended with the ventilating garment is 25 c. f. m. Heavy insulation should be worn over the ventilating garment while cooling and may be worn throughout the heat or flight situation with no tolerance impairment. (Authors' abstract)

10908
Wakin, K. G., 1959
C. S. Wise, and F. B. Moor
PHYSIOLOGIC ALTERATIONS PRODUCED BY HEAT AND COLD. II.—Medical Arts and Sciences, 13 (3): 126-138. 1959.

A review of the literature is presented on the effects of heat and cold on the skin, leg, abdomen, and brain. Temperature changes occurring in the tissues beneath the area to which heat or cold is applied may result from the conductive transfer of energy or from a reflex change. Hot baths, diathermy, and hot humid air are included among the means of inducing passive fever. Active fever, which is aroused by the organism, may be induced by injection of foreign proteins, malarial parasites, typhoid vaccine, or some colloidal substances. Discussion is included on the physiological effects of heat on the blood cells, heart rate, cardiac output, blood pressure, vascular tree (axon reflex, metabolites, vasodilatation from central effects), respiration, and sweat secretion. Excessive heat produces heat cramps, heat prostration or heat exhaustion, and heat hyperpyrexia or heat stroke. The etiopathogenesis, symptoms, and prevention of these conditions are summarized. (42 references)

10909
Watanabe, T. 1959
EFFECT OF THE COLD UPON THE METABOLISM. I. EFFECT OF THE COLD UPON THE CONTENTS OF VARIOUS BLOOD CONSTITUENTS, LIVER FAT, AND ENZYMES.—Med. Jour. Shinshu Univ. (Matsumoto, Japan), 4 (1): 27-46. March 1959.

Guinea pigs exposed to cold (-20° C.) for 48 hours exhibited a reduction in blood lipase and amylase activity; an increase in total lipids, phospholipids, and total fatty acids; no change in cholesterol ester, but a slight increase in free cholesterol; almost no change in blood sugar; a slight decrease in total blood nitrogen and in blood protein nitrogen, but an increase in nonprotein nitrogen to twice its normal value; an increase in erythrocytes, a decrease in leukocytes, and no change in hemoglobin content; a slight reduction of serum complement activity; a remarkable reduction of liver and kidney lipase activity and a slight reduction of amylase in both tissues; a large increase in total lipids, fatty acid, and cholesterol in the liver, and an increase in both free and esterified cholesterol; a slight decrease in phospholipids; an increase in liver arginase activity; an increase in liver and kidney cathepsin activity, and a decrease in serum albumin and no change in serum globulin.

10910
Way, E. L., 1961
and H. W. Elliott
ALTERATIONS IN EFFECT OF MORPHINE ON THE COLD-ACCLIMATIZED ANIMAL.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-60-26, Oct. 1961. 15 p.

Experiments were performed to determine whether adaptation to cold alters the effects of morphine on the minute volume and oxygen consumption of the unanesthetized rat, and on the median effective analges (ED_{50}) and median lethal doses (LD_{50}) in mice. The greatest depression in respiratory minute volume and rate in non-acclimatized rats occurred with doses of 10 and 20 mg./kg.; the same doses of morphine were less effective in cold-adapted rats. The ED_{50} of morphine was 3.50 mg./kg. in the control mice but cold adaptation increased the ED_{50} to 4.65 mg./kg. A comparison of the LD_{50} of the cold-exposed mice with their controls indicates that the toxicity of morphine is enhanced in the cold-acclimatized mouse.

10911
Webb, P. 1960
AERODYNAMIC HEATING.—Mechanical Eng., 82(6): 60-62. June 1960.
Condensed from: EXPOSURE TO AERODYNAMIC HEATING TRANSIENTS.—ASME Paper no. 59-A-211.

Studies were made in experimental heat chambers to determine man's tolerance to slow heat pulses, both nude and while wearing protective clothing. Exposure to slow heat pulses with slopes ranging from 15° F. per minute to 100° F. per minute with nude subjects resulted in intolerable pain at temperatures between 325° F. and 400° F. The faster the rate of temperature rise, the higher the temperature which could be tolerated. Discomfort in breathing was found to be closely related to air temperature, rather than to wall temperature. At a level of 260° F. air temperature, most subjects voluntarily changed from nasal breathing to mouth breathing, and at 300° F. air temperature, mouth breathing also became uncomfortable. Among clothed subjects, higher tolerances were realized when more numerous layers or greater thicknesses were worn. The best protection was given by a heavy coverall which had an aluminized outer surface, worn with protective boots, gloves, and helmet.

10912
Webb, P. 1959
HUMAN THERMAL TOLERANCE AND PROTECTIVE CLOTHING.—Annals New York Acad. Sci., 82(3): 714-723. Oct. 7, 1959.

Man can well tolerate temperatures of 200°, 300°, 400° F., and perhaps higher for minutes and hours, depending on the heat load and the degree of protection supplied. Excellent protection in the form of clothing is available through the proper use of ventilation, insulation, and reflective coatings. Tolerance can be further extended by cooling off just prior to an expected heat exposure. The result of this knowledge may be that clothing technology will need to advance to meet the special problems of high temperature in the clothing itself. Fabrics and joinings in the outer layers may have to retain strength despite a several-hundred-degree temperature. Gloves for handling hot surfaces, elimination or covering of metal closures and snaps that conduct heat straight to the skin, and special foot-gear with low thermal conductivity are all problems that are already troublesome in our experimental work. The new physiology of man's tolerance to supraclimatic heat poses a new challenge to the clothing industry. (Author's abstract)

10913
Webb, P. 1959
PROTECTION OF MAN AGAINST TRANSIENT EXPOSURE TO HIGH HEAT LOADS.—Advances in Astronautical Sciences, 4: 418-419. 1959.

An oven was constructed having light metal walls which were heated externally by banks of radiant heat lamps. A man was seated in the four-foot cubic space either unprotected, covered with light clothing, or dressed in heavy Arctic flight gear. Two heating rates were applied: 50° F./minute and 100° F./minute. Exposure was continued until the subject called a halt. The nude subject was able to stand a slow heat pulse which peaked at 350° F. or 400° F., and a lightly clothed man, 450° F. The heavily clothed subject scarcely felt the heat until 500° F. was reached. Measurements made of the temperature of the exposed skin showed that surface temperatures were reached which matched the established levels for pain from radiant heat. It is suggested that a properly designed protective suit be made of fabric whose fibers can stand 500° F., be covered with a reflective coating, be insulated, have no leakage pathways for heat, and have air ventilation to provide the ultimate in protection.

10914
Weiss, A. K. 1959
AN ANALYSIS OF THE METABOLIC RESPONSES OF RATS EXPOSED TO COLD.—Amer. Jour. Physiol., 196 (4): 913-916. April 1959.

When young rats (150 grams) were exposed to +5 ± 2° C. for ten days, their metabolic rate (measured at 28° C.) was elevated. Injection of sodium pentobarbital (30 mg./kg.) just prior to the metabolism determination lowered the metabolic rate of both control and cold-exposed animals, but did not alter the general pattern of the cold-induced elevation of the metabolic rate, so that the metabolism of the rats exposed to cold was still higher than that of the controls. When older rats (300 grams and more) were exposed to -5 ± 2° C. for up to ten days, the metabolic rate of the survivors was elevated also. In these animals, however, sodium pentobarbital administration lowered the metabolic rate of the cold-exposed animals to about the same level as that of the controls. This indicates that the older rats exposed to -5° C. achieve protection against the cold environment primarily through changes which may be of neurogenic origin. (Author's abstract)

10915
Weiss, A. K. 1960
FACTORS WHICH AFFECT COLD ACCLIMATIZATION. — Proceedings of the International Symposium on Cold Acclimation, Buenos Aires, August 5-7, 1959. Published in: Federation Proceedings, 19 (4, Supplement no. 5): 137-138. Dec. 1960 (Part II).

Investigations of metabolic responses to cold exposure of various rat tissues and organs have shown that acclimatization to cold is best achieved by the relatively young rat (6-16 weeks old). The ability to achieve this acclimatization by metabolic means depends in part upon the availability of endocrine reserves. When these can be mustered they bring about an increase in heat production to balance the increased heat loss. In older or senescent rats where inadequate endocrine reserves prevent metabolic acclimatization to cold, the administration of thyroid compounds can bring about artificial acclimatization. (Author's abstract, modified)

10916
Welch, B. E., 1958
E. R. Buskirk, and P. F. Iampietro
RELATION OF CLIMATE AND TEMPERATURE TO FOOD AND WATER INTAKE IN MAN.—Metabolism, 7 (2): 141-148. March 1958.

Measurements were made of caloric intake, water intake, energy expenditure, body weight, and urine output in men regularly performing moderate work in climates having a mean temperature during the period studied of 90.5°, 72°, -22.5°, and -7.3° F. Caloric intake was found to be the same in all climates in relation to body weight. Intake was 47-49 Calories/kilogram of body weight during moderate work in all climates, and 60-62 Cal./kg. of body weight during heavy work in the cold. Energy expenditure was related to weight transported in all climates. Fluid intake was not significantly changed with increases in ambient temperature up to 60°, but was increased sharply above 60°, with increased

sweating. The ratio of water intake to caloric intake was relatively constant in cold and temperate climates, but was markedly increased at temperatures above 60°. It is concluded that differences in energy expenditure with environment can be largely accounted for by differences in body weight and the weight of clothing and equipment carried during periods of work.

10917
Whittow, G. C. 1958
SOME FACTORS AFFECTING THE MAGNITUDE OF THE PRESSOR, CARDIO-ACCELERATOR AND PAIN RESPONSE TO COLD OF HEAT-ACCLIMATIZED SUBJECTS.—Clinical Sci. (London), 17 (2): 339-348. May 1958.

Blood pressure, heart rate, and subjective sensations were determined in Asian natives of Singapore during immersion of the hand in cold water. Immersion at 2° C. produced a greater systolic and diastolic pressor response and a slightly greater cardio-accelerator response than immersion at 6°. The pressor response was slightly greater when the hand was immersed at 22° for 45 minutes prior to cold immersion than when it was pre-immersed at 42°. Exposure to a hot environmental temperature decreased the circulatory response to cold immersion. Exposure to a cold environment increased the systolic pressor and cardiac responses, but decreased the diastolic pressor response (because the resting level was increased). Individual differences in the systolic pressor response were apparently inversely related to sub-lingual temperature, but no relationship was found between other responses and body temperature, resting blood pressure, or resting heart rate. Mean pressor responses were greater than those previously found in residents of temperate countries. The amount of pain felt was greater at lower immersion temperatures and at lower environmental temperatures.

10918
Whittow, G. C. 1961
FLOW OF BLOOD IN THE FOREARM OF PERSONS ACCLIMATIZED TO HEAT. —Nature (London), 192 (4804): 759-760. Nov. 25, 1961.

Forearm blood-flow was measured by venous occlusion plethysmography in 21 male Asians born and living in Singapore. Temperatures during recording were dry-bulb of 28.3±1.1° C. and wet-bulb temperature of 25.2±0.3° C. while the subjects were at rest and not sweating. The mean blood-flow was 2.7 ml./100 ml. forearm/min.±0.88 ml., which is within the range as previously recorded in the forearms of non-acclimatized people living in England and North America. It appears that the forearm blood-flow in acclimatized people is no greater than in people living in temperate climates.

10919
Wood, J. E., 1958
D. E. Bass, and P. F. Iampietro
RESPONSES OF PERIPHERAL VEINS OF MAN TO PROLONGED AND CONTINUOUS COLD EXPOSURE. —Jour. Applied Physiol., 12 (3): 357-360. May 1958.

A study was made in 5 subjects of the effects of exposure to a temperature of 60° F. for two weeks on the pressure-volume characteristics of the veins, peripheral blood flow, and venous pressure. Marked peripheral venous constriction, a decrease of peripheral blood flow, and an increase of venous pressure were observed after 3 days of cold exposure. The responses tended to lessen as the cold stimulus was continued. Changes of the venous pressure-volume curves in three subjects indicated a gradual venodilation despite the continuing cold stimulus. All values returned to approximately control levels after return to a temperature of 80°.

10920
Woodward, A. A., 1961
and E. G. Cummings
THE EFFECTS OF HYCAR-TREATED UNDERWEAR ON THE PHYSIOLOGICAL PERFORMANCE OF MEN UNDER HEAT STRESS.—Army Chemical Center. Chemical Research and Development Labs., Md. Technical Report no. CRDLR 3058, April 1961. 36 p.

Men were tested in a hot room at 100° F. and 29% relative humidity while wearing (a) a nonprotective utility costume, (b) a standard, permeable, protective costume, and (c) an experimental, permeable, protective costume that differed from the standard only in the experimental absorbent underwear. Body temperatures, heart rates, sweat-evaporation rates, and metabolic rates of the subjects were measured. No evidence was found that substitution of the experimental underwear for the standard underwear had any effect on the heat stress of the subjects, whether they exercised at low, medium, or high workloads. The fit of the underwear caused discomfort in some subjects. (Authors' abstract)

10921
Wyman, L. C., 1959
and L. L. Drapeau
VASCULAR REACTIONS TO COLD IN THE CHEEK POUCH OF INTACT AND ADRENALECTOMIZED HAMSTERS.—Amer. Jour. Physiol., 197 (4): 799-802. Oct. 1959.

Adrenalectomized golden hamsters unanesthetized or under anesthesia, did not maintain body temperature when exposed to environmental cold (2° C.) as well as intact hamsters or adrenalectomized hamsters receiving cortisone replacement therapy. At room temperature there was no significant change in caliber of small blood vessels in the cheek pouch of intact or adrenalectomized hamsters under ether, but arteries of hamsters receiving replacement therapy constricted. Suitable controls showed that this was partly due to the treatment. During two hours in cold air there was significant constriction of arteries of intact and of adrenalectomized hamsters receiving replacement therapy, but no change in veins, while the majority of untreated adrenalectomized hamsters showed no significant changes in the arteries. This is interpreted as an impairment of the normal peripheral vasoconstrictor response to cold which can be restored by replacement therapy. (Authors' abstract, modified)

10922
Wyndham, C. H., 1958
and J. F. Morrison
ADJUSTMENT TO COLD OF BUSHMEN IN THE KALAHARI DESERT.—Jour. Applied Physiol., 13 (2): 219-225. Sept. 1958.

A field study was made of the cold adaptation of naked African bushmen. Skin and core temperatures were measured in one bushman and two whites

sitting naked at an air temperature of 12.2-16.2° C. for up to 2.5 hours. The fall in total body heat content was similar in both races, but core temperature fell more and skin temperature less in whites. Surface temperatures of another bushman protected by a leather cloak while sleeping beside a fire native-fashion were recorded throughout the night at an air temperature of 14-17°. Air temperature under the cloak was found to be in the thermoneutral zone (about 26°). Trunk skin temperature remained at about 35° throughout the night, while peripheral temperatures fell to 23-27°. Shivering was not observed at any time. It is concluded that the African bushmen studied have achieved a technological rather than physiological adaptation to cold.

10923
Yaglou, C. P. 1961
EFFECT OF GEOGRAPHICAL ORIGIN ON PERFORMANCE IN HEAT. —— Arch. Environmental Health, 2 (1): 1-8. Jan. 1961.

A comparison of the performance of young, southern Floridians with that of a similar group of New Englanders, walking in the humid heat of Homestead, Fla., indicated that the Southerners had a more efficient heat regulating system, which enabled them to perform the standard exercises with distinctly less sweating, and a smaller rise of body temperature and heart rate. The Southerners required a shorter period for physical conditioning in the heat, and lost acclimatization at a slower rate than the Northerners during periods of cool, rainy weather. The superior performance of the Southerners is ascribed to their long-term acclimatization, and their knowledge of living and working in their accustomed warm climate. It would seem that in selecting personnel for duty in hot areas, the geographical origin of the individual should be given a high priority, possibly next to that of physical fitness. (Author's summary)

10924
Yang, T. L., 1959
and K. Lissák
THE EFFECT OF VARIOUS TEMPERATURES AND ACTH ON PHYSICAL PERFORMANCE.—Acta physiologica Academiae scientiarum hungaricae (Budapest), 16 (1): 47-49. 1959. In English.

Swimming experiments with albino rats have shown that the correlation between temperature and performance is not linear. There is a critical temperature at 20° C.; if this temperature is increased by as little as 1° C., performance suddenly improves. ACTH, which is ineffective under 20° C., becomes suddenly active at the critical temperature. The same mechanism seems to be in the background of the thermal and ACTH effects. (Authors' abstract)

10925
Yang, T. L., 1960
and K. Lissák
INFLUENCE OF THE ENVIRONMENTAL TEMPERATURE ON PHYSICAL PERFORMANCE, O_2 CONSUMPTION, BLOOD LACTIC ACID LEVEL AND RECTAL TEMPERATURE.—Acta Physiologica Academiae scientiarum hungaricae (Budapest), 17 (1): 63-68. 1960. In English.

Male rats were forced to swim without load in a water bath controlled at various temperatures until they were exhausted. Swimming time was the longest at the optimal temperature (29° to 30° C.), but decreased rapidly between 20° and 22° C., as well as between 39° and 41° C. The rectal and intraperitoneal temperatures, both measured thermoelectrically, varied practically parallel with the temperature of the water bath. The O_2 consumption of the animal was increased by 24% at 18° C., and by 126% at 30° C. At a bath temperature of 43° C., O_2 consumption was unchanged in the first 15 minutes following swimming. The blood lactic acid level was elevated most markedly in the groups which exhibited the slightest increase in O_2 consumption during the first 15 minutes after swimming at 18° and 43° C., respectively, while the elevation was slighter after swimming at optimal temperature. The findings suggest that the decrease in physical performance takes place in leaps at both low and high environmental temperatures. At the critical temperature limits, a considerable disturbance in oxidative activity seems to occur and working capacity is maintained only until the energy mobilized from anaerobic sources is exhausted. (Authors' abstract, modified)

g. Sound, Noise, and Vibration

[*Protective devices under 10-b; Effects of noise on hearing under 4-c; Noise characteristics of aircraft under 11-b*]

10926
Ades, H. W., 1958
A. Graybiel, S. N. Morrill, G. C. Tolhurst, and J. I. Niven
NON-AUDITORY EFFECTS OF HIGH INTENSITY SOUND STIMULATION ON DEAF HUMAN SUBJECTS.—University of Texas Southwestern Medical School, Dallas, Texas; and U. S. Naval School of Aviation Medicine, Pensacola, Florida (Joint Project NM 13 01 99, Subtask 2). Report no. 5, Sept. 8, 1958. ii+22 p.
Also published in: Jour. Aviation Med., 29 (6): 454-467. June 1958.

Several types of subjective responses were reported by deaf subjects exposed to pure tone and wide-band noise of 115 to 170 decibels. The responses included vibration, tickle, warmth, and pain, with some descriptive variants of each. When threshold values were determined and plotted, the most sensitive frequency range was from 200 to 1000 cycles per second (c.p.s.), with rapid rise of threshold at successively higher frequencies above 1000 c.p.s. Objectively, high-intensity noise induced nystagmus in subjects having appreciable residual labyrinthine function. Thresholds of nystagmus were determined for several subjects at each test frequency, and frequency-intensity curves for this phenomenon are shown. The lowest thresholds (120 to 130 decibels) are found in the frequency range of 200 to 500 c.p.s., and rise rapidly above 500 c.p.s. Incomplete data indicate that damage to the tympanic membrane is a further consequence of high levels of noise exposure, and the degree of this damage varies between individuals. (Authors' summary, in part)

10927
Ades, H. W., 1959
S. N. Morrill, A. Graybiel, and G. C. Tolhurst
THRESHOLD OF AURAL PAIN TO HIGH INTENSITY SOUND.—Aerospace Med., 30 (9): 678-684. Sept. 1959.

Deaf and normal human subjects were exposed monaurally to high-intensity noise stimuli including

pure tone and broad band noise. There was considerable individual variation, but pain thresholds for deaf subjects with anatomically intact middle ear and drum were at 150 decibels; and for subjects with a normal ear, pain was felt at 140 decibels. There is evidence of slight interaction of hearing and pain perception. The drum contains the principal pain perception mechanisms. In general, the threshold of aural pain is too high to allow pain to serve as a warning against impending acoustic trauma. By the time the noise is loud enough to produce pain, hearing loss is already well under way. (Authors' summary and conclusions, modified)

10928
Anderson, C. W. 1961
THE EFFECTS OF NOISE ENVIRONMENT SURROUNDINGS OF A MISSILE SYSTEM LAUNCHING STATION ON PERSONNEL PERFORMANCE. —— In: Digest of the 1961 [4th] International Conference on Medical Electronics (New York City), p. 73. Princeton, New Jersey: RCA Laboratories, 1961.

A discussion is presented of a situation when sound levels of a weapons system are 133 db. at 50 feet from the launcher and 118 db. at 220-300 feet from the launcher. The effects of these noise levels on communications and physiological reactions are discussed. The advantages and disadvantages of various types of ear protectors are noted.

10929
Anthony, A., and S. Babcock 1958
EFFECTS OF INTENSE NOISE ON ADRENAL AND PLASMA CHOLESTEROL OF MICE.——Experientia (Basel), 14 (3): 104-105. March 15, 1958.

Exposure of mice to intense noise (140 decibels, 150-4800 cycles/second, or 114 db., 1000-2000 cycles/second) for 5 minutes had no apparent effect immediately or 3 or 6 hours later on adrenal and plasma cholesterol levels, adrenal weight, and serum sodium, potassium, and calcium. It is suggested that noise exposure does not induce excessive adrenocortical activation.

10930
Anthony, A., and E. Ackerman 1959
STRESS EFFECTS OF NOISE IN VERTEBRATE ANIMALS.——Pennsylvania State Univ., University Park (Contract AF 33(616)-2505); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). WADC Technical Report no. 58-622, Sept. 1959. viii+49 p. AD 230 976

The extra-auditory effects of chronic exposure of laboratory animals to intense noise were investigated. The sound pressure level used was about 135-140 db. (re 0.0002 dynes/cm.^{2}) using two frequency ranges (150-4800 c.p.s. and 2-40 kc.). Exposure times were about 20-40 hours per week for periods of 2-9 weeks. The stress effects of intense noise were measured in terms of adaptive and nonadaptive changes in the adrenal gland, target organs influenced by adrenal secretions, as well as abnormal behavioral responses of animals to various types of noise situations. Brief exposures to intense noise at high frequencies cause a more marked depletion of adrenal constituents than does noise exposure at low frequencies. Chronic exposure of animals to high-frequency noise may result in a breakdown of normal endocrine defense mechanisms as evidenced by the appearance of pathology in adrenals and other organs. Tissue pathology was not evidenced in animals following prolonged exposure to low-frequency noise. These findings indicate that the histophysiological approach to the study of noise stress can be used in determining the tolerance limits of animals to the actions of intense noise as a harmful stress stimulus. (Authors' abstract)

10931
Argyris, T. S., and E. Bell 1959
THE PHYSIOLOGICAL ACTIVITY OF THE SKIN AND ITS RESPONSE TO ULTRA-SOUND.——Anat. Record, 134 (2): 153-169. June 1959.

A study was made of the effects of focused ultrasound of one megacycle frequency and 360 watts/cm.^{2} intensity for 30 seconds on the skin of mice at different stages of the hair growth cycle. Histological findings showed that skin in the growth phase was much more sensitive to ultrasound than skin in the resting phase. Included are twelve histological figures. (Authors' summary, modified)

10932
Arkad'evskiĭ, A. A. 1959
[INFLUENCE OF INTENSE "WHITE" NOISE ON AUDITORY FUNCTION] Vliianie moshchnogo "belogo" shuma na slukhovuiu funktsiiu.——Biofizika (Moskva). 4 (2): 166-169. 1959. In Russian.
English translation in: Biophysics (Pergamon Press, London), 4 (2): 41-45. 1959.

Exposure to noise of 106 decibels intensity with uniform spectral frequency distribution resulted in a persistent fall in the subject's auditory sensitivity. Sharper falls were associated with longer periods of work under noisy conditions. A 25-49 db. reduction in auditory sensitivity occurred chiefly in the 4500 c.p.s. region, which indicates the selective local action of "white" noise at these intensities. The tendency for the auditory threshold to rise further at a frequency of 4500 c.p.s. in the last hours of work reflected the influence of the exhausting action of the stimulus on the auditory analyzer since such a phenomenon was not present at frequencies of 200, 300 and 2000 c.p.s. (Authors' summary, modified)

10933
Ashe, W. F., E. T. Carter, G. Hoover, L. B. Roberts, E. Johanson, Francis Brown, and E. J. Largent 1961
SOME RESPONSES OF RATS TO WHOLE BODY MECHANICAL VIBRATION. I. —— Arch. Environmental Health, 2 (4): 369-377. April 1961.

Adult white rats were exposed to mechanical vibration in the horizontal or vertical plane at frequencies from 3 to 26 c.p.s. and at amplitudes from 0.062 to 0.25 inches for increasing daily periods of 1 to 6 hours. Vibration resulted in a loss of weight which was greater for increasing vibrations in the vertical plane and for the first hour of vibration. Body temperature was increased a maximum of 3° F. by vibrations above 5 c.p.s. The white blood count showed a fairly consistent drop on all first runs, particularly at higher amplitudes and frequencies. No changes were observed in red blood count, hemoglobin, or blood sugar. Conclusive

evidence of acclimatization to vibration was not demonstrated.

10934
Bagley, W. P. 1960
BIOLOGICAL EFFECTS OF HIGH INTENSITY NOISE. — Jour. Environmental Sci., 3 (3): 24-26, 29; (4): 18-20. June, Aug. 1960.

Brief consideration is given to structures of the hearing mechanism and to types of deafness, the spectral pattern of noise-induced deafness, levels of damaging noise exposure, the systemic effects of noise, including fatigue, digestive disturbances, and pain, and the limitations of attempts to protect against the effects of noise through ear devices.

10935
Baker, D. J., and R. G. Hansen 1959
BIOLOGICAL ACOUSTICAL TESTS. I. INTELLIGIBILITY MEASURE.—In: Project Mercury candidate evaluation program, p. 27-34. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959.

Word intelligibility scores from 31 speakers were obtained. On the basis of a 1 to 9 scale the speakers' scores were ranked. Eight of the 31 subjects were above average, 15 were average, and 8 were below average. Utilizing a rating of 1 to 7, listeners evaluated the effect of vibration upon the intelligibility of connected discourse. There was a statistically significant positive correlation between the two conditions of vibration (1% level of confidence). However, there was a statistically significant difference in the ratings with the 11 c.p.s. vibration condition having a more deteriorating effect on intelligibility. (Authors' summary)

10936
Bishop, D. E. 1961
CRUISE FLIGHT NOISE LEVELS IN A TURBOJET TRANSPORT AIRPLANE. — Noise Control, 7 (2): 37-42. March-April 1961.

Boundary layer noise was measured at four points along the cabin wall of a Convair 880 transport. Boundary layer noise levels change radically during the various flight stages, and at cruising flight it is the major contributor to the noise level in the cabin. The boundary layer spectrum shape is described as a function of a non-dimensional parameter involving frequency, aircraft speed, and a measure of the turbulent boundary layer thickness, and it also varies with the aircraft speed and the fuselage position. The generalized boundary layer curve is a good means of predicting the external and internal noise levels along the fuselage.

10937
Black, J. W. 1958
THE RECEPTION OF MESSAGES OF DIFFERENT LENGTHS.—Ohio State University Research Foundation, Columbus, Ohio (Contract N6 ONR 22525); issued by U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 18 02 99, Subtask 1). Report no. 79, Aug. 15, 1958. ii+6 p.

One of two tasks was assigned to alternate groups of listeners who heard sentences ranging in length from 3 to 17 words: either answering factual questions based on the sentences or writing the last 3 words of the sentence. The listening occurred in one of 5 acoustic conditions, from quiet to 4 decibels signal-to-noise ratio. The results of both tasks showed increased noise and increased sentence length similarly reduced correct responses to the sentences.

10938
Borisova, M. K. 1960
[THE EFFECT OF NOISE ON THE CONDITIONED REFLEX ACTIVITY OF ANIMALS] Vliianie shuma na uslovnoreflektornuiu deiatel'nost' zhivotnykh. — Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 10 (6): 908-912. Nov.-Dec. 1960. In Russian, with English summary (p. 912).
English translation in: Pavlov Journal of Higher Nervous Activity (Pergamon Press, New York), 10 (6): 971-976. June 1961.

Noise of 85 decibels intensity produced signs of defensive, protective inhibition in the cerebral cortex of white rats, which expressed itself in reduction of conditioned reflexes, prolongation of their latent period and disappearance of conditioned reflexes. The disturbance of conditioned reflex activity produced by noise depended on the typological features of higher nervous activity. In animals classed as having strong types of higher nervous activity the change in conditioned reflex acitivity developed after exposure to noise for 6 hours, and increased gradually. Noise produced much more pronounced changes in higher nervous activity, even after the first exposures for 2 and 4 hours, in animals with weak types of nervous system; the 6-hour exposure led to complete loss of all conditioned reflexes. When albino rats were rested for 5 days after exposure to noise, their conditioned reflex activity had returned to normal. (Author's conclusions)

10939
Borsky, P. N. 1961
COMMUNITY REACTIONS TO AIR FORCE NOISE. I. BASIC CONCEPTS AND PRELIMINARY METHODOLOGY.—Univ. of Chicago. National Opinion Research Center, Ill. (Contract AF 33(616)-2624); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71701). WADD Technical Report no. 60-689 (I), March 1961. vi+91 p.

A comprehensive conceptual scheme to describe the annoyance and complaint processes involved in community reactions to jet aircraft noise and related operations has been developed. The broad theoretical framework is based on a more detailed evaluation of a NACA study, a series of intensive personal interviews with New York City and Hanscom Air Force Base residents, and discussions with technical personnel concerned with acoustics, public relations, jet manufacturing, and flight operations. The theoretical scheme deals with broad aspects of the problem: the objective physical characteristics of jet stimuli and related residential disturbances, the intervening sociopsychological variables affecting individual perception, feelings of annoyance, the additional interacting factors modifying individual expression of such feelings and the overall community considerations determining the scope of community action. A standard personal interview questionnaire has also been developed and pretested for possible use in validating the

conceptual scheme and deriving precise statistical relationships among the many variables. (Author's abstract)

10940
Borsky, P. N. 1961
COMMUNITY REACTIONS TO AIR FORCE NOISE. II. DATA ON COMMUNITY STUDIES AND THEIR INTERPRETATION.—Univ. of Chicago. National Opinion Research Center. Ill. (Contract AF 41(657)-79); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 77444). WADD Technical Report no. 60-689 (II), March 1961. xxv+171 p.

To determine preliminary relationships between variations in acoustic situations and disturbance, annoyance, and complaint potentials, personal interviews were held with almost 2500 residents at different air bases. The detailed acoustic conditions at three of these bases were measured. From these studies, the instruments and procedures for assessing neighborhood reactions have been fully developed, pretested, and validated. The data has provided valuable findings and the development pf prototype statistical models for estimating neighborhood disturbance, annoyance, and complaint readiness. Community reactions are directly related to the intensity of the noise levels. A person is more disturbed, annoyed, and ready to complain if he is fearful of crashes and feels the air base is less important to local welfare and is less considerate of neighborhood feelings. Greatly disturbed people are also less satisfied with general living conditions in their areas, are more sensitive to noise of cars and trucks, and have less experience with flying. Time by itself has been proved no automatic cure of the annoyance problem. People who have lived near air bases longer are more bothered by the noise. (Author's abstract)

10941
Broadbent, D. E. 1958
EFFECT OF NOISE ON AN "INTELLECTUAL" TASK.—Jour. Acoust. Soc. America, 30 (9): 824-827. Sept. 1958.

Three groups of Naval Ratings worked for two sessions each at a subtraction task involving a considerable immediate memory load. One group had both sessions in relative quiet (70 decibels), a second had the first session in 100 decibels noise and the second in quiet, and the third group had noise and quiet in the reverse order. In the first session the noise group slowed down at solving the subtractions as time went on, relative to the groups working in quiet. A similar difference appeared in the second session, but, in addition, there was an aftereffect of noise such that the subjects who had had noise previously slowed down relative to those who had not. Slowing down of performance with time was in all groups most marked in extroverts. These results suggest firstly that intellectual work as well as simple sensory tasks must be regarded as endangered by noise. Secondly, there may be harmful aftereffects from noise, but it is not clear whether these will appear in any situation or only in one similar to that in which the noise was experienced. (Author's summary)

10942
Bugard, P. 1960
[THE EFFECT OF NOISE ON THE ORGANISM: THE IMPORTANCE OF UNSPECIFIC EFFECTS] L'action des bruits sur l'organisme, l'importance des effets non spécifiques. — Revue des Corps de santé des armées (Paris), 1 (1): 58-72. Feb. 1960. In French.

A selective review is presented of clinical and experimental observations of the physiopathological effects of noise. Early observations of workers chronically exposed to jet engine noise showed the presence of fatigue, a decline in efficiency, arterial hypotension, slight emaciation, digestive disturbances, depression, headaches, anemia, neutropenia, hypoglycemia, and eosinopenia. Through controlled laboratory exposures of animals to noise, the effects of sound were categorized as: (1) death, resulting from exposure to intense sound or ultrasound (160 db.); (2) alarm reactions (blood, endocrine system, nervous system) and adaptation during exposures to sound or ultra-sound of 130 db. intensity; and (3) an irritation syndrome produced by constant exposure to relatively low intensity noise. The auditory stimulus was shown to affect the ascending reticular formation, provoking a vigilance or alarm reaction and desynchronizing the resting electroencephalogram. Although various drugs which affect the reticular system (amphetamine, chlorpromazine, meprobamate) may be useful in protecting against noise stress, it is concluded that the essential solution to the problem is the reduction of noise at the source.

10943
Burrows, A. A. 1960
ACOUSTIC NOISE, AN INFORMATIONAL DEFINITION. — Human Factors, 2 (3): 163-168. Aug. 1960.

Some theoretical considerations are made on the previous definitions of acoustic noise and the classification of its effects on organisms. A definition is proposed relating acoustic noise to its environmental source and the informational content of the specific task in which it occurs. A preliminary experiment is presented designed to explore the differential effects of low-level sound on tracking performance in consideration of its information content. (Author's abstract, modified)

10944
Busnengo, E. 1959
[SOME EFFECTS OF EXPOSING MAN TO NOISE AND VIBRATION OF TURBOJET ENGINES. II. EFFECTS ON THE ELECTROCARDIOGRAM] Alcuni effetti dell'esposizione dell'uomo ai rumori e alle vibrazioni di motori a turbo-propulsione. II. Effetti sull'elettrocardiogramma.—Rivista di medicina aeronautica e spaziale (Roma), 22 (2): 73-84. April-June 1959. In Italian, with English summary (p. 82-83).

Cardiovascular reactions to acoustic and vibratory stimuli (noise and vibration in jet-prop aircraft) were electrocardiographically studied in 23 normal men whose work exposed them to these stimuli daily. Elevated vagal tonus was exhibited in both ECG and examination of cardiac frequency and rhythm. Cardiovascular response was related to the intensity and duration of the stimuli, vago-sympathetic equilibrium,

breakdown of part or one of the neuro-regulatory systems, and the humoral transmission mechanism of sympathetic and vagal stimuli. Based on ECG recordings, the author concludes that the effects of jet engine noise and vibrations are of a physiological rather than pathological nature.

10945
Calearo, C., 1959
G. Pestalozza, and G. P. Teatini
[THE COMPREHENSION OF SPEECH IN THE PRESENCE OF DIFFERENT NOISE CONDITIONS] La compresione della voce parlata in presenza di differenti condizioni di rumore.—Archivio italiano di otologia rinologia e laringologia (Milano), 70 (4): 570-580. July-Aug. 1959. In Italian, with English summary (p. 579-580).

Speech comprehension (short sentences of five words) was studied under different noise conditions (global thermic noise and thermic noise with band-passing filters). Low-passing filters (500, 1000, 2000 c.p.s.) caused a more pronounced masking effect than the high-passing filters (500, 1000, 2000 c.p.s.). The use of ear protectors improved speech perception in the presence of noise with high-passing filters (decrease of the signal/noise ratio) and impaired perception in the presence of noise with low-passing filters (increase of signal/noise ratio). (Authors' summary, modified)

10946
Camp, R. T. 1958
THE PERCEPTION OF MULTIPLE-CHOICE INTELLIGIBILITY ITEMS IN THE PRESENCE OF SIMULATED PROPELLER-TYPE AIRCRAFT NOISE.—Ohio State University Research Foundation, Columbus, Ohio (Contract N60NR 22525); issued by U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 18 02 99, Subtask 1). Report no. 73, July 1, 1958. iii+51 p.

The intelligibility scores of 573 listeners responding to words from four multiple-choice tests were obtained as a function of speech-to-noise ratio while the listeners were in the presence of five ambient noise conditions. The noise conditions ranged from quiet (47 decibels) to four sound pressure levels of a simulated propeller type aircraft noise spectrum (98, 108, 118, and 124 decibels). An exponential curve was fitted to the data from each noise condition. The fitted curves were consolidated into one family showing mean work intelligibility as a function of speech level with ambient noise level as the parameter. (Author's summary)

10947
Caporale, R. 1959
[SOME EFFECTS ON MAN OF EXPOSURE TO NOISES AND VIBRATIONS FROM TURBO-JET ENGINES. I. ACOUSTICAL AND NONACOUSTICAL EFFECTS] Alcuni effetti dell'esposizione dell'uomo ai rumori ed alle vibrazioni di motori a turbo-propulsione. I. Effetti acustici e non acustici.—Rivista di medicina aeronautica e spaziale (Roma), 22 (1): 17-43. Jan.-March 1959. In Italian, with English summary (p. 39-40).

Investigations of auditory conditions, vestibular functions, and patellar reflexes were conducted on 23 subjects who had been (1) chronically subjected for several months, many times per day, to noises and vibrations produced by turbo-jet engines; (2) exposed for 30 minutes without protective devices, to noises and vibrations of a turbo-jet engine (118-140 db.; 20-10,000 c.p.s.); (3) exposed a third time wearing ear muffs; and (4) again exposed, wearing ear muffs and specially made coats and boots. Results show that chronic exposure does not induce any noticeable change of the vestibular function, or of patellar reflexes (a few subjects presented a certain degree of hypoacousia). Acute exposure, without protection, caused a heightening of auditory thresholds (due to fatigue), and a reduction of the patellar reflex, but no vestibular changes. The use of ear muffs reduced the effects on the auditory apparatus and caused a disappearance of patellar reflex variations. Other articles of protective clothing were not especially useful; results obtained wearing coat and boots were not different from results obtained wearing ear muffs only. (Author's summary, modified)

10948
Carhart, R. 1959
CRITIQUE OF PRESENT EFFORTS TO DEVELOP A DAMAGE RISK CRITERION.—Amer. Indus. Hyg. Assoc. Jour., 20 (6): 441-446. Dec. 1959.

A review is presented of various damage risk criteria for noisy environments. Contemporary criteria are considered phrased and employed as though they marked firm boundaries of full protection for the industrial worker. The proper approach may be to view these criteria as means of identifying those situations where programs of hearing conservation should be initiated to achieve protection. Improved damage risk criteria will ultimately emerge from the knowledge which research is accumulating and from legal clarification of the socio-economic standards to be satisfied in guarding the hearing of the industrial worker. Only time will tell whether these improved criteria can properly be applied rigidly or whether they must merely remain guides to the need for hearing conservation programs.

10949
Carter, E. T., 1961
E. J. Largent, and W. F. Ashe
SOME RESPONSES OF RATS TO WHOLE BODY MECHANICAL VIBRATION. II. METABOLIC GAS EXCHANGE. —Arch. Environmental Health, 2 (4): 378-383. April 1961.

Respiratory gas exchange was measured in rats during exposure to mechanical sinusoidal vibrations at frequencies ranging from 3 to 26 c.p.s. No increase in gas exchange was observed at any frequency for a vibration amplitude of 0.062 inches. A rise in gas exchange was noted at an amplitude of 0.125 inches at frequencies above 15 c.p.s., and at an amplitude of 0.25 inches above 5 c.p.s. Oxygen consumption tended to decline with continuing exposure to vibration, suggesting the development of a physical adaptation to the stress.

10950
Clark, W. E. 1961
NOISE FROM AIRCRAFT OPERATIONS.—Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-5629); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71711). ASD Technical Report no. 61-611, Nov. 1961. xi+124 p.

This report provides a summary and generalization of knowledge on aircraft ground and flight

operations in the vicinity of air bases, noise source characteristics of military aircraft, and propagation of sound from aircraft to observers in the vicinity of or on air bases. Data from earlier Air Force studies, together with new data gathered specifically under this contract, are summarized and incorporated into aircraft noise prediction procedures and descriptions of operations characteristics. The intent of the report is to provide an integrated presentation of available information and techniques and the factors to be considered in determination of noise from aircraft operations that is intermediate in complexity between a simplified "handbook" and the specific, detailed, source material. (Author's abstract) (48 references)

10951
Clark, W. [E.] 1961
REACTION TO AIRCRAFT NOISE.—Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-5629); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71711). ASD Technical Report no. 61-610, Nov. 1961. xiii+138 p.

The concern of this report is the reaction to aircraft noise of people in communities near air bases and in air base offices. Four kinds of material are offered: (a) several earlier procedures, studies, and data collections are summarized; (b) additional analysis is presented of results from the concurrent sociopsychological interview studies (by the National Opinion Research Center) and noise environment studies (by this contractor) in areas near three Air Force bases, highlighting considerations of the physical environment and the aircraft operations; (c) new data, with results from earlier studies are presented on the reactions of office workers to noise; (d) conclusions are stated regarding the applicability of various available means for predicting reaction to noise intrusion. Several adaptations of earlier procedures are derived, to incorporate the perceived noisiness work and implications from previous results. This report discusses reactions to noise produced by aircraft in military operations. Although many of the concepts and relationships should have application to noise problems in civil aviation and industry, important differences may exist both in the noise stimulus and the attitudes of people. (Author's abstract) (24 references)

10952
Coermann, R. R., 1959
E. B. Magid, and W. Wolff
BIOLOGICAL ACOUSTICAL TESTS. III. THE INFLUENCE OF VIBRATION ON HOLDING THE HORIZONTAL POSITION UTILIZING THE EQUILIBRIUM CHAIR.—In: Project Mercury candidate evaluation program, p. 33-40. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959.

The results suggest that the labyrinth is little affected by vibrations under the described experimental conditions. As the frequency of vibration increased, the movements of the chair became more masked by the vibrations due to the tremendous increase in kineceptor stimulation and, together with the stressful conditions of pain and extreme discomfort, the pilot's ability to perceive the horizontal plane became severely challenged. Performance was affected by mechanical alternating forces acting directly on the head and extremities, and increased muscle tonus due to the alternating stretching of tendons and ligaments of the skeletal musculature. At certain frequencies pain of the chest or abdomen may be encountered and at other frequencies the urge to urinate or defecate may be experienced. Vibration, encountered during this study, then presents the body with a multifaceted stress, testing not only the physiological status but also psychological processes. As frequency increased, the subject experienced extreme discomfort, pain, and bladder and sigmoid colon urgencies. With rapid, severe, alternating forces acting upon various body parts, associated with increase in work output, motivation becomes a prime factor in determining performance of equilibrium. It then follows that these experiments cannot be assured to represent a clear-cut test of the influence of vibration on the sense of equilibrium, per se, but rather must be taken as the individual's total response to vibrational stress and the decrement of performance under these conditions. Only future research can estimate the validity of this test for the selection of specific qualification. (Authors' discussion and conclusions)

10953
Coermann, R. R., 1961
and K. O. Lange
THE EFFECTS OF BUFFETING ON THE HUMAN BODY [Abstract]. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 225-226. 1961.

The mechanical impedances of subjects exposed to vibrations of frequencies below 20 c.p.s. in the standing, sitting and supine positions were determined. Two resonant peaks were evident at 5 and 11 c.p.s. (in standing and sitting). Relaxation of the muscles and artificial support in the pelvic area decreased the impedance; the opposite was found with a pressure suit, which prevented relaxation. The basic natural frequency of the pelvis and spinal column was 5 c.p.s., that of the thorax-abdomen 3 c.p.s. in the supine position with relaxed abdominal muscles. This could be increased up to 8 c.p.s. by supports around the abdomen. Transmission to the head showed maxima at 5 and 11 c.p.s.

10954
Coermann, R. R. 1961
THE MECHANICAL IMPEDANCE OF THE HUMAN BODY IN SITTING AND STANDING POSITION AT LOW FREQUENCIES. — Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). ASD Technical Report no. 61-492, Sept. 1961. vi+39 p.

The theory of the mechanical impedance of systems with one or more degrees of freedom is applied to the human body. A method of measuring mechanical impedance and determining the parameters of the vibrating systems is developed. Impedance curves for longitudinal vibrations of a sitting and standing subject are established for the frequency range of 1 to 20 c.p.s. The influence of varied posture and restraining systems is investigated. Dynamic movements of body parts are measured, directly or indirectly, and compared with the impedance curves. The responsible elements in the

body for the apparent resonances are identified. Correlations between the impedance function of the body and the subjective tolerance curve to vibration are found and the reasons for the tolerance limits are elucidated. The variability of subjective tolerances due to varying posture, restraining systems, cushions, duration of exposure and vibrations are discussed, and conclusions for the development of protective devices are drawn. The correlation between the steady state response of the human body system and the effects of impact is discussed. (Author's abstract)

10955
Coermann, R. R., 1960
G. H. Ziegenruecker, A. L. Wittwer, and H. E. Von Gierke
THE PASSIVE DYNAMIC MECHANICAL PROPERTIES OF THE HUMAN THORAX-ABDOMEN SYSTEM AND OF THE WHOLE BODY SYSTEM.—Aerospace Med., 31 (6): 443-455. June 1960.

The physical and physiological effects of vibrations and impulsive forces applied to the body depend on the dynamic mechanical properties of the body. Mechanical impedance measurements on sitting subjects were performed. The results of these measurements, which exhibit resonance maxima for the impedance at 5 and 11 c.p.s., are presented with respect to the effective parameters of the circuit and the forces and energy transferred to the body. A detailed study of the effects of mechanical forces on the thorax-abdomen subsystem of supine individuals was made. Abdominal wall displacements, oscillating changes in chest circumference and periodic air flow through the mouth were measured for periodic, longitudinal vibration excitation. The resonance of all these response curves is between 3 and 4 c.p.s. A generalized unified model of the total thorax-abdomen system is derived with approximate values for its constants. The model can be used to calculate the dynamic mechanical response to different types of force application: whole body vibration, respirator excitation, slow-rising blast waves, and decompression. Steady-state, as well as impulsive loadings, can be studied on the circuit. (Authors' summary, modified)

10956
Cope, F. W. 1960
PROBLEMS IN HUMAN VIBRATION ENGINEERING.—Ergonomics (London), 3 (1): 35-43. Jan. 1960.

Vibration is considered to include the oscillatory motion of traveling vehicles. The predominant linear sinusoidal component of this motion is usually in the vertical direction and of 0-50 c.p.s. in frequency. A human being or animal subjected to vibration may exhibit a variety of symptoms and anatomical damage. These effects may be diminished by shielding the operator from the vibration of the vehicle. Excessive shielding is undesirable in that it increases the relative motion of the operator with respect to the vehicle, and, hence, may be expected to cause decrement of performance. Some of the physical theory necessary for the design of vibration-shielding equipment is given. Methods for human vibration protection are described and reference is made to a currently available device. (Author's abstract)

10957
Coulter, N. A., 1960
and J. C. West
NONLINEAR PASSIVE MECHANICAL PROPERTIES OF SKELETAL MUSCLE.—Ohio State Univ., Columbus (Contract AF 33(616) 5780); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7232, Task no. 71784). WADD Technical Report no. 60-636, Aug. 1960. iii+7 p.

The nonlinear, passive mechanical properties of skeletal muscle were investigated. The response of frog gastrocnemius muscle to sinusoidal displacements over a frequency band of 0.5 to 25 c.p.s. was determined. From the experimental data a nonlinear differential equation characterizing the passive mechanical behavior of muscle was constructed. (Authors' abstract)

10958
Culbert, S. S. 1960
and M. I. Posner
HUMAN HABITUATION TO AN ACOUSTICAL ENERGY DISTRIBUTION SPECTRUM.—Jour. Applied Psychol., 60 (4): 263-266. Aug. 1960.

The possibility that airplane jet-engine noise of a given sound pressure level would become less annoying to subjects after repeated exposure was tested in a situation in which the (taped) noise was compared to that of a propeller-driven airplane. A group of 28 subjects showed a significant increase in tolerance for the jet-engine noise (in comparison to propeller noise) after two series of exposure trials a week for three consecutive weeks. The tolerance for the habituated group at the end of three weeks was also significantly greater than that shown by 20 control subjects tested then for the first time. A test using additional subjects in another experiment corroborated the results of the first test, but no significant differences were found between those subjects exposed to inter-trial fly-overs while reading airplane instruments and those assigned to the same inter-trial task while exposed to a loud bell or silence. (Authors' summary)

10959
Davis, H., 1958
and S. R. Silverman
AUDITORY AND NON-AUDITORY EFFECTS OF HIGH INTENSITY NOISE.—Central Institute for the Deaf, St. Louis, Missouri (Contract Nonr-1151 (02)); issued by U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 13 01 99, Subtask 1). Report no. 7, June 2, 1958. viii+226 p.

Carrier flight deck personnel aboard two U. S. Navy carriers and a group of shore-based jet aircraft personnel were tested by pure tone audiometry, by various psychological and psychomotor performance tests, and by psychiatric interviews. Analysis of sick-bay calls was also made. No clear, positive effects, either auditory or non-auditory, of exposure to noise were shown by any of the tests. It is unsafe, however, to extrapolate from present noise exposures to the more severe exposures that must be anticipated in the future. Two other undesired effects of high-intensity noise, in the opinion of the investigators, are: interference with communication and decrement in performance of personnel during actual exposure. (Authors' summary)

10960
Davis, H. 1958
EFFECTS OF HIGH-INTENSITY NOISE ON NAVAL PERSONNEL.—U. S. Armed Forces Med. Jour., 9 (7): 1027-1048. July 1958.

A field study was conducted to investigate the cumulative aftereffects of high-intensity noise exposure in carrier flight-deck and shore-based jet aircraft personnel. Analysis was made of the relation between estimated relative noise exposures of various groups of personnel and results of audiometric tests, psychologic and psychomotor performance tests, psychiatric interviews, and number of sick-bay calls. A group audiometer was designed to test 10 subjects at once by the psychophysical method of single descent. Audiometric testing was conducted in the field in a specially designed mobile trailer laboratory. A noise cumulator was developed to measure the actual noise exposure of personnel by analysis of a tape recording of noise transmitted from the subject's helmet. The study revealed that operational exposures of flight-deck crews to very high intensity noise are very brief. No clear auditory or nonauditory effects of exposure to noise were shown by any of the tests, but a slight general decrement in performance was suggested. It is concluded that as of March 1957 there was no basis for alarm concerning possible cumulative ill effects of operational exposures to jet engine noise, or need for changes in operational procedures or protective equipment. It is suggested that operational noise exposures should be monitored to detect future changes which might present a hazard to personnel.

10961
Dieckmann, D. 1958
A STUDY OF THE INFLUENCE OF VIBRATION ON MAN.—Ergonomics (London), 1 (4): 347-355. Aug. 1958.

The effects of vertical and horizontal mechanical vibrations up to 100 cycles per second on the human being were examined by physical and physiological methods. Resonance phenomena are described. A strain scale is given for vertical and horizontal vibration excitation. Special examinations of the movement of the head show elliptic vibrations in spite of linear excitation. (From the author's abstract)

10962
Dreher, J. J., 1960
and W. E. Evans
SPEECH INTERFERENCE LEVEL AND AIRCRAFT ACOUSTICAL ENVIRONMENT. — Human Factors, 2 (1): 18-27. Feb. 1960.

Basic concepts and formulation of the speech interference level (SIL) measure are discussed and the implications of the use of SIL to measure aircraft cabin environment are analyzed. Intelligibility tests with both words and phrases indicate that serious interference with speech can be demonstrated by adding supposedly unimportant frequencies to the SIL criterion masking band. Innocuous effects are also demonstrated by masking with low frequencies alone. Conclusions are drawn that because of the complex nature of a propeller-driven aircraft acoustic environment, SIL criteria, without qualification, are unacceptable for measuring either intelligibility or comfort. (Authors' abstract)

10963
Drogichina, E. A., 1959
and N. B. Metlina
[THE CLINICAL PICTURE OF VIBRATION SICKNESS] K Klinike vibratsionnoi bolezni.—Klinicheskaia meditsina (Moskva), 37 (9): 104-110. Sept. 1959. In Russian, with English summary (p. 110).

The clinical picture of vibration sickness is extremely diverse. The symptomatology includes local vasomotor derangements of the axon reflex type, and a general systemic reaction evoked by the effect of vibration on reflexes. Four stages of the disease are distinguished. The first two stages are characterized by reversible vasomotor disorders, while in the third and fourth stages the pathological process becomes stabilized and may lead to more or less permanent damage. The severity and course of the disease depend not only on the duration and intensity of the vibration, but also on the individual sensitivity to that particular vibration. High-frequency vibration has the most adverse effects on the human organism. Experimental findings show that the extent of injury varies with the individual and is related to deficiencies in the endocrine and autonomic nervous systems. Current concepts in the treatment and prophylaxis of vibration disease are discussed.

10964
Dunn, W. G. 1961
PREDICTING FLIGHT VEHICLE NOISE. — Environmental Quarterly, 7 (3): 34-36. July 1961.

To design a flight vehicle four steps should be taken, namely: (1) the prediction of the acoustic environment in the near and far fields and in flight; (2) the calculation of the noise-reduction capabilities of the structure and the room characteristics of the craft's compartments; (3) the ascertaining of the interior noises and their source of origin; and (4) the setting up of tests for the qualification of the vehicle based on the predictions made. The author discusses various methods to carry out these stages. It is advised that suitable methods be used for the suppression of in-flight noises that affect flight personnel and the general community. These require the use of such devices as ear plugs, hush houses, runup pens, various types of noise mufflers, the setting up of safety zones for personnel, and education of the public.

10965
Egan, J. P., 1961
G. Z. Greenberg, and A. I. Schulman
OPERATING CHARACTERISTICS, SIGNAL DETECTABILITY, AND THE METHOD OF FREE RESPONSE. — Jour. Acoust. Soc. Amer., 33 (8): 993-1007. Aug. 1961.

The method of free response refers to the following listening situation. Against a background of noise, a weak signal is presented several times in a long (2-minute) observation interval. The temporal intervals between the presentations of the tones are randomly distributed; consequently, the listener does not know when a tone will occur, and he does not know how many tones will be presented. From one series of observation intervals to the next, the listener is instructed to adopt various criteria and to press the single response-key each

time he hears a tone. The problem consists in the determination of a procedure that allows the total number of yes responses to be partitioned meaningfully between hits and false alarms. A model is developed in which the measurable quantity, rate of response, is related to the hit rate and to the false-alarm rate. Although the criterion adopted by the listener cannot be directly evaluated, the use of a wide range of criteria makes it possible to estimate the detectability of the signal. Two experiments are described, and the results support the model. (Authors' abstract)

10966
Eldredge, D. H., 1959
W. P. Covell, and R. P. Gannon
ACOUSTIC TRAUMA FOLLOWING INTERMITTENT EXPOSURE TO TONES.—Annals Otol., Rhinology and Laryngol., 68 (3): 723-732. Sept. 1959.
Also published in: Transactions Amer. Otological Soc., 47: 94-105. 1959.

In earlier experiments it was shown that exposures to 500 c.p.s. tones produced constant loss of cochlear microphonics (CM) when the acoustic energy of the exposures was constant. This relation obtained for exposures ranging from 133 decibels sound pressure level (SPL) for five minutes to 118 decibels SPL for 160 minutes. In a new series of experiments, intermittent 500 c.p.s. tones with a 28% duty cycle and a rate of repetition of 14 bursts per second produced losses of CM and cochlear injuries indistinguishable from those produced by continuous exposures when the sum of the "on" periods equalled the continuous periods. The conclusions of the earlier experiment were confirmed and can be enlarged to include intermittent bursts of tone by describing effective duration of exposure in terms of the "on" fractions of the tones. The application of these results to man is limited by species differences and by lack of knowledge of the relations between cochlear injury in animals and temporary threshold shift in man. (Authors' summary)

10967
Engel, A., 1960
and E. S. Mendelson
LABORATORY APPROXIMATION OF INDIVIDUAL TOLERANCE TO AIRCRAFT CARRIER DECK NOISE.—Aerospace Med., 31 (9): 739-744. Sept. 1960.

Extratympanic manometry is a useful technique for studying the auditory reflex in man. Sample data were obtained regarding threshold, dynamic ranges, persistence, overstimulation, depression, and recovery of various functions of the auditory mechanisms in human subjects. The auditory reflex recordings reflect the functional states of the Eustachian tube and the middle ear. From these findings it is concluded that the method enables flight surgeons to analyze individual reactions to noise advantageously. (Authors' conclusions)

10968
Ernsting, J. 1961
RESPIRATORY EFFECTS OF WHOLE BODY VIBRATION. — RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/1164, May 1961. i+24 p.

At certain frequencies and accelerations, vertical sinusoidal vibration caused a significant increase in pulmonary ventilation (including an increase in oxygen consumption at the highest frequency) when applied to the buttocks of a seated subject over the frequency range of 1.7-9.5 c.p.s. and at amplitudes of up to ±1 g. Under all conditions investigated, however, there was a true hyperventilation as evidenced by the reduction in end-expiratory and arterial carbon dioxide tensions. Respiratory flow was affected at all frequencies, and the esophageal and gastric pressures oscillated with a frequency equal to that applied to the subject. When a constant acceleration was applied, the gastric pressure oscillations were greatest at a vibratory frequency of 3 c.p.s. The addition of external resistances to respiratory flow reduced the volume of gas oscillating in and out of the respiratory tract as well as reduced the degree of hyperventilation. (From the author's summary)

10969
Fraser, T. M., 1961
G. N. Hoover, and W. F. Ashe
TRACKING PERFORMANCE DURING LOW FREQUENCY VIBRATION. —Aerospace Med., 32 (9): 829-835. Sept. 1961.

Healthy subjects were exposed to harmonic sinusoidal vibration in 48 randomly selected combinations of three planes, four frequencies, and four amplitudes, namely 2, 4, 7, and 12 c.p.s., and ± 1/16, 1/8, 3/16, and 1/4 inch. After training to proficiency in the nil vibration state, the subjects' performance of a similarly vibrating tracking task was measured. Measurements were also made of the ability of vibrating subjects to track a non-vibrating task. Decrement in performance was observed related to plane, and to function of amplitude modified by a fractional exponent of frequency. A significant difference was observed between the performance of a vibrating task and a non-vibrating task. (Authors' summary)

10970
Gierke, H. E. von 1959
VIBRATION AND NOISE PROBLEMS EXPECTED IN MANNED SPACE CRAFT.—Noise Control, 5 (3): 8-16. May 1959.

The present information on noise, vibration, and transient accelerations of space craft during launch and re-entry is reviewed and discussed in regard to human physiological and psychological tolerances and performance. Using general knowledge of noise and vibration sources, estimations and predictions are made of noise and vibration levels which may be experienced inside and outside a manned space craft. The order of magnitude of the noise levels can be reasonably predicted for the launch phase; estimates of the noise during hypersonic re-entry are considered less accurate. It is concluded that vibration problems with regard to human occupants may be confined to the low-frequency oscillations and transient accelerations expected at rocket burn-out and during re-entry, respectively.

10971
Glekin, G. V. 1958
CHANGES IN DEGREE OF SYLLABLE ARTICULATION WHEN TABULAR MATTER IS READ OUT

REPEATEDLY UNDER NOISY AND SILENT CONDITIONS.—Biophysics (New York: Pergamon Press), 2 (4): 448-455. [1958].
English translation of item no. 7491, vol. VI.

10972
Goldman, D. E., 1960
and H. E. von Gierke
THE EFFECTS OF SHOCK AND VIBRATION ON MAN.—Naval Medical Research Inst., Bethesda, Md. Lecture and Review Series no. 60-3, Jan. 8, 1960. 48 p.

A review is presented of the following items: (1) determination of the structure and properties of the human body considered as a mechanical as well as a biological system; (2) effects of shock and vibration forces on this system; and (3) protection required by the system under various exposure conditions and means by which such protection is provided. The methodological and instrumentation problems and criteria of the measurement of the effects of shock and vibration on the human body are discussed. Consideration is given to the evaluation of data obtained from simulations of the mechanical environment, and to factors in the design of human simulations. The physical characteristics of the body tissues are described, and data concerning the passive mechanical responses of the human body and tissues exposed to impact forces and to infrasonic, sonic, and ultrasonic vibration applied in various directions are summarized. The mechanical, physiological, and psychological effects of mechanical vibration, the effects of blast and shock waves on the lungs, gastro-intestinal tract, heart, and ear, and the effects of impact or rapid deceleration in the longitudinal and transverse direction on the head and on the neck are described. Protective measures accomplished by isolation, to reduce the transmission of forces to the body, or by an increase in mechanical resistance to force are discussed, including elastic cushioning by seat suspension, and use of body harnesses, helmets, and shelters. Experimental data are presented concerning the levels of tolerance to vibration and rapid deceleration, vibration levels produced by vehicles, and typical crash impact forces.

10973
Gravendeel, D. W., 1961
and R. Plomp
PERMANENT AND TEMPORARY DIESEL ENGINE NOISE DIPS. — Arch. Otolaryngol., 74 (4): 405-407. Oct. 1961.

To find any homologies in the genesis of permanent and temporary noise dips in audiograms, the hearing losses of 48 persons exposed for 1 to 10 years to the noise of diesel engines were compared with those of 15 subjects exposed for the first time to 30 minutes of continuous diesel engine noise. Except for the slight changes in the slopes of the two curves there were no apparent, significant differences in the dips. It then appears that with continuous noise the two dips are brought about by the same mechanism, and the permanent dip arises from the temporary dip by incomplete but symmetrical recovery.

10974
Gravendeel, D. W., 1959
and R. Plomp
THE RELATION BETWEEN PERMANENT AND TEMPORARY NOISE DIPS.—A.M.A. Arch. Otolaryngol., 69 (6): 714-719. June 1959.

As a result of the influence of noise on the auditory organ, permanent (irreversible) and temporary (reversible) hearing losses may arise. Location, size, and shape of these hearing losses (dips) are best determined by means of the method of continuous audiometry. The question is considered whether the temporary and permanent dips which have come about as a result of the influence of the same noise (noise from light fire arms) may show some degree of resemblance. It appears that both kinds of dips show only to a certain extent a resemblance as to shape. As to the location of the maxima of dips there is no resemblance at all. It is clear that the laws found in the experiments concerning temporary auditory fatigue lose their validity in the case of the appearance of a permanent hearing loss. Thus it is not allowable to apply the results of these experiments to the problem of the origin of the permanent noise dip. (From the authors' summary)

10975
Grimaldi, J. V. 1958
SENSORI-MOTOR PERFORMANCE UNDER VARYING NOISE CONDITIONS.—Ergonomics (London), 2 (1): 35-43. Nov. 1958

A group of subjects performed a task (guiding a stylus around a pattern by means of hand controls) in quiet and noisy environments. The noise was intermittent, within the frequency range of 75 to 9600 c.p.s. and at sound levels of 70, 80, 90, and 100 db. The study was experimental, but simulated an occupational situation. There was a tendency for more errors and less precision when working in the noisy environment. Response times were slower and the number of errors greater than when noise levels and frequencies were highest. The frequency range of 2400-4800 c.p.s. was associated with the slowest response time and largest number of errors, both at 90 and 100 db. It appears that intermittent noise may have a reducing effect on the individual's capacity for quick and precise execution of coordinated movements. The implications for safety and certain production tasks seem obvious. (Author's summary)

10976
Grognot, P., 1959
and G. Perdriel
[EFFECTS OF NOISE ON CERTAIN VISUAL FUNCTIONS] Influence du bruit sur certaines fonctions visuelles.—Médecine aéronautique (Paris), 14 (1): 25-30. 1959. In French, with English summary (p. 30).
Also published in: Vision Research, 1 (3-4): 269-273. Oct. 1961.

Exposure to white noise above 90 db., for 5 to 15 minutes, did not cause any decrease in visual acuity, visual field, or physical components of the steroscopic sense. It was observed, however, that the depth perception was reduced. Color perception was also modified, with a trend toward protanomalopia as measured with the Nagel anomaloscope. Night vision, as measured with a Beyne scotoptometer, was strongly impaired. (Authors' summary, modified)

10977
Grognot, P., 1959
and G. Perdriel
[INFLUENCE OF NOISE ON COLOR AND NIGHT

VISION] Influence du bruit sur la vision des couleurs et la vision nocturne.—Comptes rendus de la Société de biologie (Paris), 153 (1): 142-143. 1959. In French.

Determinations were made of the effects of a complex noise (with frequencies between 50 and 5,000 c.p.s. and intensities varying between 98 and 105 db.) on the color vision and night vision of 20 human subjects. After five minutes of exposure, the rapidity of color perception was altered, and a narrowing of the visual field for colors (pronounced for red) and an appreciable diminution of night vision were observed. Visual acuity, as measured by the Beyne optometer, did not vary.

10978
Grzesik, J. 1961
[STUDIES ON THE EFFECT OF ACOUSTIC AND ULTRASONIC FIELDS ON BIOCHEMICAL PROCESSES. IV. THE EFFECT ON THE LEVELS OF PYRUVIC, OXALACETIC, CITRIC, AND ALPHA-KETOGLUTARIC ACIDS IN THE BLOOD OF GUINEA PIGS] Badania nad wpływem pola akustycznego i ultraakustycznego na procesy biochemiczne. IV. Wpływ na poziom kwasu pirogronowego, kwasu szczawiooctowego, kwasu cytrynowego i kwasu α-ketoglutarowego we krwi świnek morskich. —— Acta physiologica polonica (Warszawa), 12 (5): 757-766. Sept.-Oct. 1961. In Polish, with English summary (p. 765).

Guinea pigs were exposed to acoustic and ultrasonic fields of 2 w/cm.^{2} intensity at frequencies ranging from 100 to 50,000 c.p.s. There was a statistically significant increase of the pyruvate and alpha-ketoglutarate levels in the blood depending upon the energy dose which the animal received. This could be interpreted as a metabolic block in the sequence pyruvate → acetyl-coenzyme A as well as that of alpha-ketoglutarate → succinyl-coenzyme A. The increase in alpha ketoglutarate may also reflect increased transamination to keep the C_4 dicarboxylic acids, especially oxalacetate, within normal limits. There were no changes in the levels of oxalacetate and citrate. (Author's summary, modified)

10979
Guignard, J. C., and P. R. Travers 1959
EFFECT OF VIBRATION OF THE HEAD AND OF THE WHOLE BODY ON THE ELECTROMYOGRAPHIC ACTIVITY OF POSTURAL MUSCLES IN MAN: SOME QUALITATIVE OBSERVATIONS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 120, April 1959. i+9 p.

Vibration of the whole body or of a single limb at frequencies below 10 c.p.s. elicited a periodic synchronous stretch reflex from resting postural muscles in that limb. The amount of activity observed appeared to be related to the intensity of vibration and could be reduced by restraining passive movement of the limb. Inhibition of tendon reflexes was not observed. No change attributable to local mechanical stimulation occurred in the character of maximum volitional response or in the excitability of postural muscles. Intense vibration of the upper body, including the head, appeared to have a facilitatory effect upon statokinetic reflex activity, the effect persisting after vibration had ceased. It is tentatively concluded that this effect might be associated with vestibular stimulation by low-frequency vibration but more precise experiments will be required to show whether this is true and whether simple vibratory labyrinthine stimulation has a direct tonic effect upon postural activity. (From the authors' summary)

10980
Guignard, J. C. 1961
HUMAN FREQUENCY-RESPONSE TO VIBRATION [Abstract]. —— In: Space medical symposium. Astronautik (Stockholm), 2 (4): 227. 1961.

In exposure to infrasonic frequencies of mechanical vibration, a number of physical resonances occur in man, in particular resonance of the shoulder girdle at about 5 c.p.s. Data on the effects of vibration on task performance, visual performance, and on frequency response of eye movements will be given in the full paper.

10981
Guignard, J. C. 1959
THE PHYSICAL RESPONSE OF SEATED MEN TO LOW-FREQUENCY VERTICAL VIBRATION: SOME PRELIMINARY STUDIES.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1062, April 1959. i+10 p. AD 229 171

Vertical sinusoidal vibration was applied to ten male subjects in a standardized sitting position, at frequencies from 7 to 60 c.p.s. and accelerations up to 1 g. Transmissibility, the ratio of the peak vibration acceleration recorded at the part of the body concerned to that recorded from the reference accelerometer, was measured at the hip and at the shoulder. A peak in transmissibility indicative of resonance occurred below 10 c.p.s., and at higher frequencies transmissibility fell off in a characteristic way. There was no evidence of a major body resonance above 12 c.p.s. Tensing appears to increase transmissibility at all frequencies. Subjectively, discomfort was greatest at the lower frequencies. Below 12 c.p.s., major parts of the body appear to be excited to resonate while at higher frequencies progressively smaller parts are affected. Six of the subjects experienced some feeling of instability while being vibrated, with difficulty in holding a given posture, but the feeling ceased with the end of vibration. (Author's summary and conclusions, modified)

10982
Gundy, R. F. 1961
AUDITORY DETECTION OF AN UNSPECIFIED SIGNAL. —— Jour. Acoust. Soc. Amer., 33 (8): 1008-1012. Aug. 1961.

Listeners were required to detect an auditory signal against a background of "white noise". The effects (1) of giving trial-by-trial information as to whether or not a signal was delivered, and (2) of giving the subject an opportunity to hear the signal before the test sequence began, were studied at two levels of signal energy. The results were analyzed within the context of the theory of signal detectability. Subjects who were given an opportunity to hear the signal before the test sequence began maintained a stable level of performance throughout the experimental session. On the other

hand, subjects who were given no opportunity to hear the signal performed near chance level at the beginning of the session but showed gradual improvement as trials progressed. The effect of trial-by-trial feedback was surprisingly small in all groups. Near the end of the session, the signal was demonstrated to all subjects and the differences between the groups vanished. (Author's abstract)

10983
Gurovskii, N. N. 1959
(HYGIENIC ASSESSMENT OF THE VIBRATION FACTOR ON THE MI-4 HELICOPTER) K voprosu o gigienicheskoi otsenke vibratsionnogo faktora vertoleta MI-4.—Gigiena i sanitariia (Moskva), 24 (3): 27-33. March 1959. In Russian, with English summary (p. 33).

The physiological effects on animals and human subjects of vibrations (45 c.p.s. at an amplitude of 0.3 mm. for 1 hr.) approaching the highest frequency limits for helicopter vibrations were investigated. Initial exposure to such vibrations produced considerable changes in conditioned motor reflexes of white rats and in conditioned defense reflexes of dogs. Alterations in conditioned reflexes and lengthening of reaction times were observed in airmen exposed to vibrations on the laboratory stand and during flight in the MI-4 helicopter. It is concluded that initial vibratory stimuli evoke a spread of inhibitory processes through the central nervous system of both man and animals. However, adaptation took place quite rapidly upon repeated exposure to such stimuli in all subjects studied. It appears that vibration disturbs the excitatory-inhibitory equilibrium in the cerebral cortex, thus enhancing the inhibitory processes of the orienting reaction-external inhibition type. The rapid and stable appearance of adaptation to vibration in the human organism indicates that vibrations of the order found in MI-4 helicopters are permissible.

10984
Harbold, G. J., 1961
and J. W. Greene
A FIELD STUDY OF THE EFFECTS OF EXPOSURE TO IMPULSE NOISE ON HEARING ACUITY. —Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-2005, Subtask 1). Report no. 11, May 15, 1961. [24] p.

Delineation of the hazard of varying amounts and types of gunfire noise was attempted based on audiometric testing and questionnaire data from three general categories of Navy and Marine Corps personnel. Relationships between the audiometric data and questionnaire data supported expectations that exposure to gunfire would result in hearing losses in the test frequency range between 2 kc. and 8 kc. Beyond this the contributions from the data comparisons were unrewarding. The AADS audiometer proved to be less than adequate for research of this type; however, the Békésy-type audiometer was found to be highly sufficient. Suggestions are given for arriving at an improved methodology in the future.

10985
Harris, J. D. 1959
AUDITORY FATIGUE FOLLOWING HIGH FREQUENCY PULSE TRAINS.—Naval Medical Research Lab., New London, Conn. (Project no. NM 22 03 20.02.01, Subtask 2, Report no. 1). Report no. 306 (vol. 18, no. 1), Jan. 21, 1959. iii+9 p.

Large groups of young men were exposed tc high intensity pulse trains at 2.5 kc. and examined continuously for subsequent acuity changes at 4 kc. Duty cycle varied from 1.4% tone-on to 100%, train length from 1 to 25 min., and sound pressure level (SPL) from 90 to 120 db. A new unit, the NOX, representing total cumulative fatigue over a 10-min. interval, was invented to describe the results. The effect of SPL was linear over the 90-120 db. range. The effect was linear with log train duration. Equinoxious contours were drawn stating which combinations of intensity and duration give the same effect. Equal energy input yielded equal fatigue. At the frequency region 2-4 kc. and octave band of noise has the same effect as a pure tone about 5 db. weaker. For pulses of these durations and intensities a variety of ear protective devices can prevent any possible permanent damage. (Author's abstract)

10986
Hartz, N. 1960
SOUND, NOISE, AND HEARING.—Instruments and Control Systems, 33 (2): 249-251. Feb. 1960.

A discussion is presented of the effects of noise on the human ear. Consideration is given to safe and injurious levels of intensity and frequency, to methods of measuring noise levels, to methods of testing hearing, to techniques for reducing noise, and to personal protection against noise through use of ear defenders. Typical sound-pressure levels and the relative energy generated by these levels are tabulated.

10987
Helvey, T. C. 1960
STUDY IN BIOSEISMOLOGY: DISSIPATION OF VIBRATIONAL ENERGY IN THE HUMAN BODY. — Astronautik (Stockholm), 2 (2): 89-102. 1960. In English.

Experiments have been performed to study the dissipation of transversal and longitudinal vibrational energy in various parts of the human body. The results show that in the subsonic, low-frequency range, body parts exhibit distinct resonance frequencies which in many cases can be detrimental to human performance. It has been found that there is no direct proportionality between performance decrement and discomfort caused by the vibration. A new type of human oscillator is described briefly. The equipment provides low-frequency, high-amplitude random motion with three degrees of freedom. Although the equipment can be used for the study of the propagation of vibrational energy in the human body, its prime purpose is the study of the mechanism of the onset of disorientation and motion sickness. (Author's abstract)

10988
Hirsh, I. J., 1958
and M. Burgeat
BINAURAL EFFECTS IN REMOTE MASKING.—Jour. Acoust. Soc. Amer., 30 (9): 827-832. Sept. 1958.

An experiment was carried out to test whether the dependence of binaural masked thresholds on the interaural phase relations of both the signal tone and the noise extends to the remote masking

of low-frequency tones by a high-frequency band of noise (2000-4000 c.p.s.). The results indicate that a phase reversal of the tone at the two ears has the same effect in remote masking as in ordinary masking; but a phase reversal of the high-frequency band at the two ears produces changes in the masked threshold midway between those encountered in ordinary masking and no change at all. The results indicate that the interaural time relations between the remote-masking sources that result from a phase reversal of the high-frequency band involve a time shift of about one half-period of the band midfrequency and a decrease in the interaural correlation. (Authors' abstract, modified)

10989
Hoover, G. N., 1961
W. F. Ashe, J. H. Dines, and T. M. Fraser
VIBRATION STUDIES. III. BLOOD PRESSURE RESPONSES TO WHOLE-BODY VIBRATION IN ANESTHETIZED DOGS. —— Arch. Environmental Health, 3 (4): 426-432. Oct. 1961.

Eight dogs were subjected to sinusoidal vibrations along the horizontal axis of the body of 0-10 c.p.s. at an amplitude of 0.25 inches from 5 to 10 minutes at each frequency. Effects of the vibrations on blood pressure varied according to the blood vessel measured, but in general there was a significant drop in the average systolic and diastolic pressures at about 2.5 c.p.s. with a subsequent progressive increase at higher frequencies. The pressures as actually measured consisted of the sum of two components, the true blood pressure and pressures resulting from the vibration forces. The results indicate that vibration brings about a small decrease in true blood pressure.

10990
Hrazdira, I. 1961
[MORPHOLOGICAL CHANGES IN LEUKOCYTES AFTER ULTRASONIC IRRADIATION] Morfologické změny leukocytů po ozvučení ultrazvukem. —— Scripta medica (Brno), 34 (7-8): 315-322. 1961. In Czech, with English summary (p. 321).

Thirty normal subjects were exposed to ultrasonic waves of 800 kiloherz frequency, of the intensity used in ultrasonic therapy, i.e., from 0.2 to 2 watts/cm.^{2}. Blood samples revealed morphological changes affecting both the cell nucleus and protoplasm in all types of leukocytes. These changes were destructive and resulted in total cell disintegration. The decrease in the total number of leukocytes in relation to exposure time was exponential in character. Lymphocytes were found to be more resistant to ultrasonic exposure than granulocytes. (Author's summary, modified)

10991
Hurevich, M. I., 1960
and M. F. Syrotina
[THE EFFECT OF ULTRASONIC VIBRATIONS ON THE BLOOD] Pro vplyv ul'trazvukovykh kolyvan' na krov.—Fiziologichnyi zhurnal (Kyiv), 6 (1): 73-78. Jan. 1960. In Ukrainian, with English summary (p. 78).

The effects of ultrasound on the morphological composition of blood were investigated in vitro and in vivo. Ultrasonic vibrations at intensities of 0.2 to 3.5 watt/cm.^{2} had a destructive action on the formed elements of the blood in vitro with sodium citrate admixture. This action increased with the intensity of ultrasound. No substantial changes were detected in the composition of peripheral blood of rats one hour after their abdominal area had been vibrated for 3 min. at 0.5 watt/cm.^{2} intensity. A reduced leukocyte count was noted on the second day. In many instances it rose again on the sixth day and reached the pre-vibration level on the twelfth day. Ultrasound of 2 watts/cm.^{2} for 4 min. was fatal to rats within 1.5-2 hours; analysis of blood an hour after exposure disclosed no significant changes. Similarly there were no significant changes in the blood composition of rabbits vibrated in the abdominal area for 30 min. with 2 watts/cm.^{2} intensity. Application of ultrasound for 5 min. with the intensity increased to 4.5 watts/cm.^{2} to the abdominal area of rats caused their death within a few minutes; analysis of blood showed a reduction of leukocytes and erythrocytes. (Authors' summary, modified)

10992
Jacobs, H. I. 1960
A REVIEW OF AVAILABLE INFORMATION ON THE ACOUSTICAL AND VIBRATIONAL ASPECTS OF MANNED SPACE FLIGHT.—Aerospace Med., 31 (6): 468-477. June 1960.

A review of noise and vibration in manned space flight is presented. The two primary sources of noise are the rocket engine jet and the boundary layer turbulence or aerodynamic noise. Both produce a wide-band random noise with essentially no pure tones. The noise problem changes with the relative contribution from each source. The sound pressure levels for various engines and rockets are plotted, as are predicted levels for firing, launch, and re-entry conditions. A comparison of the predicted acoustic environment for space vehicles and the available data on human tolerance to noise indicates that noise will not present a health hazard if attention is given to the design of the manned capsule with respect to its resonance characteristics. Previous work indicates that adequate radio communications systems can be developed. The principal sources of vibration in space vehicles are the same as for noise. Vibrational energy is transmitted for the most part at the structure's resonant frequencies. The resonant frequencies depend on the missile's length, mass, and stiffness, and are usually below 50 c.p.s. Accurate prediction of the vibrational characteristics of a future vehicle is nearly impossible at the present time, but vibration as limited by the structural requirements of current space vehicle design, is within human tolerance limits.

10993
Jerison, H. J., 1958
C. W. Crannell, and D. Pownall
ACOUSTIC NOISE AND TIME JUDGMENT IN A VISUAL MOVEMENT PROJECTION TASK.—In: Symposium on Air Force Human Engineering, Personnel, and Training Research, p. 147-154. National Academy of Sciences—National Research Council, Publication no. 516. 1958.

The effect of high-level noise on time judgments was studied by having four groups of 50 subjects work on a visual movement projection task in which a moving target disappeared and a guess had to be made as to when the target was under a cross-hair. Each subject worked individually, was exposed to only one noise program, and repeated his task for ten successive trials. Effects of noise programs were sig-

nificant at the .01 level of confidence. The significant effect of noise programs was due mainly to a displacement averaging more than 1.5 sec. of the judgment time vs. trial number function for the quiet-then-noise program. The effect of trials appears to be the same regardless of noise programs and is a fairly smooth, negatively accelerated, rising curve in which judgment time increases with succeeding trials. (Authors' summary, modified)

10994
Jerison, H. J. 1959
EFFECTS OF NOISE ON HUMAN PERFORMANCE.— Jour. Applied Psychol., 43 (2): 96-101. April 1959.

The results of three experiments relating performance changes to noise levels are reported. Noise levels used were about 80 db. representing "quiet" and 110 db. representing "noise". Changes in alertness as determined on a clock-watching task were found after one and one-half hours in noise, though none were found in quiet. Time judgments — the estimation of the passage of 10 minutes — were distorted by noise; subjects responded on the average of every nine minutes in quiet and every seven minutes in noise when instructed to respond at what they judged to be 10-minute intervals. A significant but complex effect of noise on a mental counting task was also found. These effects are discussed in terms of noise as a source of psychological stress. (Author's summary)

10995
Jones, Allen R., and F. W. Church 1960
A CRITERION FOR EVALUATION OF NOISE EXPOSURE. — Indus. Hygiene Jour., 21 (6): 481-485. Dec. 1960.

A new method of appraising noise exposures has been developed. It is based on the concept of hearing conservation rather than of damage risk. Hearing conservation criteria are used to judge whether or not hearing conservation measures should be taken rather than to predict when hearing loss will occur. The method proposed for evaluating noise data takes into account the more restrictive recommendations made recently for the 4th, 5th and 6th octave bands. Exposure time variations are taken into account by means of a new form that has been devised for plotting octave band measurements. A supplemental graph is presented and can be used for summing up noise exposures at different intensity levels, with the over-all exposure expressed as "Per cent of Allowable Weekly Noise Dose." (Authors' summary)

10996
Jones, T. C. 1960
THE NOISE PROBLEM. — Tactical Air Command Surgeon's Bulletin, Headquarters Tactical Air Command, Langley Air Force Base, Va. 1 (2): 2-8. May 1960.

The sources of noise on some Air Force bases are: (1) aircraft undergoing maintenance run-ups; (2) aircraft and missiles during take-off or flight; (3) engine test stands; (4) rocket and missile test firings; (5) various ground power units or static machinery, such as sheet metal or carpenter shops; and (6) traffic and people. These sources may cause physical injury to man (deafness), interfere with communications, cause fear and annoyance, and induce or contribute to accidents.

10997
Józkiewicz, S., and M. Krause 1961
[INVESTIGATION OF THE EFFECT OF SONIC AND ULTRASONIC FIELDS ON BIOCHEMICAL PROCESSES. IV. EFFECT ON ERYTHROCYTE AND SERUM CHOLINESTERASE ACTIVITY OF GUINEA PIGS] Badania nad wpływem pola akustycznego i ultraakustycznego na procesy biochemiczne. IV. Wpływ na aktywność cholinesterazy krwinek czerwonych i osocza. — Acta physiologica polonica (Warszawa), 12 (2): 291-294. 1961. In Polish, with English summary (p. 290).

No changes were found in erythrocyte and serum cholinesterase activity of guinea pigs exposed to sonic and ultrasonic fields produced by means of an aerodynamic generator. These results, in contrast to a formerly-published report of a decrease in serum albumin, indicate that the hypothesis of a temporary liver impairment is erroneous. In addition, the lack of change shows that sonic and ultrasonic fields have no effect on the cholinergic neurons of the nervous system. (Authors' summary, modified)

10998
Khursin, M. IU. 1961
[DYNAMICS OF CHANGES IN THE CONTENT AND METABOLISM OF NUCLEIC ACIDS AFTER ULTRASOUND IRRADIATION] Dynamika zmin vmistu i obminiuvanosti nukleinovykh kyslot pislia oprominennia ul'trazvukovimi khvyliami. — Fiziologichnyi zhurnal (Kyiv), 7 (5): 667-671. Sept.-Oct. 1961. In Ukrainian, with English summary (p. 671).

Testes of albino rats were irradiated with ultrasonic waves (800 kc.p.s.) at intensities of 2.5, 2, and 1 watt/sq. cm. for 10 minutes, and the nucleic acid metabolism was investigated. After exposure to ultrasound at 2 w/cm^2 intensity or higher there was a reduction in the nucleic acid content of the testes which persisted for at least two months. Twenty days after exposure to the above intensities the nucleic acid content was reduced also in glands which were not exposed to ultrasound. An intensity of 1 w/cm^2 caused a certain reduction in testicular nucleic acid. The uptake of radioactive phosphorus by the nucleic acids in testes declined immediately after irradiation and started to rise again on the third day after exposure. Rapid changes after the exposure but not during the exposure indicate an indirect effect of high-frequency mechanical oscillations on the nucleic acid content. Ultrasound at the intensities used caused lesions of the tissues.

10999
Khursin, M. IU. 1961
[EFFECT OF ULTRASOUND ON THE NUCLEIC ACID CONTENT IN THE TISSUES OF THE ANIMAL ORGANISM] Pro vplyv ul'trazvuku na vmist nukleinovykh kyslot u tkaninakh tvarinnoho organizmu. — Fiziologichnyi zhurnal (Kyiv), 7 (2): 266-270. March-April 1961. In Ukrainian, with English summary (p. 270).

Experiments were conducted on the testes of albino rats, one gland being subjected to the action of ultrasonic waves and the second serving as a

control. A therapeutic ultrasonic generator with a frequency of 800,000 c.p.s. was used. The determination of the quantity of nucleic acids was carried out on the SF-4 spectrophotometer. It was established as a result of the investigations that ultrasonic waves of 2 w/cm.^{2} intensity and over, with a ten-minute exposure and stationary contact, regularly induce a decrease in the nucleic acid content of the testes in albino rats. The fall in nucleic acid content progresses with increase in ultrasonic intensity. At an intensity of 0.6 and 1 w/cm.^{2} ultrasound does not give rise to any substantial changes in the nucleic acid content under the given experimental conditions. (Author's summary)

11000
King, P. F., 1958
and R. P. Gannon
THE PROBLEM OF NOISE IN THE ROYAL AIR FORCE.—Proc. Royal Soc. Med. (London), 51 (1): 45-52. Jan. 1958.

Short term effects of aircraft noise are: interference with communication in flight between crew members or over radio telephone; general fatigue; temporary partial hearing loss in flight. Continued exposure to noise will perpetuate fatigue in lasting deafness. Measures adopted for protection are: careful selection of personnel by clinical and audiometric testing; periodic examinations of men; examination of noise in working situation and subsequent amelioration of it; research in type of protective helmet. A new helmet design incorporates radio telephone receiver in a protective ear muff which is built into a cotton helmet. Other studies have led to improvements in cabin insulation and a change-over to low noise level aircraft. With increasing power of aircraft engines the noise creates a far greater hazard for the ground crew. The authors suggest that the following steps may be taken: (1) instruction given to ground personnel on effects of noise, (2) periodic hearing check of exposed men, (3) ear protection by means of a plastic plug or protective ear muff, (4) rotation of crews if protections is impossible, (5) and mufflers and silencers for engines. The design of airfield or flight patterns should be planned to give as much noise relief as possible. The use of muffler pens is at the present time the preferred method for controlling the effect of noise on the civil population. Deflecting walls have a disadvantage of reflecting instead of absorbing sound.

11001
Knapp, M. J., 1959
and J. L. Bernier
THE RESPONSE OF ORAL TISSUES TO ULTRASOUND.—Jour. Amer. Dental Assoc., 58 (1): 50-61. Jan. 1959.

A hostologic study was made of the effects of an ultrasonic dental machine on teeth, their supporting structures, interpremaxillary and intermandibular suture regions, and temporomandibular joint of 15 young adult dogs. The exposure times to ultrasound were 36, 18, 9, 4.5, or 2.5 minutes. The findings are as follows: (1) Changes were directly related to exposure time. (2) Changes in dentin and the odontoblastic layer were marked. (3) The pulp tissue showed congested blood vessels and lymph channels, vacuolization, edema, fibrosis, and in three teeth "cyst" formation. (4) Inflammatory cellular exudate of the pulp was not seen, nor were there any visible changes in the periodontal membrane, alveolar bone, interpremaxillary and intermandibular suture regions, or temporomandibular joint. (5) The dynamics of the reactions over a period of time for all groups showed that the dogs sacrificed after two days and ten days sustained damage to the odontoblastic layer and to pulp tissue. The dogs sacrificed after 30 days showed good evidence of recovery. No changes from which recovery was not possible were noted in the oral soft and hard tissues of the dogs. (Authors' summary and conclusions, modified) (29 references)

11002
Krushinskii, L. V. 1958
and L. P. Dobrokhotova
THE EFFECT OF THE THYROID GLAND ON THE MORTALITY RATE IN SHOCK-HEMORRHAGIC CONDITIONS CAUSED BY STRONG SOUND STIMULI.—Bull. Exper. Biol. and Med. (Consultants Bureau, New York), 44 (8): 945-947. 1958.

English translation of item no. 7506, vol. VI, 1957.

11003
Kuligowski, Z. K. 1961
[MOTOR CONDITIONAL REFLEXES IN RATS SUBJECTED TO COMBINED ACTION OF VIBRATION AND NOISE] Ruchowe odruchy warunkowe u szczurów poddanych kompleksowemu działaniu wibracji i hałasu. — Acta physiologica polonica (Warszawa), 12 (6): 821-832. 1961. In Polish, with English summary (p. 831-2).

Gastro-intestinal conditional motor reflexes were elicited in nine rats by the method of Kotlarewski. Exposure to vibration (frequency 1.5 hertz, amplitude 16 cm.) and noise (68 db.) simultaneously for ten days, six hours on each day, resulted in prolongation of the latent period of positive reactions or in their partial abolition (40.2% of cases), and in improved differential inhibition. (Author's summary, modified)

11004
Kuznetsov, M. I., 1959
IU. F. Udalov, and N. A. Chelnokova
[THE EFFECT OF VIBRATION ON THE METABOLISM OF SOME VITAMINS IN THE HUMAN BODY] Vliianie vibratsii na obmen nekotorykh vitaminov v organizme cheloveka.—Voprosy pitaniia (Moskva), 18 (3): 14-17. May-June 1959. In Russian, with English summary (p. 17).

Nine subjects were exposed to vibrations of the frequency of 10-70 oscillations per second, with an amplitude 0.4-1.6 mm., for four hours. The test subjects were on a ration of 3800-4400 Cal./day during the experiments. The vibration caused a reduction in the vitamin C content in the blood plasma. A parallel reduction in the concentration of vitamins C, B_1, B_2 and 4-pyridoxic acid in the urine was also noted.

11005
Lawrence, M. 1961
AUDITORY PROBLEMS IN OCCUPATIONAL MEDICINE. — Arch. Environmental Health, 3 (3): 288-296. Sept. 1961.

Under the proper circumstances noise is able to produce over-fatigue, erroneous actions caused by the lack of communications, vestibular disturbances which disorientate the worker, and a loss of hear-

ing. Previous work shows that extremely high levels of sound produce vestibular disturbances with the possibility of destroying the organ of Corti. The stages in the destruction of the organ of Corti can be approximately correlated with changes in the electrical response of the cochlea, and audiometric measurements can with certain reservations be correlated with morphological damage. The extent of recovery depends on the amount of original damage and the physiological state of the ear at the time of the injury and during recovery. The influence of the physiological state is shown by the great variation in loss of sensitivity after overstimulation in guinea pigs. Using the harmonics produced by the ear at certain intensities, it is possible to judge the physiological condition of the ear, and this is already used clinically for separating conductive from perceptive deafness. The one reliable method of detecting hearing loss is still monitoring audiometry.

11006
Lehmann, J. F.,
and E. W. Johnson
SOME FACTORS INFLUENCING THE TEMPERATURE DISTRIBUTION IN THIGHS EXPOSED TO ULTRASOUND.—Arch. Physical Med. and Rehabilitation, 39 (6): 347-356. June 1958.

Temperature distribution was measured in pig thigh specimens exposed to ultrasound at a frequency of 1 megacycle per second and with a peak output intensity of 0.25 w./cm.^{2}. The decline of tissue layer temperatures with distance from the transducer was found to resemble an exponential curve. The highest temperature peak occurred in the superficial layers of exposed tissue, or within the subcutaneous fat of whole specimens. When an artificial temperature gradient was produced to simulate life before exposure to ultrasound, the temperature peak was found in the deeper tissue layers. No selective rise of temperature was observed at the periosteum or within the bone, despite the much greater absorption of ultrasound and lower specific heat of bone. This result is attributed to the greater thermal conductivity of bone and the substantial reflection of ultrasonic energy at its surface.

11007
McCabe, B. C., 1958
and M. Lawrence
THE EFFECTS OF INTENSE SOUND ON THE NON-AUDITORY LABYRINTH.—Acta oto-laryngologica (Stockholm), 49 (2): 147-157. March-April 1958. In English.

Two groups of guinea pigs were stimulated by a noise of 136 db. and 150 db. above 0.0002 dyne/cm^2, respectively, and were examined histologically for disturbance of the vestibular labyrinth. The saccule was found to be the locus of damage for these high-level sounds (destruction of the otoconia of the otolithic membrane). Other structures of the vestibule remained normal. (Authors' abstract, modified)

11008
McCroskey, R. L. 1958
THE EFFECT OF SPECIFIED LEVELS OF WHITE NOISE UPON FLICKER FUSION FREQUENCY.—Ohio State University Research Foundation, Columbus, Ohio (Contract N6 ONR 22525); issued by U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 18 02 99, Subtask 1). Report no. 80, Aug. 18, 1958. ii+10 p.

The introduction of white noise, from 85 to 115 db, into a room in which 72 individual subjects determined their threshold of fusion changed the critical frequency from approximately 27 to approximately 24. The level of noise within the range tried and the duration of the subjects' exposure to noise were not conclusively or uniformly differentiating. (Author's summary)

11009
MacDuff, J. N., 1958
and J. R. Curreri
VIBRATION CONTROL.—vii+465 p. New York, etc.: McGraw-Hill Book Co., 1958.

This textbook, which deals with some of the fundamental knowledge of vibration control, is written for mechanical engineering students at the senior or first year graduate student level. Elementary vibration theory is dicussed, along with such specific studies as rotor balancing, vibration isolation, steady-state and transient response, and sound control problems. (156 references)

11010
McKenzie, R. E. 1961
THE EFFECT OF BINAURAL BEATS ON PERFORMANCE. — Jour. Auditory Research, 1 (3): 176-185. April 1961.

A study was designed to determine the effects of binaural interaction, produced by binaural beat stimulation, upon certain performance measures. The hypothesis tested was that binaural beat stimulation would produce an interaction process in the central nervous system with resulting performance decrement. The results indicate that binaural beats do disrupt and hinder certain kinds of performance. A theoretical explanation involving disruption of the normal pattern of nervous system activity by hypersynchronous discharge is suggested as the mechanism by which certain forms of binaural stimulation, having periodic form, produce performance change. The fact that the binaural beats in this experiment were eight per second raises the possibility that the neural mechanism may be related to the normal alpha rhythm. Finally, there are indications that this neural process is not available to correct subjective assessment. (Author's summary)

11011
Magid, E. B., 1960
R. R. Coermann, and G. H. Ziegenruecker
HUMAN TOLERANCE TO WHOLE BODY SINUSOIDAL VIBRATION: SHORT-TIME, ONE-MINUTE AND THREE-MINUTE STUDIES.—Aerospace Med., 31 (11): 915-924. Nov. 1960.

The purpose of this study was to define human subjective tolerance to whole-body sinusoidal vibrations between 1 and 20 c.p.s. for short-time, one-minute, and three-minute periods. A tolerance curve based on subjective responses of the ten subjects in the short-time study was compiled. Because of the danger of incurring actual body damage, the actual tolerance level was estimated for the long-time studies. Sixteen sensations or symptoms were recorded and a table describing regional symptomatology was compiled unique to low-frequency, high-amplitude sinusoidal whole-body vibrations within the range of subjective tolerance. A discussion is given of the possible etiology of the effects of vibra-

tion on the jaw, the pharynx, speech, the pelvis, voluntary muscular contraction, muscle tone, lumbosacral pain, Valsalva maneuver, and respiration. Electrocardiograms were taken before, during, and after each run. No abnormal tracings were observed except in one case, in which the subject experienced momentary syncope associated with inversion of the P wave and a nodal tachycardia. It is suggested that subjective response be utilized to aid in defining mechanical and physiological reactions of the body to vibration. (Authors' summary, modified)

11012
Malcík, V. 1961
[AVIATION AND NOISE. III.] Letectví a hluk. III. —— Letecký obzor (Praha), 1961 (5): 141-143. 1961. In Czech.

The high incidence of abnormal otologic findings in flight personnel as compared to other occupations exposed to noise points to the influence of other flight conditions such as rapid changes in altitude, oxygen breathing, and vibration. Recent research approaching this problem by electrophysiological, audiometric, statistical, and histological techniques is cited extensively to show the direct effect of high-intensity noise on the hearing apparatus. Additional detrimental effects of noise involve psychosomatic disturbances of the cardiovascular system, and disturbances of the endocrine and nervous-system functions investigated both experimentally and in the field.

11013
Markarian, S. S.
[THE EFFECT OF VIBRATIONS ON THE EAR-NOSE-AND-THROAT ORGANS] O vliianii vibratsii na LORorgany.——Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 70-74. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 117-123. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

Five series of experiments were conducted with 14 male subjects, 22-35 years of age, using the following parameters of vibration, characteristic of certain types of aircraft: (1) frequency 10 c.p.s., amplitude 1.8 mm; (2) 40 c.p.s., amplitude 0.8 mm.; (3) 40 c.p.s., amplitude 1.6 mm.; (4) 10 c.p.s., amplitude 2.4 mm.; and (5) 70 c.p.s., amplitude 0.4 mm. The exposure in the first three series lasted 4 hrs.; in the last two series, 8 hrs. A predominantly high-frequency noise in the intensity range of 105-110 db. was added in the first and second series for six subjects. The function of the sound analyzer was examined by audiometry before the start of vibrations, five or ten min. after vibrations, and an hour after the vibration was discontinued. The function of the vestibular analyzer was investigated by means of electric rotary chair before, during and after vibrations. Vibration in the parameters studied unassociated with noise does not produce any changes in the function of the vestibular analyzer or cardiovascular system. Vibrations of a frequency of 70 c.p.s., amplitude 0.4 mm. and above produce hearing changes in presence of noise of 105-110 db. It is concluded that vibration in combination with noise within the limits indicated is not physiologically permissible.

11014
Mazzella, G., 1961
and G. P. Ghinozzi
[SOME EFFECTS OF VIBRATIONS OF LOW FREQUENCY ON THE RABBIT (HEMATOLOGICAL AND URINARY 17-KETOSTEROID VARIATIONS)] Alcuni effetti delle vibrazioni di bassa frequenza sul coniglio (variazioni ematologiche e 17 KS urinari).——In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 519-522. Roma, 1961. In Italian.

Eight rabbits were exposed to vibrations using a vibrating counter in which the frequency varied from 10 to 50 Hz every two minutes, with a constant amplitude of 1.6 mm. A hematological study revealed that (a) after the experiment, the erythrocytes decreased by 8.02%, hemoglobin decreased 5.9%, and the hematocrit decreased 6.07%; (b) no significant changes occurred in platelets or reticulocytes; and (c) leukocytes increased by 22.93%, and granulocytic neutrophils increased slightly. A study was also made of urinary 17-ketosteroids (17-KS) during the period of vibrations. It was observed that the quantity of 17-KS excreted in the urine increased as the duration of the vibrations increased. When the vibrations ceased, a decrease was noted in the quantity of excreted hormones. It is concluded that vibrations, even of low frequency, can induce in the animal the "alarm state" which corresponds in most cases to an excessive response of the adrenal gland and the neurovegetative system to influence 17-KS and blood behavior.

11015
Mozell, M. M., 1958
and D. C. White
BEHAVIORAL EFFECTS OF WHOLE BODY VIBRATION.——Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. NM 18 01 12.4, Report no. 1). Report no. NADC-MA-5802, Jan. 28, 1958. iv+17 p. AD 156 470
Also published in: Jour. Aviation Med., 29 (10): 716-724. Oct. 1958.

A study was made of the effects of whole-body vibration on visual and manual performance. Subjects were required to read within 5 seconds three 1/4-inch digits on a mileage indicator placed at a distance of 7 feet, and to center a moving trace by manipulation of an aircraft control stick during vibration. Vibration at frequencies up to 8 c.p.s. had no effect on visual performance, while increases above 8 c.p.s. had an increasingly detrimental effect which reached a maximum at 40-50 c.p.s. Increases in vibration double amplitude from 0.05 to 0.1 inch did not affect visual performance, but the interaction of frequency and amplitude was significant. Tracking performance was not affected by changes in amplitude from 0.05 to 0.16 inch, or in frequency from 0 to 23 c.p.s. It is concluded that frequency and amplitude, rather than g units, should serve as coordinates in the evaluation of vibration effects.

11016
Neely, K. K. 1959
HEARING CONSERVATION FOR THE ARMED FORCES.——Med. Services Jour. (Ottawa), 15 (4): 235-247. April 1959.

Missiles, rockets, aircraft engines, ship engines, armament, vehicles, etc. generate high-intensity noise which may create physiological and psycholog-

ical problems for exposed personnel. These problems include decreased hearing acuity, mechanical or pathological body injury, changes in work behavior, feelings of fear, apprehension, irritation, annoyance, and dissatisfaction, etc. The implemen tation of a hearing conservation program should aid in preventing permanent hearing losses in individuals exposed to high-intensity noise and in maintaining their efficiency under adverse noise conditions. The program should include environmental noise analysis; audiometry of personnel; development of hearing protection criteria for long term occupational exposure to high intensity noise; instruction of personnel in the use of ear-protection devices (ear plugs, earmuffs); and provision of an education program to instruct personnel in the psychophysiological effects of high-intensity noise, masking of voice communications, and the methods by which these effects can be minimized.

11017
Nixon, J. C., and A. Glorig 1961
NOISE-INDUCED PERMANENT THRESHOLD SHIFT AT 2000 CPS AND 4000 CPS. — Jour. Acoust. Soc. Amer., 33 (7): 904-908. July 1961.

Samples of workers were drawn from environments with continuous, steady-state noise of 77 to 96 decibels in the octave bands from 150 to 4800 c.p.s. Aging effects were subtracted from the observed median hearing levels and the remaining values were called noise-induced permanent threshold shift (NIPTS). There was a maximum NIPTS produced at 4000 c.p.s. within the first ten years of exposure to average sound pressure levels greater than 75 decibels in the higher octave bands. The maximum NIPTS values for each sample agreed well with the noise-induced temporary threshold shift values after 8 hours of exposure predicted from the sound pressure level values of the noise environments. No apparent maximum NIPTS occurred at 2000 c.p.s. within the exposure ranges studied. NIPTS for both 2000 and 4000 c.p.s. were monotonic functions of exposure time and sound pressure level. (From the authors' abstract and summary)

11018
Nowak, A. 1961
[INVESTIGATIONS OF THE INFLUENCE OF ACOUSTIC AND ULTRAACOUSTIC FIELDS ON BIOCHEMICAL PROCESSES. VII. INFLUENCE ON MITOTIC ACTIVITY IN THE CORNEAL EPITHELIUM IN GUINEA PIGS] Badania nad wpływem pola akustycznego i ultraakustycznego na procesy biochemiczne. VII. Wpływ na aktywność mitotyczną nabłonka rogowki oka u świnki morskiej. — Acta physiologica polonica (Warszawa), 12 (6): 901-904. 1961. In Polish, with English summary (p. 903-904)

A single exposure of guinea pigs to an acoustic or ultrasonic field causes a decrease of dividing cells in the corneal epithelium. Immediately after 12 or 24 noise exposures there is a marked increase in mitotic activity. An interval of 8 or 24 days after 24 exposures to noise results in a return to normal mitotic activity similar to controls Immediately after one, twelve, or twenty-four exposures to noise an inverse ratio is observed between the blood glucose level and the number of dividing cells. Eight to twenty-four days after the last exposure this relationship cannot be observed. (Author's summary, modified)

11019
O'Connell, M. H. 1960
AIRCRAFT NOISE. — School of Aviation Med., Brooks Air Force Base, Tex. Aeromedical Review no. 3-60, June 1960. iii+29 p.

A review is presented of the physical and physiological bases for the medical problems of noise in aviation. Consideration is given to the types of noise encountered during flight, from radio and from jet, reciprocating-engine, and turboprop aircraft; to the noise encountered during ground operations from various plane types; the effects of noise and ultrasonics on hearing, speech perception, fatigue, and work output; the pattern of noise-induced hearing impairment and somatic symptoms of noise damage; methods of protection against noise damage; and the effect of ear defenders on speech perception during ground and flight operations.

11020
Odend'hal, F. 1959
HOW TO PROTECT YOURSELF AGAINST NOISE. — Space-Aeronautics, 31 (6): 101-107. June 1959.

An analysis is made of the effects of noise on hearing, work performance, and spoken communication. Acceptable noise levels are graphed and fundamentals of protective wall and door design are explained.

11021
Odescalchi, C. P., and A. Pendini 1959
[EFFECT OF NOISE ON WORK EFFICIENCY IN PREVENTIVE MEDICINE] Influenza del rumore sul rendimento in medicina preventiva. — Lavoro umano (Firenze), 11 (12): 587-592. Dec. 1959. In Italian, with English summary (p. 591).

An analysis is presented of the results obtained from an industrial audiometric orientation profile and the reaction time tests in workers before and after a work cycle in a monotype department with a high, but not dangerous, noise level. In the majority of cases there was found a displacement of the auditory threshold by a mean value of 25 decibels and a marked decrease in both auditory and visual selection tests. Both findings indicate signs of fatigue. (Authors' summary, modified)

11022
Oleneva, G. N. 1961
[CIRCULATORY DISTURBANCES AND HISTOPATHOLOGICAL CHANGES IN THE BRAIN OF WHITE RATS DUE TO THE ACTION OF SOUND] Narusheniia krovoobrashcheniia i gistopatologicheskie izmeneniia v golovnom mozgu belykh krys pri deistvii zvuka. — Vestnik oto-rino-laringologii (Moskva), 23 (1): 34-40. Jan.-Feb. 1961. In Russian, with English summary (p. 40).

Groups of rats were subjected to chronic and acute sound stimulation (80-130 db.) by an electric bell. Morphological analysis showed the following: (1) Sound stimulation in rats without audiogenic seizures produced visible disturbances in the blood vessels and changes in the nerve cells, dendrites, and myelin fibers; these changes were localized chiefly in the system of the sound analyzer, particularly in the cortex and medial geniculate body, and in the area of the skin and

mechanical analyzer; there were insignificant lesions in the more distant parts of the brain. (2) Animals which responded with convulsions manifested vascular disturbances and gross lesions in the cortical area of the skin and mechanical analyzer, medial geniculate body, lateral and ventral nuclei of the thalamus opticus, hippocampus and the reticular formation, and cerebellum; some of these changes were of reversible nature.

11023
Oliver, P. 1961
NOISE—A HEALTH PROBLEM. —Jour. Roy. Inst. Public Health and Hygiene (London), 24 (7): 154-161. July 1961.

The physical properties of noise and its effect on the anatomy of the ear are described. Criteria for noise impairment thresholds suggest a sound pressure level of 85 decibels, above which damage may occur. The effects of noise may be auditory (present either as temporary or permanent hearing loss) or non-auditory (causing interference with communications, annoyance, decreased efficiency, and physiological changes). Noise-suppression principles are advocated for aircraft, especially jets. Suppression at the noise source is recommended by the use of exhaust mufflers attached to the engines or by multi-jet noise suppressors mounted on the engines undergoing test. These direct attachments reduce noise by 20-30 decibels. Noise transmission may be reduced by construction of concrete or metal sound blast walls or by raising earth ramparts.

11024
Orlovskaia, E. P. 1961
[CHANGES IN MUSCULAR EFFICIENCY DURING WORK IN NOISE CONDITIONS] Izmeneniia myshechnoi rabotosposobnosti pri rabote v usloviiakh vozdeistviia shuma. — Gigiena i sanitariia (Moskva), 26 (4): 21-24. April 1961. In Russian, with English summary (p. 24).

Ergographic studies were made of muscular efficiency in 20 persons after 2 hours of dosed physical work performed under conditions of noise. The results were compared with those obtained in control tests of the same persons under normal conditions. In noise, the muscular efficiency was greatly decreased; in the control tests it remained at the same level as, or was higher than, before the work was started. During the experimental situation, one could note a decline of all muscular efficiency indices: the muscular force was decreased, resistance to fatigue was weakened, and feelings of exhaustion were intensified. It is suggested that the decrease of working capacity in noise may be mediated by a delay in the restoration process caused by the noise. (Author's summary, modified)

11025
Osipova, V. G. 1961
[EVALUATION OF THE CONDITION OF PERIPHERAL CIRCULATION IN VIBRATION SICKNESS] K otsenke sostoianiia perifericheskogo krovoobrashcheniia pri vibratsionnoi bolezni. — Gigiena truda i professional'nye zabolevaniia (Moskva), 5 (11): 29-34. Nov. 1961. In Russian, with English summary (p. 34).

Peripheral circulatory function was examined in a group of stone cutters, a group of women grinders exposed to local vibration, and patients suffering from vibration sickness (48 subjects), and 84 healthy workers. Measurements were made of the arterial blood circulation in tissues of the hand (method of Barcroft and Swan) and skin temperature through the work day. In the control group the arterial blood supply to the hands was 3-10 ml./100 ml. tissue per minute. In patients with vibration sickness the arterial supply was below 1 ml./100 ml./min. in 27, and normal in 15 subjects. The arterial blood circulation was impaired in stone cutters and grinders before work, but improved during the working hours concomitant with an increase in the skin temperature of the fingers. A temporary rise in arterial inflow was observed in the patients after physiotherapy and after peroral administration of pachycarpine (a ganglion-blocking alkaloid).

11026
Paolucci, G., 1961
and R. Caporale
[SOME EFFECTS OF LOW-FREQUENCY VIBRATIONS ON THE RABBIT] Alcuni effetti delle vibrazioni di bassa frequenza sul coniglio.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 477-492. Roma, 1961. In Italian.

Using a modified vibrating counter, rabbits were exposed to vibrations of a frequency oscillating between 10 and 50 c.p.s., with a constant amplitude maintained at 1.6 mm. The animals were sacrificed, some after one day and others after six days of vibration exposure. Macro- and microscopic studies of the organs and articulations revealed various types of alterations in these animals, namely congestive and hemorrhagic phenomena (heart, lung, kidney, liver, adrenal gland, spleen) with microflexure of the liver and spleen. Articular changes were mostly hemorrhagic in nature. The pathological changes are attributed to the continuous and protracted microtrauma. With regard to congestion and hemorrhage of various organs, they could be produced by a double mechanism: direct and indirect. The direct mechanism may affect the vessel walls, and the indirect mechanism the blood mass. No lesions (macro- or microscopic) were found in the brain, pituitary, stomach, intestine, or pancreas. Included are figures demonstrating the histopathology of heart, lung, liver, bone marrow, kidney, adrenal gland, articular cartilage, bone epiphysis, and spongy bone.

11027
Pickett, J. M., 1958
and I. Pollack
PREDICTION OF SPEECH INTELLIGIBILITY AT HIGH NOISE LEVELS.—Jour. Acoust. Soc. Amer., 30 (10): 955-963. Oct. 1958.

Speech intelligibility in noise was measured at noise levels ranging up to 130 db. using various speech-to-noise (S/N) ratios. The noise and speech signals were mixed electrically and presented to the listeners over earphones. Five combinations of the following speech and noise spectra were used: speech frequency-emphasis of O db. and +6 db. per octave; random noise spectra with slopes at 0, +6, and -12 db. per octave. With S/N ratio held constant, large decrements in intelligibility were observed for all spec-

tra as the noise level was increased within the range studied. Methods of predicting speech intelligibility in noise are evaluated in terms of the results. Three indices for prediction of speech intelligibility are considered: (1) the over-all S/N ratio, (2) articulation index (AI) computed by the method of French and Steinberg, and (3) AI computed by Beranek's method. The most accurate index of prediction at high noise levels was found to be that of French and Steinberg, if used with a specified correction for noise level and with secondary corrections for some speech and noise spectra. The simplest index, the over-all S/N ratio, when corrected for high noise levels is reasonably accurate and acceptable for most requirements. (Authors' summary, modified)

11028
Plutchik, R. 1959
THE EFFECTS OF HIGH INTENSITY INTERMITTENT SOUND ON PERFORMANCE, FEELING, AND PHYSIOLOGY.—Psychological Bull., 56 (2): 133-151. March 1959.

A review of the more recent experiments dealing with sounds demonstrates the effects of very loud sounds on certain types of complex behavior and time estimation with the possibility implied that the decrement in performance may depend on the sound level as well as on sound intermittency. High intensity noise, even when it has no effect on performance, generally produces symptoms of discomfort, irritability, and distraction. Little is known about the relative annoyance value of different kinds and levels of intermittency. Certain unique subjective characteristics of repetitive sounds are described relating to the effects of various rates of repetition on fusion, estimation of pulse frequency, tonal character, threshold, and loudness. The greatest effects are usually obtained at repetition rates between 5 and 10 pulses per second, a frequency range which coincides more or less closely with the alpha rhythm of the brain. Various studies are cited which report the changes produced by loud or intermittent sounds on the blood pressure, gastric secretion, pulse rate, palmar sweating, respiration, muscle tension, the electroencephalogram, and blood oxygen saturation. Some theoretical concepts are presented which postulate effects of auditory intermittency parallel to those of visual flicker. (Authors' summary and conclusions, modified) (80 references)

11029
Pollack, I., 1959
and J. M. Pickett
INTELLIGIBILITY OF PEAK-CLIPPED SPEECH AT HIGH NOISE LEVELS.—Jour. Acoust. Soc. Amer., 31 (1): 14-16. Jan. 1959.

A single well-trained crew of five listeners were given intelligibility tests under various conditions. Four variables were manipulated: noise spectrum (uniform spectrum noise between 250 and 6800 c.p.s., and low frequency noise in which spectrum level fell 12 decibels per octave between 250 and 6800 c.p.s.); noise levels of 90 and 125 decibels; speech peak-clipping levels of 0.12 and 24 decibels; and speech-to-noise ratio sufficient to obtain a wide range of intelligibility scores. Speech peak clipping (and subsequent restoration of speech power) was found not to result in losses of speech intelligibility in noise. Since speech peak clipping protected the ear against high-amplitude speech peaks, its use at high noise levels appears indicated. Under restricted ranges of conditions, peak clipping may actually improve intelligibility with a constant speech power, and protect communications personnel in high noise fields.

11030
Robinson, F. R., 1961
and J. P. Cleary
EFFECTS OF HIGH INTENSITY SOUND ON CIRCULATION OF THE INNER EAR OF THE GUINEA PIG. —Aeronautical Systems Division, Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). ASD Technical Note no. 61-58, May 1961. iii+5 p.

Blood vessels of the spiral ligament were observed while under sound stimulus of 140 db. for periods up to 30 minutes without microscopically visible changes in rate of flow being recorded. A case report is made of an unusual response of the cochlea of a guinea pig to moderate levels of low frequency sound. Submicroscopic phenomena such as alterations in enzyme kinetics, capillary pore size, and permeability of tissues in response to sound stimuli are suggested as possible causes of variations in metabolism of the spiral ligament. (Authors' summary)

11031
Rosenwinkel, N. E., 1959
and K. C. Stewart
HEARING LOSS RELATED TO NON-STEADY NOISE EXPOSURES.—Amer. Indus. Hyg. Assoc. Jour., 20 (4): 290-293. Aug. 1959.

The possible existence of a relationship between noise as measured with an integrating-type meter and hearing loss was investigated. The noise to which the persons were exposed was widely fluctuating and not sensibly measurable with the conventional types of noise-measuring equipment. Analyses of the collected samples lead to the following conclusions: (1) A significant linear relationship exists between observed hearing losses in the test population and a calculated cumulative noise dose derived from environmental noise measurements conducted with the Stewart noise dose meter; this relationship exists at all frequencies of 2000 c.p.s. and over, but is most intense at 4000 c.p.s., the frequency most susceptible to acoustic trauma. (2) The described relationship cannot be used as an estimator of hearing loss for individuals exposed to noise because of the wide variance of observed hearing losses about the mean. (3) The intensities of the relationship between observed hearing loss and each of the two factors, time of exposure and relative noise dose rate, are about equal. (4) The present data are inadequate to describe the precise relationship between observed hearing losses and exposure to noise. (Authors' summary, modified)

11032
Rosenwinkel, N. E., 1959
K. C. Stewart, and L. G. Doerfler
NOISE AND HEARING LOSS. II. RECOGNITION OF THE HAZARD.—Jour. Occupational Med., 1 (4): 225-229. April 1959.

Excessive noise is apt to prove annoying and actually deleterious to the performance of people engaged in tasks which require concentration, coordination, and/or great skill. Lasting injury to hearing occurs as a result of repeated exposure to noise even though the exact relationship of loss of hear-

ing to excessive acoustic stimulation is obscure. Certain intrinsic defensive mechanisms adequate to protect the ear in noisy situations occurring in nature are: (a) the acoustic reflex of the stapedius and tensor tympani muscles, (b) alteration of the vibratory response of the stapes, (c) the position of the oval and round windows, and (d) auditory adaption. Discussed is the diagnosis and prognosis of hearing loss due to excessive noise exposure.

11033
Rossi, L., 1959
G. Oppliger, and E. Grandjean
[THE NEUROVEGETATIVE EFFECTS ON MAN OF NOISES SUPERIMPOSED ON A BACKGROUND NOISE] Gli effetti neurovegetativi sull'uomo di rumori sovrapposti ad un rumore di fondo.—Medicina del lavoro (Milano), 50 (5): 332-337. May 1959. In Italian, with English summary (p. 336).

Five subjects were exposed to noises of short duration (80-195 decibels, 2000 Hertz). A series of fifteen tests were performed in a quiet environment and another series under continous background noise (70 decibels, 500 Hertz). During the tests, the volume of the hand of each subject was registered by means of a plethysmograph. Noises of short duration induced, at times, temporary decreases in hand volume. These vasoconstrictions were considered as neurovegetative reactions due to noise. The frequency of vasomotor reactions was the same under both experimental conditions; the amplitude of the decreases in hand volume was greater in the case of tests performed under quiet conditions. The results demonstrate that a background noise does not suppress vasomotor reactions following superimposed noise. (Authors' summary, modified)

11034
Sackler, A. M., 1960
A. S. Weltman, and P. Jurtshuk
ENDOCRINE ASPECTS OF AUDITORY STRESS.—Aerospace Med., 31 (9): 749-759. Sept. 1960.

The effects of auditory stress on the endocrine system were tested on 120 rats. The experimental groups were subjected to a single 5-minute period of auditory stimulation (two mixed-sound stimuli and one pure-tone stimulus) per day for 3 weeks. There were consistently significant differences in organ weights: reduction in weight of seminal vesicles and thymus gland, and increased weight of pituitary and adrenal glands. Food and water consumption were reduced in the alarm-bell and pure-tone groups. A histological examination of the tissues and organs revealed slight differences in cell types and relative abundance. The blood glutathione index of the pure-tone stimulated rats was significantly decreased, and adrenal total cholesterol content of the buzzer-stimulated rats was significantly increased. None of the other biochemical measures was significantly alerted, but there is an indication of sex specificity of the reactions. The investigation reveals that differences in sex, tonal composition, and intensity of stimulation may be capable of yielding differences in the biological effects of intense sound. (34 references)

11035
Sanders, A. F. 1961
[SHIFTS IN ATTENTION AND NOISE IMPEDANCE] Aandachtsverschuiving en lawaaihinder. —— Nederlands tijdschrift voor de psychologie (Amsterdam), new series, 16 (6): 460-474. 1961. In Dutch, with English summary (p. 473).

It was shown that in working in noise the regularity of performance decreases. This is explained by the increasing tendency to shift attention from the task at hand to the noise, i.e., from the visual to the auditory sensory channel. Shifts in attention can occur also within one and the same channel. The latter can be investigated by means of multisource tasks where the information is transmitted from different sources requiring a continuous reorientation of attention. The hypothesis was tested that with increasing intravisual shifts of attention there is a clearer effect of the noise. The task presented was a continuous multiple-choice reaction task where the decision depended on the situation of two spatially separated lights. The noise effect was larger when the light spots were perceived at a larger visual angle. (From the author's summary)

11036
Schaefer, V. H., 1959
R. G. Ulmer, and H. J. Link
SOME BEHAVIORAL AND PHYSIOLOGICAL STUDIES IN VIBRATION.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6-95-20-001, Task no. T-5). Report no. 389, June 12, 1959. ii+28 p. AD 218 075

Four experiments designed to explore basic effects of whole-body vibration were conducted. The variables studied were body weight, food intake, fecal output, water intake, urine output, open field activity, and elevated maze and straight-alley behavior. Pathological data were also obtained. The results are interpreted as demonstrating a general decrement or debility in both behavioral and physiological functioning, similar to the usual stress pattern. It was observed that most vibration effects appear to be temporary. Evidence of adaptation to vibration is discussed. Histopathological studies revealed testicular atrophy and myocardial hemorrhages in vibrated animals. Though the present results should not be uncritically generalized, they indicate some possibility of decrement in human operators of vibrating devices. It is felt that investigations of the influence of vibration on the following variables might prove of particular value and interest: changes in metabolic functioning, adaptation, neural and other trauma, motivation, and general performance efficiency under vibration conditions. Though some of these factors cannot be studied in man, the results of animal experiments should be sufficiently generalizable to humans to permit the definition of maximum exposure conditions in terms of both safety and efficiency. (Authors' summary and conclusions)

11037
Schaefer, V. H., 1959
H. J. Link, J. U. Farrar, D. Wiens, and D. H. Yost
LETHALITY IN RATS AS A FUNCTION OF FREQUENCY IN CONSTANT-DISPLACEMENT VIBRATION.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6-95-20-001, Task no. 5). Report no. 390, June 20, 1959. i+14 p. AD 218 076

Whole-body vibration caused death, accompanied by significant pathology, in large samples of albino and hooded rats. With displacement constant at 0.25 in., lethal time decreased greatly as frequency was increased from 20 to 45 c.p.s.; subjects vibrated at 10 and 15 c.p.s., however, were apparently unaffected by

exposure. There was a decrease in variability in lethal time as frequency increased. Younger rats tended to be more resistant to vibration than older ones, though there is doubt concerning the cause of this result. Young males died more quickly than young females, but in older subjects this trend was reversed. Histopathological examination showed myocardial and pulmonary hemorrhages in all groups of subjects except those vibrated at 10 and 15 c.p.s. Also common in younger subjects were pulmonary atelectasis, emphysema, and edema. No control subjects showed any of these effects. Castration reliably lengthened survival time in male rats, providing support for the hypothesis that vibration is similar in many respects to other stress agents. In general, the results both support the supplement the relatively few previous studies in the area. It is concluded that whole-body vibration can be lethal, though what intensities are dangerous for man cannot be known from the present data. The actual causes of death are not entirely certain; intense vibration may cause fatal mechanical trauma to vital visceral organs. (Authors' summary and conclusions)

11038
Schaefer, V. H., and R. G. Ulmer 1959
A REPRESENTATIVE BIBLIOGRAPHY OF RESEARCH IN LOW-FREQUENCY MECHANICAL VIBRATION.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6-95-20-001). Report no. 405, Nov. 12, 1959. ii+27 p.

This is a selective bibliography of research on the physiological, psychological, and pathological effects of vibration, comprising 188 references.

11039
Schmitz, M. A. 1959
THE EFFECT OF LOW FREQUENCY, HIGH AMPLITUDE WHOLE BODY VERTICAL VIBRATION ON HUMAN PERFORMANCE.—Bostrom Research Labs., Milwaukee, Wisconsin (Contract DA-49-007-MD-797). Progress Report no. 2a: Jan. 31, 1958 to Jan. 31, 1959. Report no. 128, [no date]. i+58 p. AD 218 201.

Eighteen human subjects were exposed (while seated on a wooden chair on a mechanical shake table) to vibrations of 2.5 and 3.5 c.p.s. frequency at two displacements (4 conditions total) for 90-minute periods. Pre- and post-control measures were also taken before and after each test session. Their performance was compared to a vibration condition on the following tests: (1) Hand Tremor; (2) Visual Acuity; (3) Compensatory Tracking; (4) Foot Pressure Constancy; (5) Foot Reaction Time; and (6) Body Equilibrium. Results show a significant decrement in performance for visual acuity, compensatory tracking, and foot constancy. No significant changes were observed for hand tremor, foot action time, or body equilibrium test measures. The performance decrements appear to be a direct function of the vibration stimulus. No reliable change in performance for any of the measures was observed for the length of time exposed (90 minutes) although the mean compensatory tracking error did show what may be a residual effect after cessation of vibration. (From the author's summary)

11040
Sekiguchi, S. 1959
[ON THE EFFECTS OF SOUND STRESS. I. INTAKE OF INORGANIC SALT SOLUTION] Onkyō sutoresu no kōka ni tsuite. (1) Bukishitsu yōeki sesshu kodō. [Abstract].—Nihon kōkū igaku shinri-gakkai kiroku [Proceedings of the Japanese Society of Aviation Medicine and Psychology] (Tokyo), No. 7: 5. May 1959. In Japanese.

Changes in internal demand for electrolytes (Na, K) were studied in rats subjected to sound stress. WKA-strain rats were confined to metabolism determination boxes with free access to solutions of 0.15 M NaCl, 0.05 M KCl, distilled water, and food. Measurements of fluid and food intakes, urine output, and weight were made at 24-hr. intervals. After a 5-day control period, a sound stress was introduced by a bell rung for 15 min., ten times a day. After ten days the sound stress was discontinued and the after-effects were observed for several days. In normal conditions during the control period (5 days), the rats ingested the maximum quantity of NaCl. The Kcl intake, however, was increased during the stress period, and this tendency persisted after discontinuation of the sound stress. The urine output was proportional to the NaCl intake. The weight of the rats was not affected by change in the rate of food consumption.

11041
Shabalin, V. A. 1961
[THE EFFECT OF ANGULAR DISPLACEMENTS OF A JOLTING NATURE ON THE HUMAN ORGANISM] O vliianii na organizm cheloveka uglovykh peremeshchenii tolchkoobraznogo kharaktera.—Gigiena i sanitariia (Moskva), 26 (6): 46-51. June 1961. In Russian, with English summary (p. 51).
English translation published by U. S. Joint Publ. Research Serv. (New York), No. 10067 (CSO:6629-N/5), Sept. 8, 1961. 10 p. (Available from Office of Technical Services, U. S. Dept. Commerce)

Forty-eight tests were performed on 10 healthy subjects, 20-22 years of age, to determine the effect produced by aperiodic angular displacements, with an amplitude of 6°, at a frequency of 23-49 per minute (13-49 of which ended in jolts) with an acceleration of 1 to 2 g. Displacements of these parameters tended to raise the excitability of the vestibular apparatus, increased the respiratory volume to 174%, the oxygen consumption to 162%, and the metabolism to 177%. Shifts in cardiovascular and nervous function were related mainly to the frequency of angular displacements and to the number and magnitude of jolts. Displacements at the rate of 23 per minute caused bradycardia, while those at the rate of 49 per minute caused tachycardia and a rise of the maximal blood pressure. (Author's summary, modified)

11042
Shapiro, S. L. 1959
DEAFNESS FOLLOWING SHORT-TERM EXPOSURE TO INDUSTRIAL NOISE.—Annals Otol., Rhinology and Laryngol., 68 (4): 1170-1181. Dec. 1959.

Six cases of deafness are reported which occurred in workers exposed to industrial noise. Comments are made on the etiopathogenesis of this type of deafness, adaptation to noise, and prevention of hearing loss by pre-employment audiograms followed by re-examination to detect unusual susceptibility to hearing loss among workers in chronically noisy occupations.

11043
Shepelin, O. P. 1961
[THE EFFECT OF PULSATING AND STABLE NOISE ON THE BODY UNDER EXPERIMENTAL CONDITIONS] Vliianie impul'snogo i stabil'nogo shuma na organizm v eksperimental'nykh usloviiakh. — Gigiena i sanitariia (Moskva), 26 (3): 25-31. March 1961. In Russian, with English summary (p. 31).

The effects of pulsating and stable high-frequency and medium-frequency noise at levels of 70-75, 80-85, and 95-100 decibels on blood pressure, vascular reaction, chronaxy, auditory and vestibular analyzers, and salivation were studied in seven persons in a special sound- and vibration-proof chamber. The pulsating noise was found to produce a more harmful effect on the investigated functions than the stable one. A noise of 70 to 75 db. did not cause any considerable changes in the body; this fact should be considered in working out hygienic noise standards. (Author's summary)

11044
Sherrick, C. E. 1959
EFFECT OF BACKGROUND NOISE ON THE AUDITORY INTENSIVE DIFFERENCE LIMEN.—Jour. Acoust. Soc. Amer., 31 (2): 239-242. Feb. 1959.

A study of the effect of random background noise on the intensive difference limen (DL) for pure tones was made. Three frequencies (250, 1000, and 4000 c.p.s.) at three sensation levels (20, 40, and 60 decibels) were studied, with signal-to-noise ratios of -15, -10, 0, and 10 decibels present for each condition. Analysis of the data revealed only signal-to-noise ratio as a significant factor affecting the DL. Repetition of the experiment with the psychophysical method of average error, for a 1000-c.p.s. signal at levels of 10, 30, 50, and 70 decibels, and signal-to-noise ratios of -10, 0, 10, and 20 decibels resulted in a lack of systematic shift of the difference limen. The curve relating the difference limen obtained by modulation to signal-to-noise ratio appears to parallel that found in quiet when the difference limen is plotted against sensation level. Some hypotheses relating to the differences of psychophysical procedure are stated. (From the author's abstract)

11045
Speranskii, A. P., and I. L. Martsveladze 1961
[HISTOCHEMICAL INVESTIGATION OF THE CELLULAR NUCLEI IN SUBCUTANEOUS CELLULAR TISSUE OF ALBINO RATS FOLLOWING EXPERIMENTAL ULTRASOUND TREATMENT] Gistokhimicheskoe issledovanie iader kletok rykhloi soedinitel'noi tkani podkozhnoi kletchatki v sviazi s vozdeistviem ul'trazvukom v eksperimente na belykh krysakh. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 51 (5): 101-103. May 1961. In Russian, with English summary (p. 103).

The inguinal region of rats was subjected to ultrasound of two intensities, 1.17 w/cm.^{2} and 0.2 w/cm.^{2}, respectively. Histological and histochemical (Feulgen stain) studies of the subcutaneous connective tissue were made for a period of one month after the exposure. The low-intensity ultrasound caused a stimulation of the tissue and a rise in its desoxyribonucleic acid content. The high-intensity exposure results in a prolonged depression of the connective tissue function and in some disturbances of the nucleic acid metabolism.

11046
Steele, J. E. 1959
BIOLOGICAL ACOUSTICAL TESTS. II. EFFECT OF NOISE ON THE ABILITY TO PERFORM ADDITION.—In: Project Mercury candidate evaluation program, p. 31-32. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 7182). WADC Technical Report no. 59-505, Dec. 1959.

A small control group of college students showed a slight average deterioration in performance in noise while astronaut candidates showed an average increase in rate of performance. Errors in candidates was 22 (about 1% of the problems worked). Seven of these errors occurred during the first quiet period, 5 during the noise, and 10 in the final period of quiet. They were ignored in the scoring because of their small number and apparently random occurrence. The noise produced an average change in rate of addition which was approximately two-fifths as great as the average difference in rate existing between the different subjects when adding in the quiet. The reliability of the test for measuring individual susceptibility to noise-induced changes in performance is not known but is believed to be low. A score of 4 indicates no effect of noise on rate of addition. A higher score shows improved performance during noise. One fourth of the candidates showed a reduced rate of performance in the noise. The extreme was a 15% reduction. The maximum increase was 26% and the median 5%. (Quoted in part)

11047
Svadkovskaia, N. F. 1960
[ON THE CHANGES IN OXIDATIVE PROCESSES IN DIFFERENT PARTS OF THE BRAIN UNDER THE ACTION OF ULTRASONIC VIBRATIONS] Ob izmeneniakh okislitel'nykh protsessov v razlichnykh otdelakh golovnogo mozga pri vozdeistvii ul'trazvukovykh kolebanii.— Fiziologicheskii zhurnal SSSR, 46 (8):1016-1019. Aug. 1960. In Russian, with English summary (p. 1019).

Studies were conducted with live white rats investigating the effect of ultrasonic vibrations of various energy densities (2, 0.85, 0.14, and 0.08 W/cm.^{2}) upon the oxidative processes of brain tissue. A regular phasicity was discovered in the dynamics of tissue respiration and glycolysis in different sections of the brain. The presence of either the depression or the activation phase of the oxidative processes as well as the tendency of their dynamic changes depended on the applied energy densities of the ultrasonic vibrations and the time elapsed between exposure and analysis of the brain tissue by the Warburg method. (Author's summary, modified)

11048
Syrotina, M. F. 1961
[EFFECT OF ULTRASONIC VIBRATION ON THE MORPHOLOGICAL AND PROTEIN COMPOSITION OF THE BLOOD] Vplyv ul'trazvukovykh kolyvan' na morfologichnyi i bilkovyi sklad krovi. — Fiziologichnyi zhurnal (Kyiv), 7 (2): 271-276. March-April 1961. In Ukrainian, with English summary (p. 276).

Rabbits were exposed to ultrasound at a dose of 0.5 w/cm.^{2} ten minutes each day for ten days. The exposure involved the abdomen and was aimed primarily at the liver area. The following changes

were observed: a reduction of the number of erythrocytes, a decrease of hemoglobin percentage in half of the animals, an increase in the thrombocyte number, a variable leukocyte count, and a slight increase of the total serum protein.

11049
Temkin, IA. S. 1960
[PATHOGENESIS AND CLINICAL PICTURE OF VIBRATIONAL COCHLEOVESTIBULAR DISORDERS] Patogenez i klinika vibratsionnykh kokhleovestibuliarnykh narushenii. —— Vestnik oto-rino-laringologii (Moskva), 22 (3): 5-15. May-June 1960. In Russian, with English summary (p. 15).

Disturbances of the cochleovestibular function are relatively frequent in workers in reinforced concrete plants. Sound and vibration play an important role in the pathogenesis of hearing disorders, causing a reduced perception of both high and low sounds. A complete or partial disappearance of the rapid component of experimental nystagmus is the objective symptom of the central lesion. Sometimes it is one of the earliest symptoms of vibration disease. (Author's summary, modified)

11050
Terent'ev, V. G. 1959
[CHANGES IN THE VASOMOTOR REFLEXES DURING EXPOSURE OF MAN TO GENERAL VIBRATIONS] Izmenenie sosudodvigatel'nykh refleksov pri deistvii obshchikh vibratsii na cheloveka. —— Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 9(5):649-656. Sept.-Oct. 1959. In Russian, with English summary (p. 656).
English translation in: Pavlov Journal of Higher Nervous Activity (Pergamon Press, London), 9 (5):570-577. May 1960.

Vibrations of frequencies from 10 to 70 c.p.s. and amplitude of 0.4 mm. did not generally produce any changes in conditioned or unconditioned vasomotor reflexes. Vibrations of frequencies from 10 to 40 c.p.s. and amplitude 0.8-1.2 mm. and of 50 c.p.s. and amplitude 0.8 mm. produced moderate changes in conditioned and unconditioned vasomotor reflexes (reduction in the vascular reaction, disinhibition of differentiation, and increase of spontaneous fluctuations in the plethysmogram) indicative of adaptation. Prolonged exposure of 4 hours induced fatigue. Vibrations of higher frequencies and larger amplitude caused inversion or aboliton of the conditioned and unconditioned vascular reflexes. Injection of caffeine reduced the harmful effect of vibration and contributed to the more rapid restoration of conditioned and unconditioned vascular reflexes. Repeated exposure to tolerable ranges of general vibration results in adaptational changes. (From the author's summary)

11051
Trittipoe, W. J. 1958
RESIDUAL EFFECTS OF LOW NOISE LEVELS ON THE TEMPORARY THRESHOLD SHIFT.—Jour. Acoust. Soc. America, 30 (11): 1017-1109. Nov. 1958.

The present study measures the temporary threshold shift (TTS) following two conditions of high-level noise exposure: (1) a control condition where the high-level noise is preceded by a period of silence; and (2) an experimental condition where the high-level noise is preceded by noise levels which alone produce no apparent TTS. When the non-TTS-producing noise was coupled with the high-level noise, a greater threshold shift resulted than when equivalent periods of silence preceded the same high-level noise. (Author's abstract)

11052
Van Eyck, M. 1961
[RESEARCH ON LABYRINTHINE SOUND INJURY] Recherches sur le traumatisme sonore labyrinthique. —— Acta oto-laryngologica (Stockholm), 53 (2-3): 278-280. March-April 1961. In French.

Prolonged stimulation (60 minutes) by high intensity sound (100 decibels) produced labyrinthine and cochlear dysfunction in the pigeon's ear. Labyrinthine injury was characterized by a great reduction in the amplitude and duration of the nystagmus reaction to rotatory stimulation. These changes were reversible.

11053
Volkov, A. M., 1960
and V. IA. Chirkov
[OSCILLATIONS OF THE HUMAN BODY UNDER THE EFFECT OF VIBRATION] Kolebania tela cheloveka pod vliianiem vibratsii. —— Gigiena truda i professional' nye zabolevaniia (Moskva), 4 (5): 8-12. May 1960. In Russian, with English summary (p. 11-12).

The physiological effects of vibration in the frequency range of 1-70 c.p.s. were investigated on humans with the aid of a vibration table and a vibration stand. A method of simultaneous recording of the oscillatory movements of the human body was employed. The results confirm the resonance nature of oscillations in the frequency range of 5-8 c.p.s and 17-25 c.p.s. for the human body. (Authors' summary, modified)

11054
Vozhzhova, A. I., 1960
and I. A. Sapov
[METHODS FOR THE INVESTIGATION OF PHYSIOLOGICAL CHANGES IN THE HUMAN BODY UNDER THE EFFECT OF NOISE] K voprosu o metodikakh issledovaniia fiziologicheskikh sdvigov pri vozdeistvii shuma na organizm cheloveka. —— Gigiena truda i professional' nye zabolevaniia (Moskva), 4 (5): 36-40. May 1960. In Russian, with English summary (p. 40).

The authors describe a complex method for investigating the physiological effects of medium and high intensity noise in man. The tests are aimed toward the detection of functional changes in the auditory, vestibular, skin, and motor analyzers, in the cardiovascular system, and in the central nervous system. The recording of subjective impressions from the subjects under observation, and the administration of writing and arithmetic tests aid in the assessment of changes in the mental capacity under the noise stimuli. (Authors' summary, modified)

11055
Ward, W. D., 1959
A. Glorig, and D. L. Sklar
TEMPORARY THRESHOLD SHIFT PRODUCED BY INTERMITTENT EXPOSURE TO NOISE.—Jour. Acoust. Soc. America, 31 (6): 791-794. June 1959.

The temporary threshold shift (TTS) was measured 2 and 17 minutes after successive 12-minute exposures to broad-band noise at 106 decibels sound

pressure level, separated by 18 minutes of silence. The results indicate that the TTS existing at the beginning of a particular exposure can be treated as additional time of exposure. Thus, if the residual TTS has a value that would be produced by R minutes of exposure, then the total TTS at the end of an M-minute exposure is given by solving the equation for growth of TTS with exposure time set equal to M+R. (Authors' abstract)

11056
Winchester, C. F., 1959
L. E. Campbell, J. Bond, and J. C. Webb
EFFECTS OF AIRCRAFT SOUND ON SWINE.—Dept. of Agriculture. Agriculture Research Service, Beltsville, Md. (Contract AF 33(616)-55-15); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210). WADC Technical Report no. 59-200, Aug. 1959. vi+47 p. AD 233 449

To determine whether or not aircraft sounds affect swine unfavorably, a series of investigations were conducted. Direct observations and motion picture records were made of animals exposed to reproduced aircraft sounds at high levels of intensity. Heart rate measurements were made in an attempt to determine possible rate changes due to noise. Feeding trials in which pigs were exposed daily to the sound of random "fly-overs" were carried out. Possible effects of noise on reproduction were investigated. In addition, histological studies of the ears and adrenal and thyroid glands of swine after sound exposure were made. None of these lines of investigation yielded evidence indicating that swine are influenced significantly by noise. (Authors' abstract)

11057
Woodhead, M. M. 1960
VALUE OF EAR DEFENDERS FOR MENTAL WORK DURING INTERMITTENT NOISE.—Jour. Acoust. Soc. America, 32 (6): 682-684. June 1960.

Ear defenders were worn for protection against the distracting effects of bursts of loud, but not unacceptable, noise during a mental task. Two types of noise were used: one characterized by high and the other by low frequencies. Performance was better with defenders than without them, and the improvement was particularly marked with the high-frequency burst. The knowledge of wearing protective equipment against an occasional noize hazard did not cause any significant alteration in performance when the hazard was absent. There seems to be no immediate reason why comfortable defenders could not be worn over a period in which even a few loud noises are expected.' (From the author's abstract and discussion)

11058
Wright, H. N. 1959
AUDITORY ADAPTATION IN NOISE.—Jour. Acoust. Soc. America, 31 (7): 1004-1012. July 1959.

The initial rate, extent, and recovery from auditory adaptation were measured in both the presence and absence of noise in ten normal ears by the method of fixed intensity at 250, 1000, and 4000 c.p.s. It was found that the initial rate and extent of adaptation to a tone in noise were greater than to the tone alone at 4000 c.p.s., but not at either 250 or 1000 c.p.s. Recovery from adaptation to tones in both noise and quiet was found to be equivalent, but never complete, at each frequency. When the noise was sustained in one ear and a tone introduced over the noise at 1-min. intervals, there was a systematic decline in response at 250 and 1000 c.p.s., but not at 4000 c.p.s. When the noise was not sustained, but followed the same periodic intervals as the tone, there was a decline in response at 4000 c.p.s., but not at either 250 or 1000 c.p.s. (Author's abstract)

11059
Yannoulis, G. E., 1961
and L. Manolidis
[ON THE STATOACOUSTIC AND PSYCHOSOMATIC DISTURBANCES DUE TO NOISE IN AIRPORT PERSONNEL] Über die statoakustischen und psychosomatischen Störungen des Flughafenpersonals durch Lärm. — Acta oto-laryngologica (Stockholm), 53 (2-3): 219-229. March-April 1961. In German.

Fourteen individuals with normal hearing and physiological response of the posterior labyrinth were subjected to noise in the low-frequency range, medium-frequency range, and to ultrasound vibrations. Subsequently, the functions of the anterior and posterior labyrinths were tested. The results show: (1) no significant disturbances of the anterior and posterior labyrinth functions after exposure to low-frequency sound; (2) an increase of the reflex phenomena of the horizontal semicircular canal of the posterior labyrinth after exposure to medium-frequency sound; and (3) disturbances of the cochlear and the posterior labyrinth function after exposure to ultrasound depending upon the duration of exposure, condition of the middle ear, and age. The physiological effects of noise, particularly in the ultrahigh-frequency ranges are reviewed with respect to the appearance of psychosomatic disorders in flight personnel and the ground crew. The frequency spectra of noise emitted by different types of aircraft are evaluated.

11060
Ziegenruecker, G. H., 1959
and E. B. Magid
SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). WADC Technical Report no. 59-391, July 1959. iii+13 p. AD 227 341

Short-time human tolerance criteria for sinusoidal vibration from 1 to 15 c.p.s. were determined using 10 healthy male subjects ranging in age from 23 to 34 years. At each frequency, the amplitude was increased at a constant rate from zero to the point where the subject stopped the run because he thought that further increase might cause actual bodily harm. The lower levels of tolerance were found to be between 1 and 2 g at 3-4 c.p.s. and at 7-8 c.p.s. The highest tolerance level of 7-8 g was found at 15 c.p.s. Subjective tolerance limits were found to be caused by one or more of seven specific sensations or symptoms. Physiological observations during vibration exposure were also made. (Authors' abstract)

h. Physical Work

11061
Altland, P. D., 1961
and B. Highman
EFFECTS OF EXERCISE ON SERUM ENZYME

VALUES AND TISSUES OF RATS. —— Amer. Jour. Physiol., 201 (2): 393-395. Aug. 1961.

Young adult rats were exercised in a rotating drum for 16 hours. Immediately after the exercise, there was a two- to sixfold increase in serum glutamic oxalacetic transaminase, serum glutamic pyruvic transaminase, serum lactic dehydrogenase, serum aldolase, and blood urea nitrogen, and a decrease in serum alkaline phosphatase. Recovery of different enzymes from these altered values occurred at different rates during a period of 1 to more than 6 days. The rats also showed a 13% loss in body weight and severe depletion of liver glycogen. Pathologic studies revealed an abundant deposition of fine fat droplets in skeletal muscle fibers, liver cells, and renal tubular epithelium and lipid depletion of the adrenal cortex. Some animals showed small foci of inflammation and necrosis in the muscle fibers. The pathologic lesions were transient and disappeared before complete return of the serum glutamic oxalacetic transaminase and serum aldolase values to normal levels. (Authors' abstract)

11062
Åstrand, I., 1960
P. O. Åstrand, E. H. Christensen, and R. Hedman
INTERMITTENT MUSCULAR WORK. —— Acta physiologica scandinavica (Stockholm), 48 (4): 448-453. 1960. In English.

The physiological effect of rest pauses on a non-steady-state work (2,160 kgm./min.) was studied. A physically well trained subject performed in one hour a total amount of 64,800 kgm. on a bicycle ergometer by intermittent work with 0.5, 1, 2 or 3 min. periods of work and rest. Total O_2 intake, total pulmonary ventilation, total number of heart beats and blood lactic acid concentration during the work hour and during recovery were determined. It was found that the heavy work, when split into short periods of work and rest (of 0.5 or 1 min. duration), was transformed to a submaximal load on circulation and respiration and was well tolerated during one hour. With longer periods (of 2 or 3 min. duration) the work output closely approached the upper limit of performance and could be fulfilled only with the utmost strain. These findings are discussed from a physiological and practical point of view. In order to explain the low lactic acid values during the short periods of work and rest it was proposed that the myohemoglobin has an important function as an oxygen store during short spells of heavy muscular work. (Authors' abstract)

11063
Åstrand, I., 1960
P.-O. Åstrand, E. H. Christensen, and R. Hedman
CIRCULATORY AND RESPIRATORY ADAPTATION TO SEVERE MUSCULAR WORK. —— Acta physiologica scandinavica (Stockholm), 50 (3-4): 254-258. 1960. In English.

A trained subject performed a constant work output per minute (2,160 kgm./min. or 360 Watts) with variations in work time for 0.5 minute up to the maximum tolerable time of 9 minutes. The chronological changes in different functions, such as heart rate, pulmonary ventilation, etc., responsible for oxygen transport were recorded at a given time. After the start of work the subject reached identical values for these functions and for oxygen uptake independent of the total length of time which was known to the subject, when the work started. The heart rate and other related functions of importance concerning oxygen uptake are narrowly regulated by the work output and the fitness of the subject and are apparently, to an exceptionally high degree, resistant to changes in the mental state of the trained subject. (Authors' abstract)

11064
Åstrand, P.-O., 1961
and B. Saltin
OXYGEN UPTAKE DURING THE FIRST MINUTES OF HEAVY MUSCULAR EXERCISE. —— Jour. Applied Physiol., 16 (6): 971-976. Nov. 1961.

Oxygen uptake, heart rate, pulmonary ventilation, and blood lactic acid were studied in five subjects performing maximal work on a bicycle ergometer. After a 10-minute warming up period work loads were varied so that exhaustion terminated exercise after about 2-8 min. Peak oxygen uptake and heart rate were practically identical in the experiments. The heavier the work was and the shorter the work time the higher became the pulmonary ventilation. There was a more rapid increase in the functions studied when the heaviest work loads were performed. It is concluded that aerobic capacity can be measured in a work test of from a few up to about 8 min. duration, severity of work determining the actual work time necessary. Duration of work in studies of circulation and respiration during submaximal work should exceed 5 min. (Authors' abstract)

11065 1958
Bass, D. E.,
E. R. Buskirk, P. F. Iampietro, and M. Mager
COMPARISON OF BLOOD VOLUME DURING PHYSICAL CONDITIONING, HEAT ACCLIMATIZATION AND SEDENTARY LIVING.——Jour. Applied Physiol., 12 (2): 186-188. March 1958.

Blood volumes were measured in 15 subjects before and after a 3-week period of physical conditioning with or without daily exposures for 2-1/2 hours to temperatures of 90° and 120° F. No significant changes in basal plasma, blood, or red cell volumes were produced by either physical conditioning or heat acclimatization.

11066
Beckmann, A., 1958
and H. Sollmann
[EFFECT OF WARMING UP OF ATHLETES ON PERFORMANCE AND CHRONAXY VALUE] Über den Einfluss des Aufwärmens von Sportlern auf die Leistung und auf Chronaxiewerte [Abstract].——Pflügers Archiv für die gesamte Physiologie (Berlin), 268 (1): 13. Oct. 15, 1958. In German.

Observations were made of the effect of a 400-meter swim in 10 minutes on the time required subsequently to swim 50 meters and on the chronaxy value of the fermoralis nerve. Swimming performance was better in 19 of 30 subjects after the warm-up swim than without prior exercise. Chronaxy was decreased in 17 of the subjects showing an improvement in performance, and was increased in 8 of the 11 subjects

showing an impairment in performance. In 15 subjects, chronaxy and performance were measured before and after 1 hour of strenuous training. Chronaxy was increased in all subjects after training, and performance was decreased in 11 subjects. A quantitative correlation was observed between changes in chronaxy and performance.

11067

Benson, A. J., and E. J. Dearnaley 1959
ESTIMATES OF ABILITY DURING A FATIGUING TASK WITH AND WITHOUT COMPETITION AND MEASUREMENT OF ELECTROMYOGRAPHIC ACTIVITY IN MUSCLE GROUPS NOT DIRECTLY INVOLVED.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1089, Feb. 1959. 9 p.

In ten subjects the integrated electromyogram was recorded from the left gastrocnemius-soleus muscle group whilst the subject attempted to maintain a tension of 10 kg. on a double-handled isometric myograph. Three experimental conditions were investigated: (a) in which the tension was not displayed; (b) the tension developed was displayed; (c) as (b) but in addition the subject was competing for a prize awarded for the maximum duration and accuracy of pull. The times for which the tension was maintained were found to be significantly greater in condition (c) than (b). The required tension was not maintained in (a). Subjects' estimates of their time to capitulation were found, on the average, to be accurate and reflected the increased duration of pull in condition (c). The variance of the estimates decreased as the task proceeded. Subjects who were initially in error became progressively more accurate. There were appreciable differences in the pattern of increasing electromyographic activity between subjects. The rate of increase in electromyographic activity is principally determined by the motor effort demanded of the subject but that this can be influenced by the level of "arousal" or "motivation". (Authors' summary)

11068

Benson, A. J., and E. J. Dearnaley 1959
ESTIMATES OF ABILITY DURING ITERATIVE PERFORMANCE OF A FATIGUING TASK AND MEASURES OF ELECTROMYOGRAPHIC ACTIVITY IN A MUSCLE GROUP NOT DIRECTLY INVOLVED.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no FPRC 1092, July 1959. i+9 p.

In twenty subjects the integrated electromyogram was recorded from the left gastrocnemius-soleus muscle group whilst the subject attempted to maintain a tension of 10 kg. on a double-handled isometric myograph. Each subject made three pulls separated by a five-minute rest. He was instructed to pull for as long as he could and to estimate before, and at 15-second intervals during the task for how long he could maintain the tension. The times for which the tension was maintained were significantly less on the second pull but there was no significant difference between the duration of second and third pulls. Subjects' estimates of their time to capitulation were, on the average, accurate and reflected the decreasing duration of the second and third pulls. The variance of the estimates diminished as the task proceeded. Subjects who were initially in error became progressively more accurate. Rapid learning was apparent in both the initial estimates made before the task, and the interval of uncertainty within which they were made, and in the estimates made during the task. There were appreciable differences between subjects in the pattern of increasing electromyographic activity. On the average, this increase followed a rising exponential time course and was steeper for the second and third pulls. There was no significant correlations between measures of electromyographic activity and the estimates and other available data about the subjects. (Authors' summary)

11069

Beumer, H. M. 1960
OXYGEN CONSUMPTION AFTER WORK. — Nederlandse akademie van wetenschappen, Proceedings, Series C., 63 (4): 487-491. 1960. In English.

A spirographic method is described whereby continuous measurements of oxygen consumption and pulmonary ventilation after work are recorded. After a two-minute rest period these values reach a constant level. Results are in accord with those obtained by other methods.

11070

Blair, D. A., W. E. Glover, and I. C. Roddie 1961
VASOMOTOR RESPONSES IN THE HUMAN ARM DURING LEG EXERCISE. — Circulation Research, 9 (2): 264-274. March 1961.

Blood flow was measured in the hands and forearms of recumbent subjects by venous occlusion plethysmography during leg exercise on a bicycle ergometer. In three highly practiced subjects, exercise resulted in a small fall in forearm flow and a moderate rise in arterial pressure. Blocking the vasomotor fibers to forearm skin did not affect this, but blocking the deep nerves to the muscle vessels prevented the increase in vascular resistance during exercise. Treating the forearm with bretylium tosylate [a sympatholytic] had the same effect. It was concluded that vasoconstrictor tone in muscle is increased during exercise. Since treating the forearm with atropine did not affect the normal response, it was concluded that activation of vasodilator fibers to muscle is not an integral part of the general vasomotor response to exercise. Evidence was also found that the vasodilator outflow to a specific muscle group is not specifically activated when the muscle group in question is exercised. Evidence was found that the vasodilatation in the hand was due to release of vasoconstrictor tone, whereas that in the forearm was mediated through vasodilator fibers. (From the authors' summary) (30 references)

11071

Brouha, L., P. E. Smith, R. DeLanne, and M. E. Maxfield 1961
PHYSIOLOGICAL REACTIONS OF MEN AND WOMEN DURING MUSCULAR ACTIVITY AND RECOVERY IN VARIOUS ENVIRONMENTS. — Jour. Applied Physiol., 16 (1): 133-140. Jan. 1961.

Men and women performing a standard exercise were studied in three environments. Pulmonary ventilation, O_2 consumption, CO_2 elimination, heart rate, blood pressure, body temperature and weight loss were recorded. Pulmonary ventilation was decreased in the warm-dry environment and in-

creased in the warm-humid. Oxygen consumption was significantly lower in the warm-dry environment than at room temperature. The pattern of changes of these two functions was similar for both sexes. Respiratory exchange ratios were not influenced by sex, but were higher in the warm-dry environment. Increase in body temperature was found only in the warm-humid environment, with a smaller weight loss than in warm-dry conditions. Systolic blood pressure was influenced by work load but not by environments. Diastolic pressure varied little for both sexes under all conditions. Heart rate was significantly influenced by sex and environment, being highest for the women in the warm-humid conditions. Cardiac cost increased and cardiac efficiency decreased in both warm surroundings, more so for women than for men. (Authors' abstract)

11072
Busnengo, E. 1961
[CARDIOVASCULAR FUNCTION AFTER INTENSE AND PROTRACTED MUSCULAR WORK: BEHAVIOR OF THE BALLISTOCARDIOGRAM] Funzionalità cardio-circolatoria dopo intenso e protratto lavoro muscolare: comportamento del balistocardiogramma.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 200-207. Roma, 1961. In Italian.

The ballistocardiogram (BCG) was studied in 40 pilot candidates between 18 and 23 years of age after intense muscular work protracted until exhaustion. The subjects were divided into three groups according to the degree of work performed (Group I, minimum work; Group II, average work; Group III, maximum work). The I and K wave amplitudes of the BCG decreased soon after the test, returning to initial values after 30 minutes. The J wave amplitude increased soon after work in the first two groups and decreased slightly in the third. The duration of the I wave decreased soon after work and returned to initial values after 30 minutes, and the J and K waves increased. The complex morphology of the BCG assumed an altered aspect of the early M type with the maximum percentages for Group I of 14.3% at 20 minutes, 23.0% soon after and after 10 minutes for Group II, and 7.6% soon after and after 10 minutes for Group III. The V_c values showed a total and persistent reduction in the first two groups, but this reduction appeared more sensitive and with an outstanding rhythm regarding initial values for the subjects in Group III. Included are representative graphs.

11073
Busnengo, E. 1961
[CARDIOVASCULAR FUNCTION AFTER INTENSE AND PROTRACTED MUSCULAR WORK: BEHAVIOR OF THE ELECTROCARDIOGRAM] Funzionalità cardio-circolatoria dopo intenso e protratto lavoro muscolare: comportamento del l'elettrocardiogramma.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 188-199. Roma, 1961. In Italian.

Electrocardiographic (ECG) studies were made on 60 pilot candidates between 18 and 23 years of age exposed to intense muscular work on the treadmill ergometer protracted until they were exhausted. The ECG at rest exhibited conditions of vagal hypertonus as demonstrated by: (1) the high percentage of respiratory sinusal arrhythmia of various degrees related to depression of the sinusal center; (2) the morphological aspect of the terminal ventriculogram; and (3) the shortening of QT time. The ECG characteristics observed soon after the end of muscular work included (a) appearance of stabile sinusal tachycardia with notable reduction of cases with respiratory arrhythmia; (b) modifications of voltage, duration, morphology, and axial orientation of the P wave; (c) modifications of the terminal ventriculogram, especially the ST tracing; (d) tendency towards a prolonged duration of the PQ interval of a-v conduction; and (e) prolongation in all cases of the QT interval. The ventricular complex (QRS) did not present substantial changes in relation to base values during rest.

11074
Busnengo, E. 1961
[CARDIOVASCULAR FUNCTION AFTER INTENSE AND PROTRACTED MUSCULAR WORK: BEHAVIOR OF THE PERIPHERAL ARTERIAL PULSE] Funzionalità cardio-circolatoria dopo intenso e protratto lavoro muscolare: comportamento del polso arterioso periferico.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 208-213. Roma, 1961. In Italian.

Peripheral arterial piezograms were made on 22 pilot candidates between 18 and 23 years of age before and after they performed intense muscular work on the treadmill ergometer until they were exhausted. The subjects were divided into two groups according to the degree of work performed (minimum and maximum work). The aspect of the radial piezogram of the subjects at rest and after muscular work indicates the type of peripheral resistance and arterial elasticity. A decreased value was found in the C/B ratio, and insignificant changes in the B^1/B and M/C ratios, elements which prove the capacity for functional adaptation of the peripheral arterial system to work. Included are representative graphs. It is recommended that study of the peripheral arterial piezogram before and after muscular work be used as a diagnostic aid, and function test of peripheral arterial circulation.

11075
Carlsten A., 1961
B. Hallgren, R. Jagenburg, A. Svanborg, and L. Werkö
MYOCARDIAL METABOLISM OF GLUCOSE, LACTIC ACID, AMINO ACIDS AND FATTY ACIDS IN HEALTHY HUMAN INDIVIDUALS AT REST AND AT DIFFERENT WORK LOADS. —Scandinavian Jour. Clinical and Lab. Invest. (Oslo), 13 (3): 418-428. 1961.

The myocardial extraction of different substrates was studied in 18 fasting, healthy, nonhospitalized individuals by comparison of the levels in arterial plasma and in plasma from the coronary sinus at rest and after work of 100-600 "kpm" (kilo-pound-meters)/min. on a bicycle ergometer. The level of free fatty acids, glucose, and lactic acid decreased significantly during the myocardial passage at rest. A positive correlation was found between the arterial level of free fatty acids and the myocardial extraction. The extraction of glucose, amino nitrogen and free fatty acids was not influenced by different work loads, but the extrac-

tion of lactic acid increased as a result of the increased arterial level at 600 kpm. These findings indicate that the higher myocardial need for calories during work is mainly covered by an increase in coronary blood flow. Changes in the composition of the free fatty acids were found among the carbon-18 fatty acids. The percentage of stearic acid and oleic acid decreased during the myocardial passage, while linoleic acid increased. The rise of linoleic acid indicates that none of it was extracted. Although there was no change in the total amino nitrogen during the myocardial passage, there was a significant elevation of the alanine level.

11076
Christensen, E. H., 1960
R. Hedman, and I. Holmdahl
THE INFLUENCE OF REST PAUSES ON MECHANICAL EFFICIENCY. — Acta physiologica scandinavica (Stockholm), 48 (4): 443-447. 1960. In English.

Two subjects performed a given quantity of work on a Krogh bicycle ergometer within one hour. With a relatively low load, the work was continuous, with higher loads, breaks of varied length and periodicity were introduced. Mechanical efficiency was the same or slightly less when continuous work was replaced by discontinuous work. (Authors' abstract)

11077
Clarke, R. S. J., 1959
and R. F. Hellon
HYPERAEMIA FOLLOWING SUSTAINED AND RHYTHMIC EXERCISE IN THE HUMAN FOREARM AT VARIOUS TEMPERATURES.—Jour. Physiol. (London), 145 (3): 447-458. March 12, 1959.

The hyperemia following sustained and rhythmic contractions of the forearm was studied with the arm in water at temperatures ranging from 42° to 18° C. Tensions of one-third of the maximum were used. Compared with 34° C., heating the arm to 42° C. increased the hyperemia after both types of exercise. Cooling to 18° C. reduced the hyperemia after sustained contractions, but the effect after rhythmic contractions varied with the frequency. Following exercise at 30/minute the hyperemia was unaltered by cooling, but at 60/minute there was a marked increase. Cooling the hand alone had no effect on the hyperemia after rhythmic exercise. The results are explicable on the basis of an increase in viscosity in the forearm muscles on cooling, increasing the total energy required by the muscles for this type of exercise. (Authors' summary)

11078
Cottle, M. 1961
THYROID FUNCTION IN EXERCISED RATS. — Univ. of Washington, Seattle; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237). Technical Report no. 60-6, Oct. 1961. 29 p.

The possibility that the increased metabolic rate produced by exercise (running on a revolving drum) and exercise superimposed upon long-term cold exposure (5° C.) results in a consequent increased thyroid secretion rate of rats as indicated by biologic decays (release of I^{131}) was investigated. Two levels of exercise were used 1-2 hours per day and 4-6 hours per day. Both these levels of activity depressed caloric intake and weight gain but appeared to be insufficient to bring about increased energy output. Initiation of exercise did not bring about significant changes in the biologic decay rates. After exercise of longer duration the biologic half-times tended to be decreased but the difference was not significant at the 5% level from that for the unexercised rats. There appeared an interesting relationship between food intake and the biologic decay rates. That is, rats which ate less due to the limitations imposed by the feeding regime tended to have longer biologic half-times of I^{131} than those rats which had a greater caloric intake. Further testing of such a tentative finding has been suggested. (Author's abstract)

11079
Dejours, P., 1961
Y. Bechtel-Labrousse, and J. Raynaud
[STUDY OF THE CONTROL OF CARDIAC FREQUENCY AND VENTILATION DURING PASSIVE AND ACTIVE EXERCISES IN MAN] Étude du contrôle de la fréquence cardiaque et de la ventilation au cours des exercices passif et actif chez l'homme. — Comptes rendus de l'Académie des sciences (Paris), 252 (13): 2012-2014. March 27, 1961. In French.

An extrathoracic proprioceptive stimulus of ventilation and cardiac frequency was demonstrated during voluntary muscular exercise and passive movements of the legs with the circulation either free or blocked. Ventilatory and circulatory reactions were more significant during voluntary exercise than during passive mobilization.

11080
De Lanne, R., 1959
J. R. Barnes, L. Brouha, and F. Massart
CHANGES IN ACID-BASE BALANCE AND BLOOD GASES DURING MUSCULAR ACTIVITY AND RECOVERY.—Jour. Applied Physiol., 14 (3): 328-332. May 1959.

Changes in the blood gases and acid-base balance during muscular work and recovery were investigated for males and females under various controlled environmental conditions. Changes in venous blood oxygen and carbon dioxide are influenced both by the intensity and duration of the exercise and by the environmental temperature. The pH of the blood is similarly affected. The direct measurement of pH was found to be a better index of the variation in the acid-base balance than the pH calculated from Henderson's equation at a fixed CO_2 pressure. Lactic acid in the blood is, like the blood gases, influenced by ambient conditions, but is more closely related to the intensity than to the duration of the exercise. (Authors' summary)

11081
De Lanne, R., 1960
J. R. Barnes, and L. Brouha
HEMATOLOGICAL CHANGES DURING MUSCULAR ACTIVITY AND RECOVERY.—Jour. Applied Physiol., 15 (1): 31-36. Jan. 1960.

Hematological changes were studied in men and women during exercise and recovery in a room-temperature, warm-dry, or warm-humid environment. An erythrocytosis due to hemoconcentration was observed which was not followed by hemodilution and was not accompanied by the destruction or generation of red cells. Hemoconcentration was influenced by exercise, but not by thermal stress, in spite of greater water losses in warm environ-

ments. Sex differences at rest were found for red and white cells, but the pattern of the reactions to exercise was similar for both sexes. Leukocytosis resulted from exercise and heat exposure, with a greater effect of exercise in the females. This is due to increased capillary circulation, hemoconcentration and lymphatic pressure, but not to the stimulation of leucopoietic centers. Changes in the systemic circulation followed by an increase of lymph flow explain the lymphocytosis. Granulocytosis occurs later, persists longer, and may be related to the concentration of circulating corticosteroid hormones. (Authors' abstract, modified)

11082
Döbeln, W. von, 1958
C. G. Engström, and G. Ström
PHYSICAL TRAINING AND PHYSICAL WORKING CAPACITY IN SWEDISH AIR FORCE STAFF PERSONNEL.—Meddelanden från flyg- och naval-medicinska nämnden (Stockholm), 7 (2): 34-35. 1958. In English.

The influence of physical training on work capacity was observed in 67 Swedish Air Force staff personnel. Staff members were chosen because of the initial low state of training of this group. Two observations were made, one at the beginning, and the other at the end of a one-year training period. The training program which persisted during the year consisted of two 30-min. exercise periods a week. Work capacity was measured by the bicycle-ergometer test, and pulse-rate responses were used for calculating maximal oxygen-intake capacity. Heart volume during standing was determined by a fluoroscopic method. Analysis of the data after the one-year period showed that the physical work capacity was increased by about 10%. Heart volume had decreased in a group of 26 pilots between the ages of 25 and 40 years. The observed increase in work capacity is thought to reflect more effective peripheral circulation.

11083
Döbeln, W. von, 1959
C. G. Engström, and G. Ström
PHYSICAL WORKING CAPACITY OF SWEDISH AIR FORCE PILOTS.—Jour. Aviation Med., 30 (3): 162-166. March 1959.

The physical working capacity of Swedish Air Force pilots, staff personnel, and pilot applicants was determined as the pulse rate response in steady state to stepwise increased submaximal loads on a bycycle ergometer. The pulse rate response to work was independent of age within each group of subjects; it was different between the groups, which was considered to be due to different degrees of physical training. The mean pulse rate of the active pilots at a load of 900 kilopondmeters per minute was 145 beats per minute. It is suggested for practical reasons that in mass testing of healthy men, the physical working capacity may be determined as the pulse rate after six minutes work at this single load. (Authors' summary)

11084
Egolinskii, IA. A. 1961
[SOME DATA ON EXPERIMENTAL ENDURANCE TRAINING] Nekotorye dannye po eksperimental'noi trenirovke vynoslivosti cheloveka. — Fiziologicheskii zhurnal SSSR (Leningrad), 47 (1): 38-45. Jan. 1961. In Russian.

English translation in: Sechenov Physiolog. Jour. USSR (Pergamon Press, New York), 47 (1): 38-47. Sept. 1961.

The effectiveness of endurance training was studied by selective training of the flexor muscles of the right middle finger on a hand ergograph for 80 subjects. Work endurance began to increase after 4-5 exercises and exceeded the initial value 5 to 10 times after 10-15 exercises. At a moderate working rate endurance development was better with moderate weights. With a standard load low or medium rates were more effective. Good results were achieved with both work to the point of complete fatigue (standard weight and rate), or work of shorter duration. Endurance training of the muscles of the right hand was associated with increased work-potential in the symmetrical muscles of the left hand. The effects of training were retained for 12 to 18 months. Distinct individual patterns in endurance development were noted.

11085
Elsner, R. W. 1960
CHANGES IN PERIPHERAL CIRCULATION WITH EXERCISE TRAINING.—Univ. of Washington, Seattle; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 59-16, Nov. 1960. x+110 p.

Peripheral circulation was measured after moderate exercise in four groups of healthy young men: athletes, non-athletes, sedentary subjects, and Eskimos. Oxygen consumption during exercise and recovery was similar in all groups when the values were referred to surface area of the subjects. Heart rate was lowest in the athletes, and postexercise blood flow was lower and recovered more rapidly in athletes. The Eskimo group responded to exercise in much the same manner as the athletes. In other experiments to test the importance of changes in body temperatures produced by exercise on the postexercise blood flow response, it was demonstrated that blood flow recovery was little affected by circulatory changes of temperature regulation. The physiological responses of the body to exercise are reviewed. (219 references)

11086
Filipova, G. G. 1958
[CHANGES IN CONDITIONED MOTOR (DEFENSIVE) REFLEXES UNDER THE INFLUENCE OF A HEAVY DYNAMIC LOAD] Zminy rukhovykh (zakhysnykh) umovnykh refleksiv pid vplyvom vazhkoho dynamichnoho navantazhennia.—Fiziologichnyi zhurnal (Kyiv), 4 (6): 719-729. 1958. In Ukrainian, with English summary (p. 729).

Dogs were required to run on a treadmill with a load on the back. Conditioned reflexes were determined before and after the experiments. During the experiment an electrocardiogram was taken. The changes in the reflexes, recorded during the experiment, were similar in most cases. Animals with neurotic characteristics developed random deviations from the normal response patterns. Healthy animals showed a rapid restitution of the conditioned reflexes after the experiments, while in animals with an unbalanced nervous system such restitution occurred with less regularity.

11087
Giusti, C., 1961
B. Menghi, and G. C. Torreggiani
[VECTORIAL ANALYSIS OF THE ELECTROCARDIOGRAPHIC CHANGES CAUSED BY EFFORT IN NORMAL SUBJECTS] Analisi vettoriale delle modificazioni elettrocardiographiche da sforzo in soggetti normali. —— Cuore e circolazione (Roma), 45 (5): 249-264. Oct. 1961. In Italian, with English summary (p. 263).

Electrocardiographic changes after exercise were studied in 60 normal subjects by the analysis of changes of ÂQRS, ÂT and Ĝ. The exercise test caused both rotation and amplitude variations of the QRS, T and G vectors in the frontal and horizontal planes. In the frontal plane, ÂT and Ĝ after exercise placed between 0° and +90°; in the horizontal plane, ÂT placed in the left fore sextant, Ĝ between -50° and +80°. The ÂT changes are attributed to modifications, after exercise, of the Ĝ and ÂGRS vectors, which both cause changes of tracings in normal subjects. (Authors' summary)

11088
Gotze, W., 1961
A. Kofes, S. Kubicki, and M. Wolter
[EEG AND EMG INVESTIGATIONS VIA TELEMETRY OF HEALTHY SUBJECTS AND SUBJECTS WITH CEREBRAL DISORDERS WHILE UNDER WORK STRESS] EEG- und EMG-Untersuchungen an Gesunden und Hirnkranken unter Arbeitsbelastung nach Radioübertragung. —— In: Klinische Elektroencephalographie (7th Congress of the German EEG Association, Bad Nauheim, Oct. 2-4, 1958), p. 108-117. Berlin: Springer Verlag, 1961. In German.

A new method of telemetry of electroencephalographic and electromyographic data is described. It permits the exploration of the effects of physical stress on the electrical activity of the brain. In the experiments conducted with healthy subjects a lowered amplitude and irregularity of the alpha rhythm was observed during walking. Walking with the eyes closed produced an off-effect. Running intensified the phenomena observed during walking.

11089
Gollnick, P. D., 1961
and G. R. Hearn
LACTIC DEHYDROGENASE ACTIVITIES OF HEART AND SKELETAL MUSCLE OF EXERCISED RATS. —— Amer. Jour. Physiol., 201 (4): 694-696. Oct. 1961.

Adult rats were exercised for 5 weeks on a training program consisting of swimming for one-half hour daily in water at 37° C. All exercised animals gained less body weight than did their controls. The adrenals and heart ventricles of the exercised animals were enlarged, whereas the kidneys and gastrocnemii were smaller. Unit and total protein of the heart ventricles were greater for the exercised animals. Lactic dehydrogenase activities were determined in the heart ventricles and gastrocnemii. The activities were expressed in terms of unit, actual total, and relative total values. After exercise, the activities of the heart ventricles were increased, whereas those of the skeletal muscle were unchanged. (Authors' abstract, modified)

11090
Goor, H. van 1961
and W. L. Mosterd
GAS EXCHANGE DURING AND AFTER MUSCULAR WORK. —— Nederlandse akademie van wetenschappen, Proceedings, Series C, 64 (1): 96-98. 1961. In English.

Continuous measurements were made of the oxygen consumption of a subject performing work on a bicycle ergometer. In muscular work of short duration (½ min.), the oxygen intake reached a maximum some time after the work period, regardless of the amount of work involved. An immediate fall of the oxygen intake was observed at the end of strenuous work only if this had lasted for 1½ minutes or more.

11091
Goor, H. van 1961
and W. L. Mosterd
GAS EXCHANGE DURING INTERVAL TRAINING. —— Nederlandse akademie van wetenschappen, Proceedings, Series C, 64 (1): 15-20, 1 folding leaf. 1961. In English.

Respiratory gas exchange (oxygen uptake and carbon dioxide production) was measured in persons performing work on a bicycle ergometer in cycles of ½ minute work and one minute rest. The gas exchange rose after the period of work and maximum oxygen intake occurred during the rest phase.

11092
Grandpierre, R., 1960
C. Jacquemin, P. Mases, and R. Falet
[RESPONSE EVALUATION IN THE MUSCULAR EXERCISE FITNESS TEST AND RESPIRATORY RESPONSES TO THE "STOOL" TEST] Evaluation des réponses dans le test d'aptitude à l'exercice musculaire: Les réponses au test de l'escabeau.——In: Selected papers from symposium held 16-17 June 1958, Paris, France, p. 15-20. Supplement to AGARDograph 2. Paris, July 1960. In French, with English summary (p. 19).

Respiratory rate, turnover, and oxygen tension of expired air were studied mathematically after the "stool" test, a modification of the Harvard step test. After the test, a rapid decrease in oxygen consumption was noted.

11093
Graybiel, A., 1960
and N. W. Allebach
THE WORK ELECTROCARDIOGRAM.——In: Selected papers from symposium held 16-17 June, 1958, Paris, France, p. 21-46. Supplement to AGARDograph 2. Paris, July 1960.

The 'escabeau'-test (stool-test), derived from the current step-test, is of value as far as the respiratory changes involved are concerned. The authors evaluate the ventilatory frequence, ventilation flow and oxygen concentration in expired gases. Special consideration is given to the changes in oxygen consumption; this is done at the end of the test. The recovery curve resembles a decreasing exponential. The proposed measurement includes the time needed for the oxygen consumption to be reduced to a half. (Authors' summary)

11094
Hughes, B. G. 1961
THE ROYAL CANADIAN AIR FORCE 5BX PLAN FOR PHYSICAL FITNESS. —— Air Line Pilot, 30 (6): 4-5, 23. Aug. 1961.

A condensed description of the physical-exercise plan developed by the Royal Canadian Air Force is given. Included are diagrams and descriptions of the various physical exercises, a chart showing exercise levels for ages of men and boys as well as rating scales of physical capacity. The plan is designed to maintain general physical tone by short, daily exercise.

11095
Kelsey, I. B. 1961
EFFECTS OF MENTAL PRACTICE AND PHYSICAL PRACTICE UPON MUSCULAR ENDURANCE. —— Research Quarterly, 32 (1): 47-54. March 1961.

Muscular endurance of the abdominal and thigh muscles is increased significantly over a 20-day period by a daily 5-minute mental rehearsal of sit-ups. An equivalent amount of physical practice of this exercise results in a much greater endurance increase (322% as opposed to 29%). Physical practice is recommended over mental practice wherever possible to facilitate an increase in muscular endurance. However, the greatest endurance increases will probably result from an efficient combination of both mental and physical practice.

11096
Lalli, G., 1961
and L. Cascino
[MODIFICATIONS OF CHOLINESTERASE ACTIVITY OF PLASMA AND ERYTHROCYTES IN SUBJECTS EXPOSED TO MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Modifiche dell'attività colinoesterasica del plasma e degli eritrociti in soggetti sottoposti a lavoro muscolare protratto sino ad esaurimento.——In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 173-180. Roma, 1961. In Italian.

Intense muscular work on the treadmill ergometer protracted until the subjects, between 18 and 20 years of age, were exhausted, produced significant increases in plasma cholinesterase activity during the first minutes of rest. This phenomenon was of short duration, for after 15-20 minutes these changes were notably attenuated. The increases of plasma cholinesterase activity observed after work did not appear to be correlated in any manner to the duration of work. A minor correlation was found between these increases and lactic acidemia and hemoconcentration. Cholinesterase activity of erythrocytes after work showed no significant modifications.

11097
Lalli, G. 1961
[MODIFICATIONS OF PLASMA SODIUM IN SUBJECTS EXPOSED TO MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Modifiche del sodio nel plasma di soggetti sottoposti a lavoro muscolare protratto sino ad esaurimento.——In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 214-218. Roma, 1961. In Italian.

An increase was found in the plasma sodium of 37 pilot candidates (18-20 years of age) performing intense muscular work on the treadmill ergometer until they were exhausted. This increase was unsteady and uncorrelated, at least in a significant manner, with the quantity or duration of work performed or with the increase in blood lactic acid (considered as an index of hemoconcentration after work). After 15-20 minutes of rest, the sodium level returned practically to base values.

11098
Lalli, G., 1961
G. Paolucci, and G. Ghinozzi
[MODIFICATION OF LACTIC ACID CONCENTRATION AND pH OF VENOUS BLOOD IN SUBJECTS EXPOSED TO MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Modifiche della concentrazione dell'acido lattico e del pH nel sangue venoso di soggetti sottoposti a lavoro muscolare protratto sino ad esaurimento.——In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 12-28. Roma, 1961. In Italian.

Pilot candidates between 18 and 20 years of age were subjected to varying degrees of muscular work on the treadmill ergometer until they were exhausted. Determinations and tabulations were made of lactic acid in the subjects at rest; average, maximum and minimum values; values after work as a function of work time; and curves during rest as a function of time. In subjects performing much work lactic acid production was slower and by the end of work had already reached equilibrium. In less efficient subjects who performed less work, production was greater at the end of work and the equilibrium was not yet reached; quantities of lactic acid continued to pour into the blood. Studies were also made (with tabulations) of venous pH values, correlation between increases of pH and work time, pH curve during work as a function of time, and comparative velocity of attaining changes in lactic acid and pH during rest. The correlation between the increase of lactic acid and the decrease of pH during rest was also tabulated. The correlation was highest for 10 minutes at rest, then decreased appreciably. Since it appears that the maximum quantity of lactic acid exhibited after muscular work depends on psychological factors, the use of lactic acid values as a character test is discussed.

11099
Lalli, G., 1961
and G. Venditti
[MODIFICATIONS OF SOME LIPID AND LIPOPROTEIN FRACTIONS AND OF SOME COLLOIDAL LIABILITY TESTS IN SUBJECTS EXPOSED TO INTENSE MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Modifiche di alcune frazioni lipidiche e lipoproteiche e di alcuni tests di labilità colloidale in soggetti sottoposti a lavoro muscolare intenso e protratto sino ad esaurimento.——In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 219-230. Roma, 1961. In Italian.

Blood lipid and lipoprotein fractions were studied in 25 young pilot candidates subjected to intense muscular work on the treadmill ergometer until they were exhausted. A maximum increase was found in blood lipids and lipoproteins during the first stage of rest after work. This was correlated with positive Kunkel reactions with phenol and

Veronal. Total lipids and cholesterols showed a slight but significant increase. Of doubtful values were the increases of esterified cholesterol, β-lipoprotein (expressed in percentage of total lipoprotein), and the MacLagen reaction which demonstrated an abnormal behavior with its maximum increase after 15 minutes followed by a decrease. Correlations between work time were consistent only for total lipids. Correlations with increases in blood lactic acid were always positive along with values of cholesterolemia and Kunkel reaction with Veronal. These findings indicate that during intense muscular work the first change is attributed to hemoconcentration (represented by lactic acidemia as a valid index), followed by increases in the active osmotic substances in muscle.

11100
Lomonaco, T., 1958
A. Scano, F. Rossanigo, and B. Tagliamonte
[RESPIRATORY AND CARDIO-CIRCULATORY BEHAVIOR DURING AND AFTER THE 30-CM-HIGH STEP TEST IN SUBJECTS DIFFERENTLY TRAINED TO PERFORM PHYSICAL EXERCISE] Comportamento respiratorio e cardio-circolatorio durante e dopo la prova dello scalino alto 30 cm in soggetti diversamente allenati all'esercizio fisico.—Rivista di medicina aeronautica (Roma), 21 (2): 219-235. April-June 1958. In Italian, with English summary (p. 234).

A functional test consisting of mounting and descending a 30-cm.-high step, 30 times per minute for 10 minutes, was carried out by 60 healthy young men belonging to two groups: the first composed of 50 individuals not trained in physical exercises; the second of 10 well-trained subjects. Pulmonary ventilation, respiratory frequency, O_2-concentration in the exhaled air, pulse rate, and humeral blood pressure were continuously determined immediately before, during, and (for 15 minutes) after the test. The O_2 consumption, the energy consumption, the cal./liter ratio, and the O_2 equivalent were calculated on the basis of the data thus obtained. The results show that this test may represent a useful means of cardiocirculatory and respiratory functional investigation, and that it may be easily applied also to individuals who have not been physically trained. From the experiments made it was possible to obtain average statistical values of the aforementioned physiological elements, to be used for the "calibration" of the test and thus for the quantitative functional evaluation of healthy subjects. The tests confirmed the higher physical efficiency of individuals under stress.

11101
Maccagno, A. L., 1961
and A. Venerando
[METHOD AND ELEMENTS TO GUIDE IN THE CARDIORESPIRATORY EVALUATION OF ATHLETES. I. RESPIRATORY EVALUATION] Metodica ed elementi di guidizio per la valutazione cardiorespiratoria degli atleti. I. Valutazione respiratoria.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 29-32. Roma, 1961. In Italian.

The respiratory function of 150 athletes was evaluated during effort (cycloergometry) and at rest. It was observed that at the tenth minute of effort the coefficient of increased oxygen consumption was always higher in comparison with starting values of the coefficient of increased ventilation. When this did not occur, the athlete always showed signs of fatigue. For example, when oxygen consumption increased 4-5 times, ventilation increased 2-3 times. In all athletes examined, pulse frequency at ten minutes of effort was proportionally greater than respiratory frequency. In most athletes, maximum oxygen consumption was attained several minutes before maximum ventilation was reached. Pulse frequency also reached the maximum point several minutes later than respiratory frequency. Sometimes the two maximal values coincided at the same minute of effort. The highest coefficient of increased oxygen consumption, in comparison to that of ventilation, may be due to its more efficient utilization by the subject. Other hypotheses are presented to explain the phenomena observed.

11102
McDonald, R. D., 1961
K. Yagi, and E. Stockton
HUMAN EOSINOPHIL RESPONSE TO ACUTE PHYSICAL EXERTION. — Psychosomatic Med., 23 (1): 63-66. Jan.-Feb. 1961.

In contrast to the finding of eosinopenia immediately following emotional stress with minimal physical activity, the response to 1/2 hr. of exertion is an immediate eosinophilia, followed by an eosinopenia beginning within two hours and extending over at least two more hours. (Authors' summary)

11103
Malhotra, M. S., 1960
S. S. Ramaswamy, and S. N. Ray
EFFECT OF ENVIRONMENTAL TEMPERATURE ON WORK AND RESTING METABOLISM. — Jour. Applied Physiol., 15 (5): 769-770. Sept. 1960.

Observations of basal metabolic rate at 25-28° C. of energy expenditure during exercise (military drill) under outdoor conditions were made in young male subjects at intervals throughout the year. No significant differences were observed in basal metabolic rate or in exercising metabolic rate by body weight (including clothing) for any season. It is suggested that the total exercising energy expenditure during winter may be increased as a result of the additional clothing worn.

11104
Margaria, R., 1961
P. Cerretelli, S. Marchi, and L. Rossi
MAXIMUM EXERCISE IN OXYGEN. — Internationale Zeitschrift für angewandte Physiologie (Berlin), 18 (6): 465-467. 1961. In English.

The maximum oxygen consumption, as measured during strenuous exercise, is increased by 10% when breathing pure oxygen, of the same order of magnitude as the O_2 increase in blood. The better performance while breathing O_2 is therefore explained as due to the increased blood O_2 available, other factors, such as a higher saturation of hemoglobin or a faster blood circulation, having no appreciable importance. (Authors' summary)

11105
Mazzella, G. 1960
[LEUKOCYTIC PEROXIDASES, OXIDASES AND GLYCOPOLYSACCHARIDES AFTER INTENSE AND PROLONGED MUSCULAR WORK] Perossidasi, ossidasi e glicopolisaccaridi leucocitari dopo lavo-

ro muscolare intenso e protratto. — Rivista di medicina aeronautica e spaziale (Roma), 23 (1): 117-122. Jan.-March 1960. In Italian, with English summary (p. 121)

No statistically significant changes were observed in the leukocyte content of peroxidases, oxidases and glycopolysaccharides of thirty-nine men, with an average age of nineteen, following intense muscular exercise on a treadmill ergometer prolonged for a period of thirty minutes. An increase was observed in the leukocyte count.

11106
Mazzella, G. 1961
[LEUKOCYTE RESISTANCE AFTER INTENSE MUSCULAR WORK] Resistenze leucocitarie dopo lavoro muscolare intenso.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 153-162. Roma, 1961. In Italian.

Forty subjects of 19 years of age performed intense muscular work. Blood samples were taken before work, soon after work, and after a 30-minute rest period. Following intense work until exhaustion the increased number of leukocytes was not quantitatively related to the degree of work. The numberical increase of leukocytes was attributed largely to the relative and absolute increases in mononucleate cells (lymphocytes and monocytes). Upon subjecting leukocytes to the leukocyte resistance test it was found that their resistance decreased in hypotonic saline solutions, quickly and easily destroying the mononucleate elements which had entered the circulation in great numbers. Although the emission and destruction of these elements was rapid, they returned to within normal limits after 30 minutes. This phenomenon may be attributed to an adrenaline type of substance if not to adrenaline itself. Included is a graph of leukocyte-destruction curves, and a table listing percentage loss in absolute values of polynucleates and mononucleates considered before and after work, and after 120 minutes.

11107
Mazzella, G. 1961
[HEMATOLOGICAL VARIATIONS IN SUBJECTS EXPOSED TO MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Variazioni ematologiche in soggetti sottoposti a lavoro muscolare protratto sino ad esaurimento.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 141-152, 1 folding table. In Italian.

Forty subjects between 18 and 24 years of age were exposed to protracted muscular work on the treadmill ergometer until they became exhausted. Hematological studies made after work showed a great increase in leukocytes (47.8%) with relative and absolute lymphocytosis. This phenomenon may be caused by the action of adrenaline on the hematopoietic organs, associated with fatigue factors, and hemoconcentration caused by the increase of muscular osmotic pressure. Also considered as possible causative factors are water loss due to perspiration and hyperventilation. Leukocytosis was not proportional with the quantity of work done. Hemoglobin revealed an increase lower than that of erythrocytes, whereas reticulocytes exhibited a somewhat irregular behavior. Included are representative tables and graphs of the blood picture before and after work and during rest, and the leukocyte and eosinophil picture before and after work and during rest.

11108
Michael, E. D., 1961
K. E. Hutton, and S. M. Horvath
CARDIORESPIRATORY RESPONSES DURING PROLONGED EXERCISE. — Jour. Applied Physiol., 16 (6): 997-1000. Nov. 1961.

Three healthy male subjects 20 years of age were exercised for 2-8 hours riding a bicycle ergometer or walking on a treadmill. Higher heart rates were found with the bicycle rides than with the walking exercises with equivalent oxygen uptakes. The subjects could not work on the bicycle ergometer at oxygen uptakes of 1.8 liters/min. for more than 4 hours but could with this uptake walk 8 hours. The results indicated that an 8-hour period of exercise could be completed without undue fatigue whenever the energy cost did not exceed 35% of the maximum oxygen uptake where heart rates, oxygen uptakes, and rectal temperatures remained below 120 beats/min., 1.4 liters/min., and 38° C., respectively. The heart rate appeared to be the important factor for estimating 8-hour work endurance. A rate of 140 beats/min. could not be maintained for more than 4 hours or a rate of 160 beats/min. for more than 2 hours without extreme fatigue. (Authors' abstract)

11109
Paolucci, G. 1961
[ALBUMINURIA AND CYLINDRURIA IN SUBJECTS EXPOSED TO INTENSE MUSCULAR WORK PROTRACTED UNTIL EXHAUSTION] Albuminuria e cilindruria in soggetti sottoposti a lavoro muscolare intenso, e protratto fino ad esaurimento.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 167-172. Roma, 1961. In Italian.

Men between 18-24 years of age performed intense muscular work on the treadmill ergometer until they were exhausted. The subjects were divided into three groups according to the duration of work (minimum, average, maximum work) and urinary studies were made. Out of 143 subjects, 65 had abnormal elements in the urine after muscular work; albumin, 27.2%; cylinders, 72.4%; and albumin and cylinders in the same subject, 37.2%. Cases with abnormal urinary elements increased proportionally with the degree of work. It is postulated that these elements may result from renal circulatory changes caused by possible arteriolar vasoconstriction or venous capillary stasis, depending on the stress.

11110
Person, R. S. 1960
[ELECTROPHYSIOLOGICAL STUDY OF THE ACTIVITY OF THE MOTOR APPARATUS OF MAN DURING FATIGUE] Elektrofiziologicheskoe issledovanie deiatel'nosti dvigatel'nogo apparata cheloveka pri utomlenii. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 810-818. July 1960. In Russian, with English summary (p. 818).
English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 46 (7): 945-954. 1960.

Electromyographic investigations of static work using a constant and moderate load demonstrated increase in the amplitude and reduction of frequency of the EMG during fatigue. Increase in amplitude of the summated EMG was present with

all loads. Reduction of frequency was proportional to the load employed. The amplitude of the summated EMG in the active muscle increased also in the absence of a spread of excitation to the antagonists during fatigue. During static work of supporting a load, the increase in amplitude was accompanied by increased tremor. When the load was supported by pressure on a dynamometer with the same force, tremor was reduced, and the amplitude decreased considerably. These results point to changes in the functional conditions of nerve centers during fatigue, with reduction in economy and greater tension. A greater number of motor units is excited because of incoordination phenomena and synchronization of motor-neuron discharges. The results are not in agreement with the concept of fatigue as a peripheral phenomenon.

11111
Person, R. S., 1960
and K. Golubovich
[ELECTROMYOGRAPHIC INVESTIGATION ON FATIGUE IN MAN IN THE PRESENCE OF ARTIFICIAL ISCHEMIA OF THE ACTIVE MUSCLE] Elektromiograficheskoe issledovanie utomleniia u cheloveka v usloviiakh iskusstvennoi ishemii rabotaiushchei myshtsy. —— Fiziologicheskii zhurnal SSSR (Moskva), 46 (10): 1181-1187. Oct. 1960. In Russian, with English summary (p. 1186-1187).
English translation in: Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 46 (10): 1380-1387. Feb. 1961.

Surface electrodes were used to record the electromyograms of man during fatigue (static work with a constant load) while the blood supply to the muscles was normal and while ischemia was artificially produced by application of a pneumatic cuff. Ischemia of the active muscle had both a local and a reflex effect, accelerating and intensifying those changes in the efferent impulsation to the muscle which are characteristic of fatigue (increase of amplitude and reduction of frequency in the EMG). This reflex effect was also seen in the presence o ischemia of adjacent muscles not taking part in the activity. This demonstrates the importance of afferent influences, determined by changes in the active organ, in the development of central processes connected with fatigue. (Authors' conclusions, modified)

11112
Pineda, A., 1961
and M. A. Adkisson
ELECTROENCEPHALOGRAPHIC STUDIES IN PHYSICAL FATIGUE. —— Texas Reports Biol. and Med., 19 (2): 332-342. Summer 1961.

Electroencephalographic studies on 16 human subjects were performed in the rested state and immediately following strenuous physical exercise, and the changes in amplitude and per cent time alpha (alpha index) were noted. There was a significant and consistent increase in the alpha index of all subjects following exercise, and in the appearance of alpha rhythm in some subjects in which alpha had been absent prior to the exercise. Subjects with moderate alpha activity prior to physical fatigue demonstrated more dramatically the increase in alpha index. The average increase in amplitude ranged from 15 microvolts in the right occipital region to 19 microvolts in the right frontal region, and an average of 16 microvolts increase on the left following physical fatigue. The various factors involved which might have produced the EEG changes observed after physical fatigue are discussed. (Authors' summary, modified)

11113
Reeves, J. T., 1961
R. F. Grover, S. G. Blount, and G. F. Filley
CARDIAC OUTPUT RESPONSE TO STANDING AND TREADMILL WALKING. —— Jour. Applied Physiol., 16 (2): 283-288. March 1961.

Cardiac output measurements during cardiac catheterization were obtained in normal subjects for several grades of treadmill exercise. Femoral venous blood was sampled and the A-V oxygen difference for the exercising leg obtained. Measurements of central and femoral A-V oxygen difference and total oxygen uptake were also obtained in normal subjects during supine rest and during standing. When subjects merely stood, the A-V oxygen difference for the leg increased (whether the leg bore weight or not) much more than did that for the whole body. During treadmill walking femoral A-V oxygen difference was usually no greater than that during standing. Cardiac output was smaller and total body A-V oxygen difference was greater for treadmill walking than for supine bicycle exercise in which comparable levels of oxygen uptake were achieved. It is clear that change in posture alters the cardiac output response to exercise. An important aspect of the altered response was a marked difference in the circulation within the leg for these two postures both at rest and during exercise. (Authors' abstract)

11114
Reeves, J. T., 1961
R. F. Grover, G. F. Filley, and S. G. Blount
CIRCULATORY CHANGES IN MAN DURING MILD SUPINE EXERCISE. —— Jour. Applied Physiol., 16 (2): 279-282. March 1961.

Cardiac output and femoral A-V oxygen difference were measured in each of seven normal men at rest and during several stints of supine exercise to investigate the mechanisms of oxygen transport for stepwise increments of oxygen uptake. The femoral A-V oxygen difference increased sharply for mild exercise and showed smaller further increase for heavier exercise stints. The pulmonary A-V oxygen difference followed a similar behavior where the changes were of smaller magnitude. For mild exercise, increasing oxygen transport apparently depends to a greater extent on increasing femoral tissue oxygen extraction and to a lesser extent on increased femoral and total blood flow. For heavier exertion, increasing oxygen transport depends to a greater extent on increasing flow and to a smaller extent on a widening tissue oxygen extraction. Mechanisms which are utilized to meet the increased metabolic demands of exercise depend in part upon the severity of the exertion. Cardiac output appears not to be a simple linear function of oxygen uptake for various metabolic demands ranging from rest to heavy exercise. (Authors' abstract)

11115
Reichard, G. A., 1961
B. Issekutz, P. Kimbel, R. C. Putnam, N. J. Hochella, and S. Weinhouse
BLOOD GLUCOSE METABOLISM IN MAN DURING MUSCULAR WORK. —— Jour. Applied Physiol., 16 (6): 1001-1005. Nov. 1961.

A resting human subject was given an intravenous injection of a "trace" dose of C^{14}-labeled glucose, and blood and respiratory carbon dioxide (CO_2) samples were collected during ensuing rest, exercise, and rest periods. Immediately with onset of exercise, blood lactate level and CO_2 excretion increased greatly, but their low specific activities in comparison with that of the blood glucose indicated their origin from endogenous substrates, presumably muscle glycogen. During the subsequent recovery period the specific activities of lactate and CO_2 rose while the blood lactate and respiratory CO_2 excretion dropped to normal levels. Although the level of blood glucose did not change markedly, its specific activity fell more rapidly during work than during rest, indicating a greater "turnover". However, this increased turnover began some time after commencement of work and continued into the subsequent recovery period. These findings suggest that the stored muscle glycogen represents the immediate fuel for glycolysis and respiration of working muscle. Subsequently, there is an increased uptake of the blood glucose by working muscle, compensated in the present experiments by an increased hepatic glucose output. (From the authors' abstract)

11116
Robinson, K. W., 1958
and W. V. Macfarlane
URINARY EXCRETION OF ADRENAL STEROIDS DURING EXERCISE IN HOT ATMOSPHERES.—Jour. Applied Physiol., 12 (1): 13-16. Jan. 1958.

A study was made of adrenal cortical activity and the salt- and water-saving activity of the kidney during a 4-hour period of intermittent exercise (rowing) at a temperature of 40.5° C. Analyses of urine collected at half-hour intervals revealed a rapid initial fall in the output of 17-ketosteroids and 17-ketogenic steroids to a constant low level. When the severity of exercise was increased to the point of distress in one subject, the initial fall in steroids was followed by an increase to control levels. All measures showed a rapid return to control values after return to a cool environment.

11117
Rossanigo, F., 1958
and B. Tagliamonte
[RESPIRATORY AND CARDIOCIRCULATORY CONDITIONS DURING AND AFTER THE 50-CM.-HIGH STEP TEST IN SUBJECTS TRAINED TO PERFORM PHYSICAL EXERCISE] Condizioni respiratorie e cardio-circolatorie durante e dopo la prova dello scalino alto 50 cm in soggetti allenati all'esercizio fisico.—Rivista di medicina aeronautica (Roma), 21 (2): 243-254. April-June 1958. In Italian, with English summary (p. 252).

A group of 10 subjects trained to perform physical exercises, carried out a functional test which consisted in mounting and descending a 50-cm.-high step, 30 times per minute for five minutes. Pulmonary ventilation as well as pulse rate and respiratory frequency were measured immediately before and during muscular work, and during the first 15 minutes of recovery. Humeral arterial pressure was measured at rest, immediately after work, and during recovery. Oxygen consumption, energy consumption (in cal./min.), cal./liter ratio, and O_2 equivalent were calculated from the data obtained. The results, compared with those obtained in a previous investigation conducted on untrained subjects, revealed greater physical efficiency of trained individuals, as evidenced both by a higher energetic yield of lung ventilation and by a more satisfactory response of the cardiovascular system. They also proved that even trained subjects cannot reach a "steady state" by means of such exercise. (Authors' summary, modified)

11118
Rowe, D. S., 1961
and J. F. Soothill
THE PROTEINS OF POSTURAL AND EXERCISE PROTEINURIA. —— Clinical Sci. (London), 21 (1): 87-91. Aug. 1961.

The types of proteinuria induced in healthy subjects by exercise and by changes of posture differ in terms of selectivity to a range of serum protein molecules of different molecular weights, as shown by immunochemical estimation of urine/serum concentration ratios. Values obtained for the mean molecular weight of the protein were lower for exercise proteinuria than for postural proteinuria. (From the authors' summary)

11119
Saha, H. 1959
STUDIES ON THE RESPIRATORY METABOLISM OF TENSING NORGAY AND OTHER SUBJECTS.—— Indian Jour. Med. Research (Kasauli), 47 (4): 423-427. July 1959.

The respiratory metabolism of Tensing Norgay (the first man to climb Mt. Everest) was compared with that of three other subjects during hill-climbing with loads at an altitude of about 7,000 feet above sea-level at Darjeeling. Each subject performed four experiments involving work of different grades of severity. Tensing Norgay's low respiratory quotient values indicated that he could perform these experiments without any sign of exhaustion. The values of metabolic rate ratio showed that of all the subjects he had the best physical fitness. In addition, he exhibited a maximum and constant respiratory efficiency as demonstrated by the volume of expired oxygen values. (From the author's summary)

11120
Saiki, H., 1961
and Y. Ebe
[CORRELATION BETWEEN MUSCLE FORCE AND EMG (Abstract)]. —— In: [Abstracts from the 6th meeting of the Japanese Aviation Medicine and Psychology Society]. Nihon Kōkū Igaku Shinri Gakkai Kiroku (Tokyo), no. 11: 3-4. May 27, 1961. In Japanese.

Adult men using a steel grip performed pushing, pulling, adductive, and abductive movements. Each movement was divided into four stages with tensions of 1.5, 3.0, 4.5 and 6.0 kilograms, and the subject maintained each tension for five seconds. A limited proportional relation exists between muscle force and the electromyographic recording, and

when tension exceeds a certain point the correlation describes a plateau. Excitability is sometimes reduced when muscle tension is consistently increased. When muscle tension is maintained, an enlargement of the spike is seen, and as excitability is reduced the ability to maintain tension is lost. (Dr. H. Saiki)

11121
Schlessinger, B. S., 1958
F. H. Wilson, and C. B. Haven
INFLUENCE OF EXERCISE AND DIET ON THE BLOOD LIPIDS OF A MILITARY POPULATION.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 59-6, Oct. 1958. 6 p.
Also published in: Military Med., 123 (4): 274-278. Oct. 1958.

Blood samples were obtained from a group of 199 basic trainees at the beginning, midpoint, and termination of the 8-week training period. During this period, the subjects were placed on a regimen of extensive physical exercise and a diet high in fat content. Analyses of the blood lipids showed that the concentrations of the cholesterol, lipid phosphorus, and S_f° 20-400 lipoproteins increased, and the levels of S_f° 0-12, S_f° 12-20, and 1.2 lipoproteins as well as the atherogenic index decreased. The results indicated a beneficial effect of the physical exercise regimen. (Authors' abstract)

11122
Schleusing, G., 1961
J. Hiller, and G. Neumann
[PHENOMENA OF ADAPTATION TO EXERCISE IN THE HEART AND CIRCULATION] Trainingsanpassungserscheinungen von Herz und Kreislauf.—Zeitschrift für Alternsforschung (Leipzig), 15 (2): 111-121. May 1961. In German, with English summary (p. 120)

Investigations were conducted with 25 non-athletic individuals and 187 athletes of various disciplines. Physiological indices determined were cardiac output, O_2 intake, and pulse rate, as well as body size, body weight, body surface, and Kamp index. The following quotients were calculated: (1) HV (heart volume):O_2; (2) HV:body weight; (3) HV:body surface in sq. m.; (4) HV:Kamp index, (5) O_2:pulse:body weight; and (6) O_2:pulse:Kamp index. The quotients insure a better evaluation of the progress of adaptation to exercise than the absolute values in isolated consideration. (Authors' summary, modified)

11123
Schwartz, A. E., 1958
W. Lawrence, and K. E. Roberts
ELEVATION OF PERIPHERAL BLOOD AMMONIA FOLLOWING MUSCULAR EXERCISE.—Proc. Soc. Exper. Biol. and Med., 98 (3): 548-550. July 1958.

The relationship of blood ammonia concentration to the hyperpnea associated with muscular exercise was investigated. Blood ammonia, blood pH, and plasma total CO_2 content were measured in patients subjected to electroshock therapy, in dogs administered Metrazol to induce convulsions, and in normal subjects performing voluntary muscular exercise (running). Muscular exercise produced consistent decreases in blood pH and plasma CO_2, and an increase in blood ammonia. The increase in blood ammonia is attributed to deamination within the muscles. A causative relationship between blood ammonia and hyperpnea was not established, since the maximal increase in ventilation occurred immediately after exercise in normal subjects, while the elevation in blood ammonia reached a maximum after 4 minutes of exercise, and persisted after ventilation returned to normal levels.

11124
Sendroy, J. 1958
RELATIONSHIP OF OXYGEN DEBT TO BLOOD LACTATE AND PYRUVATE IN EXERCISED DOGS.—Naval Medical Research Inst., Bethesda, Md. (Project no. NM 004 006.04.01). Research Report (vol. 16, p. 787-802), Oct. 3, 1958.
AD 210 414

In experiments carried out on anesthetized dogs, 31 oxygen debt estimates were obtained from 5 animals subjected to various intensities of exercise by electrical stimulation. The blood lactate levels found in recovery did not indicate the extent of development of O_2 debt; hence these values obscured the metabolic basis of debt. According to present concepts of biological oxidations and tissue energy production, the mass action effect of measured pyruvate changes in conditions of O_2 lack may be used to correct the values for total lactate production. The "excess lactate" which remains should alone be related to oxygen debt development. Oxygen debt values, based on the oxygen-equivalent of lactate distributed throughout the total body water, have been calculated from total, and "excess", blood lactate levels. The data show a wide divergence between values for the conventional respiratory debt and those for body lactate calculated from total blood lactate analyses. However, there is a close correlation between "excess lactate" debt, and oxygen debt, at levels of exercise from mild to severe. Although lactate production was increased in resting animals injected with pyruvate, no significant part of this was calculable as "excess lactate". These experiments suggest that (1) blood total lactate concentration is unrelated to body oxygen debt, but (2) the production of "excess lactate", a simple function of changes in both body pyruvate and lactate, is highly predictive of the oxygen debt. (Author's abstract) (41 references)

11125
Sepe, E. 1959
[EFFECT OF MUSCULAR WORK PROLONGED TO EXHAUSTION ON BEHAVIOR OF THE PATELLAR REFLEX IN MAN] Effetto di un lavoro muscolare protratto sino alla fatica sul comportamento del riflesso rotuleo nell'uomo.—Rivista di medicina aeronautica e spaziale (Roma), 22 (1): 104-112. Jan.-Mar. 1959. In Italian, with English summary (p. 111).

The patellar reflex was recorded before and after exercise in 10 normal men between 20 and 30 years of age and weighing 65-85 kg. The intensity and duration of exercise were capable of inducing moderate fatigue. Based on tabulations of the electromyographic action potentials executed before and immediately after the exercise by eliciting the reflex with graded stimuli, the author concludes that aside from a moderate increase of the latency interval between stimulation and reflex response, fatigue reduces the amplitude and heightens the patellar reflex.

11126
Shepard, R. H., 1959
E. Varnauskas, H. B. Martin, H. A. White, S. Permutt, J. E. Cotes, and R. L. Riley
THE RELATIONSHIP BETWEEN CARDIAC OUTPUT AND THE APPARENT DIFFUSING CAPACITY OF THE LUNG IN NORMAL MEN DURING TREADMILL EXERCISE.—Johns Hopkins Hospital. Dept. of Environmental Medicine, Baltimore, Md.; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 58-137, Jan. 1959. 13 p.

Two methods for estimating pulmonary diffusing capacity (steady-state O_2 method of Lilienthal and Riley and steady-state CO method of Filley) were compared by applying them simultaneously in three normal young men at different levels of treadmill exercise with and without hypoxia. Carciac output (indicator dilution) was estimated at the same time. Subjects were studied at each of four levels of exercise producing oxygen uptakes between 1 and 2.5 liters per minute and cardiac outputs between 9 and 22 liters per minute. Diffusing capacity for CO increased progressively with increasing exercise in all subjects. It was higher during hyposix than during air breathing at the same level of exercise, as were total ventilation, tidal volume, and cardiac output. This increase in DCO cannot be explained solely on the basis of increased affinity of hemoglobin for CO during hypoxia. Diffusing capacity for oxygen increased progressively until the cardiac output reached about 15 liters per minute but did not increase significantly with further increase in cardiac output. The reasons for the difference in the shape of the curve of diffusing capacity vs. cardiac output in the case of CO as opposed to O_2 remain obscure but are believed to be related primarily to differences in the weighting of the many factors involved. (Authors' abstract)

11127
Sills, F. D., 1958
and A. L. Olson
ACTION POTENTIALS IN UNEXERCISED ARM WHEN OPPOSITE ARM IS EXERCISED.—Research Quarterly, 29 (2): 213-221. May 1958.

The electrical activity in an unexercised arm was recorded when the opposite arm was exercised. The subject exercised the opposite arm by raising it to a 45° angle, as four and one-half pound weights were systematically added until the subject could no longer perform the exercise. The microvoltage was recorded by taking a photograph of the cathode-ray-oscillograph. It was found that: (a) the microvoltage increased as the resistance increased; (b) on an average, 70% of maximum strength elicited a potential of ten microvolts in the unexercised arm; and (c) maximum contractions elicited, on an average, 30.4 microvolts in the unexercised arm. It is concluded that either muscle setting or active exercises will elicit higher potentials in an arm than will exercising the opposite arm against maximum resistance. (Authors' abstract)

11128
Sologub, E. B. 1960
[CHANGES IN THE EEG OF MAN PRODUCED BY MUSCULAR WORK] Izmeneniia EEG cheloveka pod vliianiem myshechnoi raboty. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 786-794. July 1960. In Russian, with English summary (p. 794). English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, New York), 46 (7): 917-928. Dec. 1960.

Simultaneous recordings of the EEG, ECG, EMG, pneumogram and ergogram revealed a relationship between EEG changes and the stages of exercise. Asynchronous high frequency (AHF) activity seen on the EEG during the first stage and the beginning of the second stage was replaced by snychronous high frequency activity during transition to the steady state, by slow potentials in the work rhythm, and, finally, by alpha waves. Parallel to EEG changes, a reduction of respiratory and cardiac center excitability, "concentration of muscular force", and a sharp increase in endurance were observed. Reappearance of AHF in the "dead point" state indicates inhibition of the cortical centers and asynchronism of their excitation with resulting disruption of the cardiac, respiratory, and motor functions. Local responses of the motor area in the cortex to proprioceptive stimuli shifted during work as follows: the amplitude increased, the slow components disappeared, high-frequency oscillations increased, and latency was reduced from 120-90 to 10-30 msec. (Author's conclusions, modified)

11129
Starke, R. D., 1961
and R. G. Bartlett
A SIMPLE TECHNIQUE FOR MEASURING THE OXYGEN COST OF PHYSICAL WORK. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 8, Dec. 5, 1961. ii+8 p.

A simple, inexpensive, yet accurate method for measuring the oxygen cost of a physical work load has been developed. With the use of minor modifications of a common metabolimeter, oxygen cost is simply computed by measuring the volume displacement of resting oxygen uptake slopes on either side of a period of physical work. (Authors' abstract)

11130
Sterescu, N., 1961
Z. Covăsneanu, and A. Stancu
[EXPERIMENTAL STUDIES ON THE FUNCTIONAL STATE OF THE THYROID GLAND DURING THE PERIOD OF REST WHICH FOLLOWS EFFORT: STUDIES USING RADIOIODINE (I^{131}) AND RADIOPHOSPHORUS (P^{32})] Cercetări experimentale privind starea funcţională a tiroidei în perioada repausului post-efort: Studii cu ajutorul I^{131} şi P^{32}. — Studii şi cercetări de fiziologie (Bucureşti), 6 (1): 107-113. 1961. In Rumanian, with French summary (p. 112).

Radioiodine (I^{131}) and radiophosphorus (P^{32}) were administered to guinea pigs at the end of a period of physical effort. During the rest period the thyroid remained in a state of compensatory hyperfunction to become normal an hour after the cessation of the effort. The thyroid iodine absorption was increased by 46%, and thyroid phosphorus absorption by 38%. The functional stimulation of the thyroid during the rest period following effort is due to an activation of the thyrotropic hormone secretion, which can be blocked by thyroxine administration.

11131
Strollo, M. 1961
[ASPECTS OF MENTAL ACTIVITY IN RELATION TO INTENSE AND PROTRACTED MUSCULAR WORK] Aspetti dell'attività mentale in rapporto a lavoro muscolare intenso e protratto.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 43-51. Roma, 1961. In Italian.

Young men between 18 and 22 years of age were given two tests, arithmetical calculations (150 subjects) and the "barrage" test (Boganelli) or cancellation signs (50 subjects), while at rest and after prolonged, intense muscular work performed either on the cyclo- or treadmill ergometer. Percentual qualitative and quantitative studies were made of individual performance of the two tests and the number of errors made after muscular work, along with tabulations of individual performance of the tests before and after work. Prolonged intense muscular work did not cause significant modifications in mental efficiency during performance of the two tests.

11132
Strollo, M. 1961
[PERCEPTIVE AND PSYCHOMOTOR FUNCTION IN RELATION TO PROTRACTED AND INTENSE MUSCULAR WORK] Funzione percettiva e psicomotoria in rapporto a lavoro muscolare protratto ed intenso.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 52-60. Roma, 1961. In Italian.

Tachistoscopic (measuring visual perception) and simple reaction time (measuring psychomotor performance) tests were administered to 50 males between 18-22 years of age before and after prolonged, intense muscular effort on the cyclo- and treadmill ergometer, and after the first fifteen minutes of rest (tachistoscopy only). A slight decrease of the reproduced elements in the tachistoscopic test was observed after muscular work, with an increase of errors during post-work sittings. Regarding the reaction time test, 70% of the subjects revealed no change or a slight improvement after work; the remaining 30% showed a slight prolongation of motor reaction time. Included are representative tabulations of percentual quantitative and qualitative data of individual performance on psychomotor and perceptual tests before and after prolonged, intense muscular work.

11133
Swartz, B., 1958
and K. Akerman
CALIBRATION OF A SIMPLIFIED BICYCLE-ERGOMETER TEST OF PHYSICAL WORKING CAPACITY.—Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 7 (1): 1-5. 1958. In English.

In a simplified bicycle-ergometer test, the subject's pulse and breathing frequencies were measured for 6 or 8 minutes, and his work capacity was determined for a single weight load. Data obtained from this test were compared with the results of a conventional but longer clinical method, in order to determine the feasibility of employing the simplified method for testing work capacities on large numbers of service personnel. A weight pack of 900 kg./min. was used for men, and a load of 600 kg./min. for women. Under these loads, an expected pulse rate ranging from 120-600 beats/min. was anticipated. The results obtained during a short test period from the simplified test indicated fluctuations of pulse rates in individuals with low working capacities. The authors conclude that the best may be of value in preliminary classifications of individuals with respect to their work capacity.

11134
Szwarcowa, H., 1961
and A. Wroński
[THE EFFECT OF PHYSICAL EXERTION AND FATIGUE ON THE RATE OF UROPEPSIN EXCRETION] Wpływ wysiłku fizycznego i zmęczenia na wydalanie uropepsyny doniesienie wstępne. —Endokrynologia polska (Warszawa), 12 (1): 95-103. Jan.-Feb. 1961. In Polish, with English summary (p. 103).

Uropepsin excretion was measured at rest, after routine exercise, and after exhausting exercise in 7 women and 28 men living at the School of Physical Education in Poland. Contrary to other findings differences in uropepsin excretion between men and women under the above conditions did not exceed 28.7%, probably due to similar living and training conditions. Uropepsin excretion increased significantly after routine exercise; it diminished after exhausting exercise. The rate of uropepsin excretion reflects adrenocortical function which is stimulated by physical exercise. Excessive exertion causes transitional functional insufficiency of the adrenal cortex accompanied by diminished uropepsin output. It is proposed that measuring the rate of uropepsin output may be of value in estimating an individual's capacity for physical work. (Authors' summary, modified)

11135
Takahashi, A. 1961
MUSCLE EXERCISE AND THE HYPOTHALAMO-SYMPATHICO-ADRENOMEDULLARY SYSTEM, WITH SPECIAL REFERENCE TO THE HOMEOSTASIS OF BLOOD SUGAR LEVEL FOLLOWING MUSCLE EXERCISE AND THE INTERRELATIONSHIP BETWEEN MUSCLE EXERCISE AND ADRENALINE. —Nagoya Jour. Med. Sci. (Nagoya), 24 (1): 37-71. Aug. 1961.

Normal subjects and patients with various neurohumoral disorders excercised with a load of 4 kg. for 5 minutes on a bicycle ergometer. Before exercise various sympathicolytic drugs were given. Following muscle exercise hyperlacticacidemia, leukocytosis, eosinopenia, and increased urinary excretion of adrenaline and noradrenaline were observed. These reactions were effected by the sympathicolytic drugs. Excercise activated the sympathico-adrenomedullary system and promoted adrenaline secretion. Adrenaline probably activated muscle phosphorylase, which prevented overfatigue. After exercise in normal subjects the blood sugar pattern was usually stable, while in pretreated or pathologic subjects there was an irregularly fluctuating pattern. It appeared that after exercise the blood sugar level was partially modulated by the sympathico-adrenomedullary system. (Author's summary, modified) (98 references)

11136
Trakhtenberg, I. M., 1958
and I. V. Savitsky [Savitskii]
EXPERIMENTAL DATA ON SECHENOV'S PHENOMENON DURING DYNAMIC WORK. II. CHANGES IN EFFICIENCY IN THE PROCESS OF PROLONGED MUSCULAR ACTIVITY WITH PASSIVE AND ACTIVE INTERRUPTIONS.—Bull. Exper. Biol. and Med. (Consultants Bureau, New York), 43 (1): 26-28. 1958.
English translation of item no. 7580, vol. VI, 1957.

11137
Vereshchagin, N. K. 1958
THE EFFECTS OF STATIC EFFORTS ON BODILY FUNCTIONS.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 43 (7/8): 646-651. [1958].
English translation of item no. 7582, vol VI.

i. Fatigue

11138
Armington, J. C., 1959
and L. L. Mitnick
ELECTROENCEPHALOGRAM AND SLEEP DEPRIVATION.—Jour. Applied Physiol., 14 (2): 247-250. March 1959.

The occipital alpha rhythm was recorded from ten subjects before, during and after a 98-hour period of sleep deprivation. The alpha rhythm declined progressively and was nearly absent in most subjects after 50 hours of deprivation. At every stage of deprivation the alpha activity was smaller during counting as compared to adding numbers. Stimuli that normally produce alpha block were found to elicit alpha rhythm when the effects of deprivation were apparent. Following deprivation, alpha activity recovered rapidly and within 24 hours was essentially normal. (Authors' abstract)

11139
Ax, A., 1961
and E. D. Luby
AUTONOMIC RESPONSES TO SLEEP DEPRIVATION. —Arch. Gen. Psychiat., 4 (1): 55-59. Jan. 1961.

Five subjects were studied physiologically during a 123-hour vigil of wakefulness. Of twelve physiological measures, six showed consistent changes from previgil and postvigil control values. Palmar sweating, muscle tension, finger temperature, and body temperature fell consistently. Palmar sweating and diastolic blood pressure increments to a pain stimulus also declined markedly. These physiological effects of prolonged wakefulness are interpreted as evidence for decreased arousal or activation and profound central sympathetic fatigue. Apparent contradictory changes are discussed. The increased respiration rate and pulmonary ventilation appear to be the result of increased CO_2 and lactate in the blood, a product of more anaerobic glycolysis as evidenced in collaborative biochemical studies. (Authors' summary)

11140
Cappon, D., 1960
and R. Banks
STUDIES IN PERCEPTUAL DISTORTION: OPPORTUNISTIC OBSERVATIONS ON SLEEP DEPRIVATION DURING A TALKATHON.—A. M. A. Arch. Gen. Psychiat., 2 (3): 346-349. March 1960.

A preliminary study of perceptual changes in subjects deprived of sleep for up to 88 hours during a talkathon showed that the frequency of perceptual distortions tended to increase with increasing sleep loss. Perceptual changes were followed by the appearance of emotional disturbances. A comparison of results obtained from the administration of various standard tests indicated that the more neurotic, nervous, anxious, and less intelligent person was able to withstand sleep deprivation less well.

11141
Falet, R., 1959
P. Mases, and C. Jacquemin
[REGARDING DONAGGIO'S TEST AS A MEANS OF EXPLORING FATIGUE OF THE AVIATOR] À propos du test de Donaggio comme moyen d'exploration de la fatigue de l'aviateur.—Médecine aéronautique (Paris), 14 (1): 5-13. 1959. In French, with English summary (p. 11).

In studies of fatigue, Donaggio's reaction is currently considered a good test for the detection of mucoproteinuria. The authors, while not considering this test in itself as being absolutely reliable, believe that it could be included in an explorative psychophysiological battery of tests for pilots. Taking early results obtained in this field as a base-line, the present research has introduced technical precision into Donaggio's reaction and effected a statistical exploration of results obtained with horse albumin as a substance exerting a positive obstacle action. It is proved that mucoprotein extracted from carcinomatous patients and from positive urine of normal subjects acts in the same way as horse or bovine albumin. Using the standard curve obtained with horse albumin, the authors offer a numerical expression of mucoproteinuria which should improve the accuracy of the Donaggio reaction and thereby facilitate the study of variations of mucoproteins in urine caused by fatiguing flying tasks. (Authors' summary, modified)

11142
Fel'dman, G. L. 1961
THE EFFECT OF DEPRIVATION OF SLEEP ON ELECTRICAL ACTIVITY AND OTHER INDICES OF CEREBRAL ACTIVITY IN ANIMALS. —Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (2): 186-195. Dec. 1961.

Sleep deprivation experiments were carried out on 34 animals (kittens, adult cats, and puppies) with implanted electrodes in the motor and visual cortices, and in subcortical areas. After 36 hours of sleep deprivation the alpha-rhythm slowed down but its amplitude increased; inhibition of the alpha-rhythm in response to external stimulation was weakened and its latency prolonged; thresholds for electrical brain stimulation were raised. At 60-82 hours of sleep deprivation the alpha-rhythm became even slower (2-5/second), the general level of electrical activity was lowered; the alpha inhibition in response to external stimulation was reduced or absent; thresholds for electrical stimulation were raised 30-40%; the strength of motor reaction did not increase parallel to an increase in stimulus strength; and the animal's motor coordination deteriorated. After a prolonged period of sleep deprivation, when the animal went to sleep, transitional stages in EEG between wakefulness

and sleep were absent and the deep sleep that ensued was characterized by an extreme reduction of all electrical potentials. All indices were restored almost to the initial levels by 24 hours of sleep.

11143
Fenning, L. M. 1960
VISUAL HYGIENE FOR RADAR OBSERVERS. — Optical Jour. and Rev. Optometry, 97 (24): 35-36. Dec. 15, 1960.

Factors which produce optical and neurological fatigue are described, and prophylactic measures are suggested. The radar observer is advised to keep his line of sight perpendicular to the oscilloscope, to change the visual axis and viewing distance periodically, to avoid staring at one target by fixating behind the rotating sweep for a period of one-half to one second, and to keep the equipment set for optimum indicator visibility. Proper posture and diet and avoidance of alcohol and nicotine poisoning, frequent short rest intervals, and limitation of scope duty to one-half hour periods are mentioned as hygienic measures. Visual examinations should include phoria measurements. One solution to the fatiguing effects of contrasts in radar room illumination is the installation of the Broad Blue Band Lighting System, which provides blue flood lighting for the radar room with orange filters placed over the face of the scope.

11144
Floru, R., 1961
M. Sterescu-Volanschi, E. Bittman, R. Elias, and A. Pescaru
[RESEARCH ON THE PECULIARITIES OF NERVOUS FATIGUE DURING THE PROCESS OF MECHANIZED AND AUTOMATIZED PRODUCTION] Cercetări privind particularităţile oboselii nervoase in producţia mecanizată şi automatizată. — Studii şi cercetări de fiziologie (Bucureşti), 6 (4): 658-693. 1961. In Rumanian, with French summary (p. 693).

A decrease in the threshold of flicker fusion was found at the end of the day in persons working with automatic machines. The arrest of the alpha rhythm upon a continuous or intermittent light stimulus disappeared or decreased considerably at the end of work.

11145
Frederik, W. S. 1959
PHYSIOLOGICAL ASPECTS OF HUMAN FATIGUE. —A. M. A. Arch. Indus. Health, 20 (4): 297-302. Oct. 1959.

Controversial findings in earlier studies of various indices of fatigue are now explained on the basis that any deterioration of performance is caused by functional fatigue for that particular test. Analysis of 1958 world running records showed that for high-energy output performances (short distance runs) objective fatigue measured by deterioration of performance occurs earlier than subjective fatigue. For low sustained performance (marathon runners) the subjective feeling of fatigue always precedes the actual deterioration in performance. It is hypothesized that for very low-level performances the subjective fatigue will begin well ahead of objective fatigue. Application of these findings to performances in general resulted in the discovery that the simultaneous performance of two tasks produces after a certain time deterioration which is noticeable in each part of this combined task. At the same time the subject is still able to perform either of the tasks separately without any difficulty. This implies that the analysis of the performance on one task being done simultaneously with another one could be utilized as an indicator of the onset of functional objective fatigue of the combined tasks. The determination of the onset of functional objective fatigue of a complex task, such as flying an airplane, was done by subjecting the pilot to a choice reaction test while performing his duty as a pilot. The onset of functional objective fatigue was indicated by a significant change in the shape of the reaction time distribution as recorded on the "performance indicator."

11146
Fujie, Z., 1960
and A. Tsuruta
[THE EFFECT OF THIOCTIC ACID ON FATIGUE] Chiokutosan no hiro ni oyobosu eikyo ni tsuite. — Japanese Defense Forces Med. Jour. (Tokyo), 7 (5): 31-33. May 1960. In Japanese, with English abstract (p. 33).

The effect of thioctic acid on fatigue was studied in jet aircraft maintenance personnel by means of the cupriferrocyanide colloid reaction and flicker fusion frequency measurements. The results indicated that thioctic acid is effective in the prevention of fatigue.

11147
Fujiwara, M., 1959
and K. Miki
[ON THE FATIGUE OF PILOTS OF THE ANTI-SUBMARINE PATROL-INTERCEPTOR AIRCRAFT, S2F] S2F taisen shōkai kōgekiki sōjūshi no hirō ni tsuite. — Japanese Defense Forces Med. Jour. (Tokyo), 6 (4): 14-17. April 1959. In Japanese, with English summary (p. 17).

Aspects of fatigue were studied in 51 pilots whose duty involved flying at extremely low altitudes (30-100 feet above open water) day and night and application of more vigilance and surveillance than is required during high-altitude flight. A subjective survey of symptoms and dot-counting tests were used to study psychophysical aspects; tactile discrimination of size and shape of objects was used to measure physiological aspects; and urinalysis (with albumin determinations and a modified Donaggio test) was used for the study of biochemical aspects. Low-level, day flights did not cause excessive physical fatigue. Certain amounts of psycho-neurotic fatigue (subconsciously manifested) were present, however, indicating that more emphasis should be placed on the psychological rather than physical prevention of fatigue. (Authors' abstract, modified)

11148
Galatioto, I. 1959
[CRITICAL FUSION FREQUENCY AS A TEST OF OPERATIONAL FATIGUE IN AIR RESCUE CREWS]. La frequenza critica di fusione come test di fatica operazionale negli equipaggi del soccorso aereo. — Rivista di medicina aeronautica e spaziale (Roma), 22 (1): 148-162. Jan.-Mar. 1959. In Italian, with English summary (p. 160-161).

The results of critical fusion frequency tests in 24 air rescue crewmen were evaluated during rest and after rescue flights of long duration over the sea. Based on a critical review of the tabulated

data, the author detected fatigue in the crewmen which was caused by glare from the sea surface, turbulence, duration of flight, emotional stress, and an exceedingly prolonged series of operational flights without rest. Operational fatigue of this type was found in each crewman examined.

11149
Grose, J. E. 1958
DEPRESSION OF MUSCLE FATIGUE CURVES BY HEAT AND COLD.—Research Quarterly, 29 (1): 19-31. March 1958.

Immersion of the forearm in hot water (48° C. for eight minutes) did not affect initial strength or steady-state "fatigue level," but did cause a 34% increase in the rapidity of fatigue. Substitution of cold water (10° C.) decreased initial strength 11% without altering the observed fatigue level; because of less work per contraction, fatigue was considerably less than under control conditions. Massage was without effect. Using a spring-loaded ergograph, the fatigue curve showed an exponential drop-off in work output, and was accurately described by a simple mathematical formula. (Author's abstract)

11150
Haider, M., 1961
and N. F. Dixon
INFLUENCES OF TRAINING AND FATIGUE ON THE CONTINUOUS RECORDING OF A VISUAL DIFFERENTIAL THRESHOLD. — Brit. Jour. Psychol. (London), 52 (3): 227-237. Aug. 1961.

A visual differential threshold was recorded continuously for 14 min. in each of six different sessions. Integrated scores for 1/2 min. periods, indicative of mean threshold values, showed a marked tendency to rise between the second and the tenth minute of the experiment. This was attributed to a fatigue decrement of a central state of vigilance or alertness. The scoring of length of curve and number of control adjustments during 1/2 min. periods, indicative of the subject's working behavior, showed no such consistent tendencies. In the first run, however, the method of working showed some training effects which seemed to mask the fatigue decrement of mean threshold values and led to a change in the criteria of judgement for the second run. All three variables showed marked and fairly consistent individual differences. No clear differences between morning and evening values could be established. (Authors' abstract)

11151
Harris, S. J. 1960
THE EFFECTS OF SLEEP LOSS ON COMPONENT MOVEMENTS OF HUMAN MOTION.—Jour. Applied Psychol., 44 (1): 50-55. Feb. 1960.

An experiment was conducted to determine the effects of 60 hr. of sleeplessness on various nervomuscular and perceptual performances. Nineteen male subjects were tested during a five-day training period, a three-day sleep loss period, and a two-day recovery period. Manipulative and travel movements in a panel control test, bimanual and unimanual coordination, and leg movement were tested according to duration required for performance. Steadiness and critical flicker frequency were also tested. Results obtained show that loss of sleep produced a differential effect on manipulation and travel movements in the panel control task. While the duration of travel movements increased, the duration of manipulation movements decreased (presumably through increased motivation). Speed of performance in the bimanual and unimanual coordination tasks and in leg movement was decreased. An irregular change was noted during the sleep loss period in the test of hand steadiness. A significant decrease in critical flicker frequency was noted. The data on travel movements and coordination tasks showed consistent diurnal variation during the sleep loss period, indicating that this type of movement is influenced by normal psychophysiological variations as well as by the more extreme stress conditions produced by sleep loss.

11152
Hauty, G. T., 1958
and R. B. Payne
FATIGUE, CONFINEMENT, AND PROFICIENCY DECREMENT.—In: Vistas in astronautics, p. 304-309. Ed. by M. Alperin, M. Stern, and H. Wooster. N. Y.: Pergamon Press, 1958.
Reprinted in: Reports on space medicine — 1958. School of Aviation Medicine (U.S. Air Force), Randolph Air Force Base, Texas. [6] p. [Unnumbered Report], Feb. 1959.

Twenty-four volunteers were required to perform for 30 consecutive hours a task which consisted of monitoring several simulated aircraft indicators and, upon the detection of departures from null, executing corrective action. With the exception of short and infrequent periods for lunch, relief, and exercise, they remained confined to this task situation and were not permitted to sleep. While urinalyses revealed very little temporal change in physiological function, task proficiency followed a highly regular pattern of change. Initial proficiency levels were maintained up to midnight at which time decline set in and progressed until 6 a.m. At this point proficiency began to increase until from noon to the termination of work, it was one-half that of initial levels. Dextro-amphetamine (5 mg.) restored proficiency substantially with no evidence of a "let-down" effect. Nearly all subjects reported perceptual disturbances ranging widely in degree of bizarreness and presumed adverse effect upon proficiency. Since these aberrations occurred within a normal sensory environment, it may be that such will occur to a greater degree in the closed ecological system of a space vehicle. (Authors' abstract, modified)

11153
Hicks, S. A. 1959
THE MOTIVATIONAL EFFECTS OF REST PERIODS ON PERFORMANCE.—Aberdeen Proving Ground. Human Engineering Lab., Md. (Project no. TB1-1000). Technical Memorandum no. 8-59, Aug. 1959. ii+18 p. AD 220 590

The motivational effects of different rest schedules on the performance of heavy rotary tasks were investigated. The schedules used were: (1) fixed interval (FI) which was defined as rest after a given period of time; and (2) fixed ratio (FR) which was defined as rest after a given number of responses. In addition, a no-rest condition was used to introduce a fatigue effects so that under experimental conditions, the subject would not be operating at peak efficiency. Results indicated that for the type of task under consideration, the FR schedule, as opposed to the FI schedule, elicits more stable work and reduces the deleterious effects

of fatigue, thereby producing greater total work output. There are indications that the motivating value of rest periods is contingent upon the difficulty of the work. In addition, other factors could operate to change the effect of a rest period given for superior performance. (ASTIA abstract)

11154
International Civil Aviation Organization 1961
FLIGHT CREW FATIGUE AND FLIGHT TIME LIMITATIONS.—International Civil Aviation Organization, Montreal, Canada. ICAO Circular no. 52-AN/47/2, Second Edition, 1961. i+126 p.

As no reliable objective indices of fatigue are at present available from which to determine comparative degrees of fatigue accurately, rough approximations of the times involved in becoming tired enough to have clearly passed beyond the threshold of acceptable efficiency have had to suffice so far. A compilation of the current regulations of the contracting countries, and those established by operators and approved by their countries, is presented in order to acquaint all countries with the types of flight time limitations now in force.

11155
Ishihara, I., and Y. Komori 1960
FATIGUE AND RHYTHMICAL EXCRETION OF 17-HYDROXYCORTICOIDS IN URINE. — Ann. Rep. Research Inst. of Environmental Med. Nagoya Univ. (Nagoya, Japan), 8: 47-53. 1960.

Throughout a twenty-four hour period of work consisting of watch, patrol, and rest, followed by an off-day, subjects were simultaneously tested for fatigue symptoms, flicker fusion values, and daily variations in the urinary excretion of 17-hydroxycorticoids, 17-ketosteroids, and mucoproteins. It was observed that: (1) frequency of fatigue symptoms after duty were greater than before duty; (2) the average value of flicker fusion decreased after duty; (3) average values of total urinary 17-hydroxycorticoids and mucoproteins on duty days were higher than on off-days. Daily variation in urinary 17-hydroxycorticoids was almost similar to fatigue symptoms, and (4) fatigue symptoms were highest on the first duty-day, declined daily, and were lowest in the middle of the work period. Emotional stress appeared to be stronger in the beginning of a work period than at other times.

11156
Jones, G. Melvill, 1960
FATIGUE EFFECTS IN RADIO OPERATORS DURING A PROGRAM OF HIGH INTENSITY, LONG DURATION, FLYING.—Aerospace Med., 31 (6): 478-484. June 1960.

An investigation of activity in radio operators during long-duration reconnaissance flights in piston engine aircraft is described. The basic flying unit was a 15-hour sortie divided into 5-hour watches. The subjects were given an hourly task, their achievement being scored as its percentage completion in each hour. The results were examined from hour to hour within a watch, from watch to watch within a sortie, and from sortie to sortie within the 8-day trial. The optimum duration of watch for a signaler on radio operator duty in flight was found to be three hours. A consistent reduction in measured activity, associated with subjective deterioration, became manifest after this time. The penalty for exceeding this duration tended to increase as the sortie progressed. There was a progressive decrease in mean level of activity from watch to watch throughout the standard sortie. The decline could be partially offset by introducing appropriate rest schedules during long flights. Changes from one sortie to the next, although statistically significant, were not progressive. It is suggested that the results were masked by beginning and end effects. (Author's summary, in part)

11157
Juin, G. 1961
[ON THE AGGRAVATION OF FATIGUE FACTORS IN CREW MEN OF FRENCH COMMERCIAL AIRLINES FLYING JET AIRCRAFT] Considérations sur l'aggravation des facteurs de fatigue chez les équipages de l'aviation commerciale française volant sur appareils à réaction. — Rivista di medicina aeronautica e spaziale (Roma), 24 (1): 29-43. Jan.-March 1961. In French, with English summary (p. 42).

Fatigue in the crew of commercial jet aircraft is due to either physical or psychological factors. The former include hypoxia, abrupt temperature changes, accelerations, digestive disturbances, changes in physiological rhythm, vibrations, ultrasonics, etc. Among the psychological causes are continuous attention, frequent emotional stresses, rapid and repeated sensory stimulation, etc. Flight fatigue appears to be increased by the introduction of jets, making adaptation of the flyer to his occupation more difficult. (Author's summary, modified)

11158
Klein, S. J. 1958
THE RELATIONSHIP OF MUSCLE ACTION POTENTIALS TO BREAKDOWN OF WORK IN TASK ORIENTED SUBJECTS.—Naval Air Medical Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. NM 17 01 131). Report no. NAMC-ACEL-392, Dec. 11, 1958. vi+14 p.

This study is concerned with the development of stress criteria and their effects on and relationship to performance in mental and motor work. The present experiment is a further examination of the hypothesis that within any given task situation the direction of the relationship between muscle action potentials and performance is not necessarily dependent upon how the muscle action potentials are induced. Different levels of muscle action potentials were induced by varying the rate of lift in an ergographic task and by varying the temperature of a thermal stimulus applied to the working hand. Breakdown is both a quantitative and qualitative deterioration of ergographic work and may be related to decreased efficiency of performance. The results indicate that increased muscle action potentials, regardless of how induced, are associated with increased work breakdown, as determined by higher order partial correlations. The effects of the stimuli used to induce the various levels of electrical activity upon breakdown, as examined by the analysis of variance, were non-significant. (Author's abstract)

11159
Le Roux, R. 1960
[OPERATIONAL FATIGUE OF HELICOPTER PILOTS] La fatigue opérationnelle des pilotes

d'hélicoptères. — Revue des Corps de santé des armées (Paris), 1 (4): 493-518. Aug. 1960. In French.

Operational fatigue in helicopter pilots may be caused by environmental heat, aircraft vibrations and noise, earphones, tension produced on the base by the order to stand-by, piloting, or by physical and psychological factors. The detection of fatigue was made by means of the biometric tests of Pignet and Ruffier, by measurements of arterial tension before and after effort, by the Flack test, and by Ruffier-Dickson's cardiac resistance index (which permits classification of fatigue in five stages). Therapeutic trials with adenosine triphosphate, vitamin C, desoxycorticosterone, adrenocortical extract, and periods of massage, relaxation and oxygenation were not satisfactory. Rest under constant medical supervision is the treatment recommended for operational fatigue.

11160
Lubin, A., 1959
and H. L. Williams
SLEEP LOSS, TREMOR, AND THE CONCEPTUAL RETICULAR FORMATION.—Perceptual and Motor Skills, 9 (3): 237-238. Sept. 3, 1959.

Some speculations are presented on the way in which reticular formation activity may account for overt behavior during sleep loss. These speculations predict first a decrease in tremor and then an increase, as sleep loss increases. Four assumptions are used to derive the nonmonotonic effect of sleep loss on tremor. It is concluded that if (a) cerebral tonus and muscle tonus are monotonic functions of electrical activity in the reticular formation, and (b) tremor is caused by the servomechanism properties of the stretch reflex arc, then sleep loss will lead first to an increase in steadiness and later to a series of spasmodic drops. (Authors' summary, modified)

11161
Luby, E. D., 1960
C. E. Frohman, J. L. Grisell, J. E. Lenzo, and J. S. Gottlieb
SLEEP DEPRIVATION: EFFECTS ON BEHAVIOR, THINKING, MOTOR PERFORMANCE, AND BIOLOGICAL ENERGY TRANSFER SYSTEMS.—Psychosomatic Med., 22 (3): 182-192. May-June 1960.

The effect of sleep deprivation on behavior, thinking, motor performance, and biological energy transfer systems was studied in a single subject who remained awake without drugs for 220 hours. Behavioral changes included irritability, paranoid thinking, expansiveness, grandiosity, hypnagogic states, visual hallucinations, and episodic rage. Deficits in thinking and visual-motor performance occurred cyclically across days of wakefulness, with gradual deterioration finally resulting in virtual untestability on the ninth day. Energy transfer systems responded to sleep deprivation as a stressor with a marked increase in the specific activities of adenosine triphosphate, adenylic acid, and fructose-1, 6-diphosphate. (From the authors' summary and conclusion).

11162
McCormack, P. D. 1960
PERFORMANCE IN A VIGILANCE TASK AS A FUNCTION OF LENGTH OF INTER-STIMULUS INTERVAL. — Canad. Jour. Psychol. (Toronto), 14 (4): 265-268. Dec. 1960.

Ten males and 10 females served as subjects in a vigilance task consisting of two 35-min. sessions. The subject was instructed to press a switch immediately after a light was seen. The light appeared randomly in time with the intervals between presentations being 30, 45, 60, 75, and 90 sec. Response times showed a significant increase throughout the duration of the task but remained invariant with length of inter-stimulus interval. Both phenomena were consistent from day to day for subjects of both sexes. Data from this and two earlier studies indicate a linear relation between response time and task duration. The findings of the present study are consistent with the hypothesis that inhibition accumulates linearly with time and dissipates only during periods of interpolated rest. (Author's summary)

11163
Malmo, R. B., 1960
and W. W. Surwillo
SLEEP DEPRIVATION: CHANGES IN PERFORMANCE AND PHYSIOLOGICAL INDICANTS OF ACTIVATION. — Psychol. Monographs, 74 (15): 1-24. 1960.

Three male subjects were required to perform a simple one-hour tracking task every few hours during a 60-hour period of sleep deprivation. Reliable increases during tracking were observed in palmar conductance, respiration, muscle tension in one muscle group (of several studied), and, in two cases, in heart rate. The pain threshold and the amplitude of the alpha component (8-12 c.p.s.) of the EEG were decreased. Performance was impaired with increasing exposure in two subjects, and improved in one. Various hallucinations associated with the tracking apparatus were experienced. The data support the conclusion that sleep deprivation increases the level of activation. (42 references)

11164
Morris, G. O., 1960
H. L. Williams, and A. Lubin
MISPERCEPTION AND DISORIENTATION DURING SLEEP DEPRIVATION.—A. M. A. Arch. Gen. Psychiat., 2 (3): 247-254. March 1960.

Informal observations and interviews of subjects deprived of sleep for 72 or 98 hours showed that an increase in visual misperception and temporal and cognitive disorganization occurred as sleep loss increased. Other phenomena reported were tactual illusions, feelings of depersonalization, and spatial disorientation. Although subjects generally denied sleepiness, the presence of lapses, or brief pauses in ongoing behavior, were apparent, and were often associated with subjective illusions.

11165
Morris, G. O., 1961
and M. T. Singer
SLEEP DEPRIVATION: TRANSACTIONAL AND SUBJECTIVE OBSERVATIONS. — Arch. Gen. Psychiat., 5 (5): 453-461. Nov. 1961.

A group of 74 male, Army enlisted personnel were tested and studied over a two-year span while in sleep-deprivation periods of 72 and 96 hours. The effects of sleep deprivation appear as large defects in perception, orientation, cognition, spontaneous attentiveness, and awareness including comprehension and reality grasp, plus reduced control and integration of affect. These changes represent extensions of the subjects' personality, and are

congruent with the over-all personality of the individuals. The effect of the staff of investigators upon the subjects was great, as it influenced motivation, anxiety, and irritability. The subjective experiences of the subjects can only be judged within the over-all environment, as a purely intrapsychic view is incomplete.

11166
Murawski, B. K., and J. Crabbé 1960
EFFECT OF SLEEP DEPRIVATION ON PLASMA 17-HYDROXYCORTICOSTEROIDS.—Jour. Applied Physiol., 15 (2): 280-282. Mar. 1960.

Paid volunteers (18 male college students) were deprived of sleep for one night on two separate occasions when alone. On a third occasion they were asked to stay up all night in groups of four. Plasma concentrations of 17-hydroxycorticosteroids at 8 A.M. following the nights without sleep were 4 to 5 micrograms lower than control values. The noon values after sleep deprivation in a solitary setting were not significantly different from the corresponding control values. When subjects stayed up with three other people, the noon values tended to be higher. Urinary 17-hydroxycorticosteroid level showed a decrease following the nights without sleep, but this decrease did not reach statistical significance. (From the authors' abstract)

11167
Murray, E. J., E. H. Schein, K. T. Erikson, W. F. Hill, and M. Cohen 1959
THE EFFECTS OF SLEEP DEPRIVATION ON SOCIAL BEHAVIOR.—Jour. Social Psychol., 49 (second half): 229-236. May 1959.

During two separate experiments on 72 and 98 hours of sleep deprivation, observations were made of the social, recreational, and general behavior of ten human subjects. Categories included social conversation, games, television, reading, hobbies, and non-participation. The strongest and most significant finding was that with sleep deprivation the subjects tended to change restlessly from one activity to another. Working on hobbies and crafts decreased during the sleep deprivation period. Social conversation, of a listless sort, showed an over-all increase with sleep deprivation although the exact shape of the relationship could not be specified. The results were interpreted as indicating efforts on the part of the subjects to maintain wakefulness by avoiding situations producing drowsiness. (Authors' summary and conclusions)

11168
Scholander, T. 1961
THE EFFECTS OF MODERATE SLEEP DEPRIVATION ON THE HABITUATION OF AUTONOMIC RESPONSE ELEMENTS. — Acta physiologica scandinavica (Stockholm), 51 (4): 325-342. April 1961. In English.

Phasic responses and prestimulus values of electrodermal activity, pupillary size, and pulse rate, as well as the prestimulus respiration rate were recorded during monotonously repeated auditory stimulation. Intra-individual comparisons were made between the results obtained after one night of wakefulness and after normal sleep. Among the recorded variables only two, viz., the response amplitudes (i.e., maximal post-stimulus changes) of the electrodermal activity and the pupil were influenced in a statistically significant way by sleep deprivation. The habituation of the response amplitude of the electrodermal activity was delayed and the mean level of the pupillary response amplitude was increased. It is assumed that these effects were due to a conflict between a wish to stay awake and the successively increasing sleepiness induced by the sleep deprivation and the monotony of the experimental situation. (Author's summary)

11169
Simonson, E. 1959
THE FUSION FREQUENCY OF FLICKER AS A CRITERION OF CENTRAL NERVOUS SYSTEM FATIGUE.—Amer. Jour. Opthalmol., 47 (4): 556-565. April 1959.

The effect of fatigue on the flicker fusion frequency is reviewed. Most authors found a drop of the fusion frequency of flicker in sedentary work, which can be counteracted by stimulating drugs and by rest pauses. However, there is no consistent correlation to general performance, to the visual component of performance, and to subjective fatigue. Different types of physical exertion produce different effects on the fusion frequency of flicker. The fusion frequency of flicker is probably related to the excitability of the central nervous system, involving also disturbance of the sympathetic-parasympathetic regulation in fatigue. (Author's summary)

11170
Strollo, M., E. De Angelis, and E. Molinari 1960
[AN INVESTIGATION WITH THE TACHODOMETER BEFORE AND AFTER MENTAL AND MUSCULAR FATIGUE] Una indagine col tacodometro prima e dopo fatica mentale e muscolare. — Rivista di medicina aeronautica e spaziale (Roma), 23 (1): 103-116. Jan.-March 1960. In Italian, with English summary (p. 114-115).

Two groups of fifteen subjects were investigated with a tachodometer while at rest and after either physical or mental fatigue. One group was subjected to intense muscular work on a treadmill ergometer prolonged for a period of fifteen minutes, and the other given a battery of psychomotor tests consecutively for a period of three hours without a break. Subjects of both types of fatigue displayed some deterioration of responses, but those subjected to mental fatigue exhibited a greater deterioration of responses. This tachodometric psychodiagnostic technique may be adapted for use in the selection of flight candidates.

11171
Suzuki, I. 1961
EFFECTS OF INSUFFICIENT SLEEP ON SERUM CHOLESTEROL AND BLOOD REDUCED GLUTATHIONE LEVEL. — Jour. Sci. and Labour (Tokyo), 37 (4): 166-177. April 1961. In Japanese, with English summary (p. 166).

Five subjects who had 3 or 6 hours of sleep on successive 4 or 6 days, respectively, underwent light mental work daily for 2 hours in the morning and 3 hours in the afternoon. The level of serum cholesterol rose markedly before and at the beginning of the period of sleep deprivation due to a high fat diet, but decreased or remained almost unchanged in the latter half of the experiment. The

free cholesterol level decreased gradually, and the esterified cholesterol level rose significantly before and at the beginning owing to diet, with no change thereafter. The cholesterol ester ratio (percentage of ester of total cholesterol) increased initially and varied thereafter in each subject. Blood glutathione level was decreased after 3 or 4 days of sleeplessness. (53 references)

11172
Ukolova, M. A. 1959
AN EXPERIMENTAL NEUROSIS DUE TO LACK OF SLEEP.—Bull. Exper. Biol. and Med., 47 (5): 566-569. May 1959.

The course of higher nervous activity processes was studied in two dogs with the aid of the classical Pavlov's method of conditioned salivary reflexes after they were deprived of sleep for 48 hours. Disturbances of conditioned reflex activity (neurotic type) developed under these conditions, the degree and type reflecting the typological peculiarities of the animals. (Author's summary, modified)

11173
Volkov, I. F. 1961
[METHOD OF STUDYING FATIGUE IN FLIGHT PERSONNEL] Metodika dlia izucheniia utomleniia letnogo sostava. — Voenno-meditsinskii zhurnal (Moskva), 1961 (1): 78. Jan. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (1): 108-109. Washington: U. S. Joint Pub. Research Serv., no. 9169 (1374-N/38), April 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Two methods employing the same apparatus are proposed for the detection of fatigue in flight personnel. The first determines the rate of perception and distribution of attention by the subject as he goes about the task of locating and naming consecutive numbers on tables of random numbers. The time needed to locate all numbers is taken as an index of the rate of perception. In the second test the subject positions and drops a metal rod into holes of successively smaller diameter, ending with the one in which contact occurs upon positioning because of finger tremor. In the majority of pilots the time for finding all numbers was less than 40 seconds. A time exceeding 50 seconds is indicative of fatigue. In the second test excessive tremor is shown if the contact occurs in a hole of 4.5 mm. or larger in diameter.

11174
Wilkinson, R. T. 1960
THE EFFECT OF LACK OF SLEEP ON VISUAL WATCH-KEEPING.—Quart. Jour. Exper. Psychol., 12 (1): 36-40. Feb. 1960.

Subjects deprived of sleep for one night showed a marked deterioration in their ability to see a small, faint, brief visual signal presented at random positions on a small screen at 4 random intervals during 4 successive 10-minute periods. The average number of observations of the signal decreased progressively throughout the test and totaled 8.9 for the 40-minute period, while the number of observations by subjects not deprived of sleep remained fairly constant and totaled 11.9.

11175
Williams, H. L., 1959
A. Lubin, and J. J. Goodnow
IMPAIRED PERFORMANCE WITH ACUTE SLEEP LOSS.—Psychological Monographs, 73 (14): 1-26. 1959.

In 49 subjects deprived of sleep for 72-98 hours, performance deteriorated on a variety of tasks. Deficit took the form of lapses (brief periods of no response accompanied by extreme drowsiness and a decline in electroencephalographic alpha amplitude). Four features of lapses were noted. (1) They occur in other conditions such as fatigue and hypoxia and appear to characterize impairment in general. (2) They increase in both frequency and duration as sleep loss progresses. (3) They are strongly affected by stimulus monotony. (4) Their specific effect on performance varies with the properties of the task. (Authors' summary, modified) (53 references)

11176
Zhukov, E. K., 1960
and IU. Z. Zakhar'iants
[ELECTROPHYSIOLOGICAL DATA ON SOME MECHANISMS FOR THE OVERCOMING OF FATIGUE] Elektrofiziologicheskie dannye o nekotorykh mekhanizmakh preodoleniia utomleniia. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 819-827. July 1960. In Russian, with English summary (p. 827).
English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 46 (7): 955-963. Feb. 1960.

At a certain stage of fatigue, holding or raising a weight load is subjectively felt as a task of great difficulty. Objective signs at this stage are changes in respiration, flushing of the face, sweating, and spread of excitation to other muscles. Through voluntary expenditure of effort, work performance can be maintained at the same level for a considerable time. Characteristic changes in EMG at this time are increase in the size of action potentials, summated electrical activity, and synchronization of muscle fiber activity. Sustained performance, in spite of increasing fatigue, is apparently achieved by involvement of increasing numbers of neuromotor units and synchronization of their activity. Thus, there are two phases of fatigue, "overcoming of fatigue" and "complete exhaustion", which should be considered in the analysis of functional shifts in the organism due to fatigue and in practical evaluation of the degree of fatigue.

k. Mental Stress

11177
Anthony, H. S. 1960
ANXIETY AS A FUNCTION OF PSYCHOMOTOR AND SOCIAL BEHAVIOUR.—Brit. Jour. Psychol. (London), 51 (2): 141-152. May 1960.

A study was conducted to determine the relation between (a) psychomotor behavior, measured as the amplitude and duration of a manual response to visual signals, (b) task difficulty, and (c) social behavior, in the form of delinquency in a military milieu. Significant association was established between psychomotor performance and subsequent social behavior; delinquent groups exhibited a response overactivity previously found

to be typical of anxiety. It is suggested that the difference between the response pattern of the delinquent and nondelinquent groups may be accounted for in terms of the Brown-Farber theory of frustration. The psychomotor and socal behavior of the delinquent groups are held to show a common feature of extreme avoidance-tendency in frustrating circumstances. (From the author's abstract)

11178
Bovard, E. W. 1961
A NOTE ON THE THRESHOLD FOR EMOTIONAL STRESS. —— Psychol. Review, 68 (3): 216-218. May 1961.

Certain phases of behavior under stress are reinterpreted on the basis of neuroanatomical and electrical evidence. The twofold response to stress over the pituitary-adrenal and the sympathetic-adrenal medulla routes is mediated by the posterior and medial hypothalamus. The threshold for emotional stress is determined largely by the level of electrical activity in the afore-mentioned areas. Posterior hypothalamic activity in turn may be dampened by increase of anterior and lateral hypothalamic activity, and by the hippocampal-fornix system. A third dampening influence is exerted by chemical negative feedback over the pituitary-adrenal axis. Consequences of prolonged stress are thus averted by influences from the hippocampal-fornix and chemical negative feedback. Social stimuli and handling have been shown to arouse anterior and lateral hypothalamic activity consequently dampening the posterior activity to raise the stress threshold. Conversely, any stressful stimulus will elevate the posterior hypothalamic activity and lower the stress threshold to other, formerly innocuous, stimuli.

11179
Burns, N. M., 1960
and E. C. Gifford
HUMAN ENGINEERING INVESTIGATIONS OF AIRCRAFT COCKPIT VISUAL DISPLAYS. I. TIME ESTIMATION AND ANXIETY.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-424, Jan. 29, 1960. iv+14 p.

The scores of ten subjects on the Manifest Anxiety Scale were compared with scores on a test of time-estimation ability (15 to 300 seconds) in which overestimation of the passage of time was equivalent to inability to withhold a response (pressing a button). A statistically significant correlation coefficient was obtained for the higher time intervals. The hypothesis that a high level of manifest anxiety will demonstrate itself as an inability to withhold response for a protracted period is thus supported.

11180
Fulkerson, S. C. 1960
INDIVIDUAL DIFFERENCES IN REACTION TO FAILURE-INDUCED STRESS.—Jour. Abnormal and Social Psychol., 60 (1): 136-139. Jan. 1960.

The McKinney Reporting Test and the Minnesota Multiphasic Personality Inventory (MMPI) were administered to samples of aviation cadets, aircraft commanders, co-pilots, and ROTC student officers. Two criterion groups representing the extremes in adjustment were selected within each of the military samples to form high and low adjustment groups. The ROTC officers were divided at the median into upper and lower adjustment groups. There was an over-all significant tendency among the low-adjustment cases for those who shifted toward more accurate performance on the McKinney stress period to answer on the Hysteria scale of theMMPI like Janet's psychasthenic (Pt) type, and for those who became more inaccurate to answer like the hysteric. This tendency did not hold for high-adjustment cases. The McKinney test did not correlate with the Pt scale. (Author's summary)

11181
Marsh, J. T., 1960
and A. F. Rasmussen
RESPONSE OF ADRENALS, THYMUS, SPLEEN AND LEUCOCYTES TO SHUTTLE BOX AND CONFINEMENT STRESS.—Proc. Soc. Exper. Biol. and Med., 104 (2): 180-183. June 1960.

Changes in organ weights and leukocytes following daily exposure of female mice to emotionally disturbing shuttle box or confinement stress were consistently observed. Adrenal hypertrophy and drops in circulating leukocytes were relatively rapid with significant changes observed following 3 to 7 days of stress. Involution of thymus and spleen occurred more slowly, with differences becoming maximum following 14 to 28 days of stress. Differences between experimental and control values returned to nonsignificant levels in 21 days following termination of stress. (Authors' summary)

11182
Meade, R. D. 1960
TIME PERCEPTIONS AS AFFECTED BY NEED TENSION.—Jour. Psychol., 49 (2): 249-253. April 1960.

Experiments were performed to test the results of a study by Rosenzweig and Koht, which indicated that time estimates were shorter under high-need tension than under low-need tension. No significant difference in time estimates was found between low- and high-need tension conditions when subjects worked on wooden block puzzles for successive or single 5-minute periods of low- or high-need tension. Since, in successive testings, the time estimate was longer under the first condition (whether at high- or low-need tension), it is concluded that perceived progress rather than need tension determined time estimates in these experiments and in that of Rosenzweig and Koht.

11183
Speisman, J. C., 1961
J. Osborn, and R. S. Lazarus
CLUSTER ANALYSES OF SKIN RESISTANCE AND HEART RATE AT REST AND UNDER STRESS. —— Psychosomatic Med., 23 (4): 323-343. July-Aug. 1961.

Thirty-five male and female subjects participated in an experimental procedure consisting of a personality assessment session, a control session (neutral film on corn farming), and an experimental session (stressor film on primitive subincision rites). During the control and experimental sessions continuous recordings of heart rate and skin resistance were taken, and just prior to the subjects' exposure to the films, a base-line rate (no obvious stimulus) was taken on each autonomic

channel. The main conclusions were: (1) Certain types of autonomic measurement, such as level and variability are independent of each other. (2) The structure of autonomic measurement varies with the specific channel (heart rate or skin resistance) being studied and the experimental conditions under which the measurements are made. Consistent and extensive reaction on autonomic indices to the presentation of the subincision film justifies regarding it as stressful. There is little relation between heart rate and skin resistance activity. (From the authors' summary and conclusions)

11184
Sperber, Z. 1961
TEST ANXIETY AND PERFORMANCE UNDER STRESS. —— Jour. Consulting Psychol., 25 (3): 226-233. June 1961.

Air Force recruits scoring in the highest and lowest quartiles on Sarason's measure of test anxiety were tested under high and low stress conditions, including failure and time press. The significant performance differences were: (1) Under high stress, High Test Anxiety subjects (HTA) performed better than Low Test Anxiety subjects (LTA) on the Number Matching tests. (2) Under low stress, LTA subjects performed better than HTA subjects on the Letter Substitution and Number Matching tests. (3) Performance of HTA subjects under high stress was superior to that of a group matched on test anxiety but subject to low stress on two of the three Number Matching tests. (4) Performance of LTA subjects under low stress was superior to that of a group matched on test anxiety but subject to high stress on the two Letter Series tests. A theoretical formulation is advanced which emphasizes the complex interaction of anxiety, motive, defense, and task variables. (From the author's summarv) (39 references)

11185
Strollo, M. 1961
[A CANCELLATION TEST BEFORE AND AFTER MENTAL WORK] Una prova di "cancellazione" prima e dopo lavoro mentale.——Atti delle giornate mediche delle forze armate (Torino, 6-7 giungo 1961), p. 388-390. Torino: Minerva Medica, Dec. 23, 1961. In Italian.

Two hundred twenty-five males between 18 and 22 years of age were subjected at the end of selection tests to various mental efficiency tests uninterrupted over an average four-hour period. Before beginning the various tests and at the end of them the subjects were given a cancellation-sign test of the Toulouse-Piéron type, and the number of omissions was tabulated. In numerical terms there were 2,780 omissions before mental work, and 1,513 after previous mental activity. Improvement was found in the performance of the cancellation-sign test after mental activity in 144 persons (64%), 63 (28%) worsened their performance, and 18 (8%) showed no variation. These results indicate that mental work prolonged over a four-hour period apparently does not significantly influence the subjects' conscious mechanisms in performing a valid cancellation-type reaction.

I. Isolation and Sensory Deprivation

11186
Baron, A., J. J. Antonitis, and R. H. Beale 1961
EFFECTS OF ACTIVITY DEPRIVATION UPON BAR PRESSING. —— Jour. Compar. and Physiol. Psychol., 54 (3): 291-293. June 1961.

The effects of confinement on unconditioned bar pressing in mice were studied in an experiment involving two degrees and three durations of confinement as the major variables in a factorial design. Prior to the 1-hr. bar-press test, members of three confined groups were placed in small cages for either 5, 65, or 125 min. while members of three nonconfined groups were placed for equal lengths of time in larger cages. Mice in a seventh group were tested immediately after removal from living cages. The results showed that bar pressing was increased after 65 min. of confinement to a somewhat greater degree than after 125 min. of confinement, while bar pressing after nonconfining exposure to a novel environment decreased progressively with increasing duration of such prior exposure. Results could be interpreted either as reflecting a general activity drive or as representing the self-reinforcing aspects of the bar-press response. (Authors' summary, modified)

11187
Bennett, A. M. H. 1961
SENSORY DEPRIVATION IN AVIATION.——In: Sensory deprivation, p. 161-173. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

Five examples of unexplained confusion in flight are presented. All instances occurred at high altitude, in aviators who were solo or separated effectively from other crew members, while the aircraft were flying straight and level. Under these conditions, the aviator suffers a considerable degree of perceptual deprivation, and it is suggested that the explanation is to be found in this fact. Many aviators experience feelings of unreality and detachment when flying solo at high altitude on flights that require a minimum of physical activity, but in the majority of them there is no interference with the control of the aircraft. The aviator's efficiency may be impaired by the intensity of his emotional response to the experience, or by illusions of turning which may be consequent upon his perceptual isolation. (Author's summary, modified)

11188
Burns, N. [M.] 1959
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS: A SECOND STUDY. I. RATIONALE AND HABITABILITY ASPECTS OF CONFINEMENT STUDY.——Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project No. TED NAM AE-1403). Report No. NAMC-ACEL-413, Dec. 8, 1959. v + [28] p.

An introduction is given to a six-part report on a confinement experiment in which six men were isolated for a period of eight days in a chamber of limited space and facilities equipped with a closed loop, solid chemical rebreathing system. A description with illustrations is given of the test chamber, and a discussion is presented of the

selection of subjects, the rationale, and the performance measures used. No marked psychological or physiological deterioration was noted in the subjects during or after confinement under the experimental conditions.

11189
Burns, N. M., 1961
and E. C. Gifford
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS – A SECOND STUDY. II. EFFECTS OF LONG TERM CONFINEMENT ON PERFORMANCE. —— Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-414, March 13, 1961. v+22 p.

Rigidity, suggestibility, and time estimation were systematically investigated for six men confined for eight days in a simulated space capsule. Rigidity increased for apparently superficial tasks; however, performance did not deteriorate when the task elicited a high degree of ego involvement. Confined subjects consistently overestimated passage of time when compared to a group of control subjects – overestimation increased as length of confinement increased. Less systematic observations on group cohesiveness and suggestibility revealed that: (1) as length of confinement increased, interpersonal behavior tended to disintegrate, and (2) some tendency towards increased suggestibility was demonstrated.

11190
Burns, N. M., 1960
and R. B. Ziegler
ENVIRONMENTAL REQUIREMENT OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS: A SECOND STUDY. III. EFFECTS OF LONG TERM CONFINEMENT ON PERSONALITY AND PERCEPTION.——Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-1403). Report no. NAMC-ACEL-415, July 22, 1960. v+[60] p.

Six naval enlisted men served as subjects for eight days of confinement in a simulated space vehicle. The effects on personal perception, personality changes, and group interactions are described. The data obtained are compared with the pre-confinement observations in order to provide a detailed analysis of the personality and perceptual changes that can be anticipated in future long-range space and orbital flights. An extensive review of the anecdotal and experimental literature is also provided. (Authors' abstract)

11191
Cameron, D. E., 1961
L. Levy, T. Ban, and L. Rubenstein
SENSORY DEPRIVATION: EFFECTS UPON THE FUNCTIONING HUMAN IN SPACE SYSTEMS.—— In: Psychophysiological aspects of space flight, p. 225-237. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

Behavioral changes can be produced in adult human subjects by exposure to reduction of sensory input or, possibly, by exposure to marked changes in the meaning of sensory input. Reduction in input can be achieved by (a) interference with reception of environmental stimuli; (b) less certainly, by blocking of conduction within the body; and (c) still less certainly, by interference with reception by the brain. There is variation from person to person in susceptibility to reduction in input. There is no definite evidence that extending the duration of exposure to reduction in sensory input or increasing the reduction in input beyond a given level increases the extent or range of change. Periods of exposure of less than one day probably do not produce changes properly attributable to reduction in input. Such changes as do occur after a few hours may be due to changes in behavior which normally occur when people are by themselves, lowering of the sensory threshold, and anticipation, i.e., a placebo-like effect. Changes tend to disappear within about a day after removal from the area of reduced input. (Authors' conclusions, modified)

11192
Cohen, B. D., 1959
G. Rosenbaum, S. I. Dobie, and J. S. Gottlieb
SENSORY ISOLATION: HALLUCINOGENIC EFFECTS OF A BRIEF PROCEDURE.——Jour. Nervous and Mental Diseases, 129 (5): 486-491. Nov. 1959.

Subjects deprived of sensory stimulation and confined individually for one hour in an isolation room did not exhibit any cognitive dysfunction or vivid pictorial hallucinations. The hallucinatory reactions obtained were less elaborate and more commonplace than the phenomena previously reported in studies of prolonged isolation. The hallucinatory perceptions resulted largely from increased sensitivity to residual stimuli, which ultimately generate the fabrication of events in a situation providing only minimal opportunities to test reality. Several tentative relationships are suggested: (1) reactions to brief isolation reflect dominant needs and habit systems of the individual subject; (2) the degree to which the isolation procedure constitutes a stress-experience may be positively related to the degree of reality-contact of the subject; normal subjects reacted with more discomfort and less positive feelings to the isolation procedure; (3) the probability of evoking a hallucinatory response was inversely related to the stress effects (emotionality) shown overtly by the isolated subject; and (4) the number of visual sensory reactions reported was higher when there was a diffuse input of stimulation, than when stimulation was totally restricted. It is possible that with diffuse (unpatterned) visual stimulation the peripheral sensory reactions evoked in the one-hour procedure may provide the perceptual ingredients for the more complex and elaborate phenomena reported by subjects after more prolonged periods of isolation. (From the authors' summary and conclusion)

11193
Cohen, S. I., 1961
A. J. Silverman, B. Bressler, and B. Shmavonian
PROBLEMS IN ISOLATION STUDIES.——In: Sensory deprivation, p. 114-129. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

Two studies are described which attempt to delineate the factors in isolation experiments which are stress-inducing and to investigate the relationship of specific personality factors to individual differences in response patterns. The first study was conducted to determine the effects of four hours of isolation in a soundproof chamber. Psychological assessment of the four subjects suggests that reaction to isolation and sensory

deprivation is a variation in intellectual performance for each subject. Although short-time retentive ability (digit span subtest) increased, each subject showed decreased arithmetical reasoning, and ability to abstract, generalize, and reason. In the second study, an attempt was made to define more clearly the subjective psychological reactions. All subjects were confused and disorganized immediately after leaving isolation, 7 of the 10 reported some sort of visual phenomena, and specific fears expressed by the subjects were varied.

11194
Davis, J. M., 1960
W. F. McCourt, and P. Solomon
THE EFFECT OF VISUAL STIMULATION ON HALLUCINATIONS AND OTHER MENTAL EXPERIENCES DURING SENSORY DEPRIVATION.—Amer. Jour. Psychiat., 116 (10): 889-892. April 1960

An experiment was conducted with 10 subjects to test the hypothesis that it is the absence of meaningful stimulation, rather than sensory stimulation as such, that produced the effects of sensory deprivation. Visual stimulation in the form of random light flashes and tachistoscopic projects of colored Rorschach cards was added to a standardized sensory-deprivation procedure involving the use of a tank respirator. Duration of the experiment was 10 1/2 hours unless terminated earlier. Immediately after conclusion of the experiment, psychological tests were administered and the subject was interviewed. The results were consistent with the above hypothesis in that random visual stimulation did not prevent occurrence of mental aberrations. In addition, the results indicated that subjects who reacted to sensory deprivation stress with mental clouding responded less physiologically in terms of heart rate.

11195
Davis, J. M., 1961
W. F. McCourt, J. Courtney, and P. Solomon
SENSORY DEPRIVATION: THE ROLE OF SOCIAL ISOLATION. —Arch. Gen. Psychiat., 5 (1): 84-90. July 1961.

Two series of experiments were conducted to test the effect of social contact in a standardized sensory deprivation situation. In the first, 5 pairs of male strangers were tested, each of a pair being in his own tank-type respirator, not seeing one another but permitted to converse. In the second, 11 married couples were tested similarly. The results indicated that social contact, provided in this manner, did not eliminate the effect of sensory deprivation, but it did ameliorate it. (Authors' summary)

11196
Doane, B. K., 1959
W. Mahatoo, W. Heron, and T. H. Scott
CHANGES IN PERCEPTUAL FUNCTION AFTER ISOLATION.—Canad. Jour. Psychol. (Toronto), 13 (3): 210-219. Sept. 1959.

There are certain general areas of perception which seem to be affected by the isolation procedure. Results from visual tests indicate that the most prominent effects are a decrease in the constancies and an increase in the after-effects of stimulation (figural after-effect, color adaptation, and the after-image movement). Size constancy is markedly reduced and shape constancy probably reduced. It is possible that the experimental subjects' poorer performance in the tactual form-discrimination and spatial orientation tests was caused by visual dysfunction. Hallucinations of extreme vividness, impairment of thought processes, sensory and perceptual changes, together with significant changes in the electroencephalogram, all testify to the widespread effect on central neural function that is induced by limiting the normal variation of sensory stimulation. No decrease of total sensory stimulation was observed in the subjects, but since sensory systems respond most actively to change of stimulation, it is possible that the lack of a varied input results in an inactivity of pathways at some higher levels of the central nervous system. If these pathways consequently become sensitized, it might account for increased figural after-effect, autokinetic movement, and color adaptation.

11197
Eilbert, L. R., 1959
and R. Glaser
DIFFERENCE BETWEEN WELL AND POORLY ADJUSTED GROUPS IN AN ISOLATED ENVIRONMENT.—Jour. Applied Psychol., 43 (4): 271-274. Aug. 1959.

This study explores the possibility of identifying variables which will predict an individual's adjustment to isolated restrictive environment. More specifically, these variables will serve as a basis for the development of selection techniques to minimize the number of personal adjustment problems of men on Arctic bases. From a population of 648 airmen, (mean length of stay in the Arctic 7 mos.) two groups of subjects were selected on the basis of supervisor ratings of adjustment (one sigma above or below the mean for their section) for the identification of variables differentiating between the well adjusted and poorly adjusted group, 112 subjects and 83 subjects, respectively. The following survey and test instruments were used: (1) Biographical Inventory, (2) self-appraisal blank, (3) Incomplete Sentences Test, (4) medical symptoms list, (5) modified Taylor Manifest Anxiety Scale, (6) food aversion list, (7) general information test, (8) peer nomination form, (9) Air Force aptitude test scores, (10) job proficiency scores, and (11) medical record data. In general the results suggest the hypothesis that individuals who adjust well to Arctic isolation are individuals who also adjust well to their military assignments elsewhere, describe themselves as conscientious, responsible individuals who accept authority and are considered to be well adjusted to the Arctic by their peers as well as their supervisors. As a group the well-adjusted airmen had a lower sick call rate, higher job proficiency test scores, and significantly differed in the distribution of the mean aptitude test scores from the poorly adjusted group. The poorly adjusted group was characterized by urban background, relatively high socioeconomic background, a history of minor infractions of military regulations, more complaints, fears of the Arctic, less inclination towards better job performance and greater difficulties in interpersonal relationships. The authors discuss the possible generalization of the data to other types of isolated environments.

11198
Evrard, E., 1959
J. G. Henrotte, and P. Jonckheere
[CONTRIBUTION TO THE STUDY OF PSYCHO-PHYSIOLOGICAL BEHAVIOR OF AN ISOLATED

SUBJECT CONFINED IN A SMALL CLOSED CABIN UNDER VERY UNFAVORABLE CONDITIONS] Contribution à l'étude du comportement psycho-physiologique d'un sujet isolé en milieu confiné dans des conditions très défavorables.—Médecine aéronautique (Paris), 14 (1): 31-50. 1959. In French, with English summary (p. 49-50).

A forty-year-old male volunteer was isolated in a decompression chamber which was very limited and cramped in space, and which contained only the minimum features of comfort. The experiment was terminated after 31 hours at the appearance of the first signs of fatigue and upon a sudden decrease in motivation of the subject. The unfavorable conditions of humidity and temperature and the inability of the subject to stretch his legs were important sources of stress. Tests and observations showed slight psychological and physiological depression developing with marked parallelism during the first night, followed by a return to normal in the morning and a second depression in the evening of the same day. These periods appeared to be connected to the day-night biological rhythms of the subject. The activities of the subject remained orderly and methodical, and his judgment was good with the exception of some rare episodes. The authors suggest that further similar tests are needed in order to determine the degree of resistance to fatigue for longer periods, and to define the types of motivation and personalities which are necessary to resist such intense stresses. (Authors' summary, modified)

11199
Flaherty, B. E., 1960
D. E. Flinn, G. T. Hauty, and G. R. Steinkamp
PSYCHIATRY AND SPACE FLIGHT. — School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-80, Sept. 1960. 9 p.

Studies are described in which four volunteers underwent isolation in a space cabin simulator for up to 30 hours. Elements of isolation and monotony of sensory input were provided by lack of visual contact with the environment outside the chamber, constant background noise, and the requirement for intensive prolonged attention to a small perceptual field of work. Periodic task reports were made on an intercom system, and continuous electrical measurements were made of task proficiency. Two subjects successfully completed the flight, but experienced perceptual aberrations. Psychiatric examination of the two unsuccessful subjects was able to relate one failure after 1½ hours to anxiety derived from lifelong feelings of inadequacy, and the other after 22 hours to anxieties provoked by the onset of misperceptions.

11200
Freedman, S. J., 1961
H. U. Grunebaum, and M. Greenblatt
PERCEPTUAL AND COGNITIVE CHANGES IN SENSORY DEPRIVATION.—In: Sensory deprivation, p. 58-71. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

Differences in perceptual and cognitive functions were recorded in two groups of subjects in relative social isolation for 8 hours. One group was subjected to continuous nonpatterned visual and auditory stimulation while the other was not. After an 8-hour exposure to nonpatterned stimulation, experimental subjects showed false perception and impaired visual-motor coordination. Changes in cognitive functioning and in feelings about oneself, others, and the environment were reported by all experimental subjects. Each subject experienced difficulty in thinking coherently, concentrating, and talking; and several reported changes in body image, hallucinations, and fears of an unreal or paranoid nature.

11201
Freedman, S. J. 1961
PERCEPTUAL CHANGES IN SENSORY DEPRIVATION: SUGGESTIONS FOR A CONATIVE THEORY. — Jour. Nervous and Mental Disease, 132 (1): 17-21. Jan. 1961.

The occurrence of distortions of visually perceived objects following periods of sensory deprivation indicates a partial breakdown of the customary process of stabilizing, structuring, and organizing the visual world. It is suggested that spatial orientation requires continuous sampling of the perceptual environment both for reaffirmation of existing schemata and for evidence of change. In sensory deprivation (or in exposure to diffuse or flashing light), the undifferentiated visual field provides no usable information for spatial orientation, and the unconscious striving to incorporate non-order into previously existing schemata degrades the internal perceptual frame of reference. Thus, visual distortions occur until renewed experience with a patterned environment is sufficient to restore normal visual function.

11202
Freedman, S. J. 1960
SENSORY DEPRIVATION AND PERCEPTUAL LAG. — Massachusetts Mental Health Center, Boston (Contract AF 33(616)-5663); issued by Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7220, Task no. 71741). WADD Technical Report no. 60-745, Dec. 1960. iii+7 p.

The effects of a 3-hour sensory deprivation session upon perceived visual speed were studied with (a) homogeneous, diffuse-light visual stimulation; (b) blackout; and (c) randomly changing visual stimulation. Randomizing the spatio-temporal distribution of visual inputs greatly enhances the apparent decrease in visual speed which is produced by the two homogeneous conditions. Regularizing the nature of the visual input apparently diminishes this "perceptual lag" effect. Synchronization and desynchronization of discharge in the neurovisual system may be the mechanism involved. Serious distortions in speed perception develop in one-half hour. The effects are cumulative with distributed exposure to sensory deprivation conditions. (Author's abstract)

11203
Freedman, S. J., 1959
and M. Greenblatt
STUDIES IN HUMAN ISOLATION.—Massachusetts Mental Health Center, Boston, Mass. (Contract AF 33(616)-5663); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio, (Project no. 7220, Task no. 71741). WADC Technical Report no. 59-266, Sept. 1959. vi+46 p.

Thirty normal college-age subjects were run in eight-hour experimental sessions involving (a) non-patterned visual and auditory input combined

with social isolation, (b) visual deprivation (blackout) combined with auditory non-patterning and social isolation, and (c) social isolation alone. Perceptual and cognitive distortions and disorientations differentially induced by these conditions are described. Six additional somewhat "deviant" subjects were run under (a). A good quantitative measure of perceptual distortion was developed. Both perceptual and cognitive effects occur with either non-patterning or blackout of the visual field, but social isolation subjects experience essentially no effects. There is no consistent relationship between the two kinds of effects. The visual imagery reported strongly resembles hypnagogic imagery and this experience is related to a history of hypnagogic imagery. A theoretical formulation is proposed which would attribute the perceptual distortions to the organism's continuous automatic search for order in a non-ordered perceptual environment. (Authors' abstract)

11204
Gerathewohl, S. J. 1959
WORK PROFICIENCY IN THE SPACE CABIN SIMULATOR.—Aerospace Med., 30 (10): 722-735. Oct. 1959.

Three test subjects performed a simple mental task during experiments lasting seven and ten days, respectively, in a Space Cabin Flight Simulator. The number of additions made in the arithmetic test taken daily increased almost steadily during the stay in the hermetically sealed cabins, but so did the error and correction scores obtained. The individual subjects became more irritable as time progressed; but they retained learned and useful behavior. The results suggest that capable, well-trained, and highly motivated subjects can adjust successfully to the severe stresses associated with the exposure to an engineered environment. (Author's summary)

11205
Giffen, M. B. 1959
BREAK OFF: A PHASE OF SPATIAL DISORIENTATION. —U. S. Armed Forces Med. Jour., 10 (11): 1299-1303. Nov. 1959.

In response to the appearance of a new term in aviation — "break off" — a study was made of symptoms described by pilots experiencing this sensation at high altitudes. The phenomenon appears to be essentially one of isolation, both subjective and objective, and can be artificially produced by the removal of sources of stimuli. A marked feeling of loneliness and detachment from reality is the most common symptom experienced by airmen, while personality changes and hallucinations may occur in extreme cases. These effects are attributable to the disorientation of the subject with his environment, due to the absence of sensory stimuli. It is essential that in contemplated space exploration the problem of "break off" be satisfactorily treated.

11206
Goldberger, L., and R. R. Holt 1961
A COMPARISON OF ISOLATION EFFECTS AND THEIR PERSONALITY CORRELATES IN TWO DIVERGENT SAMPLES.—N. Y. Univ. Research Center for Mental Health, New York (Contract AF 33(616)-6103); issued by Aeronautical Systems Div. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71745). Technical Report no. 61-417, Aug. 1961. v+46 p.

Findings are reported from a pair of replicated studies using male subjects and conditions of perceptual isolation (sensory deprivation) similar to those used in the McGill studies. The first group consisted of fourteen undergraduates; the second group consisted of sixteen unemployed actors. All subjects were put through an intensive multiform assessment, which included a battery of objectively scorable tests, plus qualitative data from projective techniques, interview, and autobiography. Reactions to the altered sensory environment, which the subjects experienced for eight hours, were judged from the typed protocols of their verbalizations during the period of confinement. In all, fourteen dependent variables were derived from the protocols. These were then intercorrelated, and both the individual variables and their syndromes were related to the variables from the personality assessment. First the general group phenomena, then the patterns of correlations are discussed, with the special emphasis on those that were replicated. (Authors' abstract)

11207
Goldberger, L., and R. R. Holt 1961
EXPERIMENTAL INTERFERENCE WITH REALITY CONTACT: INDIVIDUAL DIFFERENCES.—In: Sensory deprivation, p. 130-142. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

Individual differences to isolation and sensory deprivation were measured in 14 males in order to predict mature handling of the primary process thought and to correlate the results with the Rorschach test. The subjects' hearing was dominated by white noise, and they could see only translucent light. The data obtained indicate a general feeling of decreased efficiency and lack of thought continuity, affective disturbances, fantasy, general increase in vividness and frequency of visual and auditory imagery, disturbances in the time sense, and other effects reminiscent of the primary process, such as depersonalization, body image disturbances, and creative activity. Behavior in isolation was generally predicted by Rorschach rating, and the correlation coefficients reached statistical significance for three variables: controlled primary process thinking, amount of pleasant effect, and amount of unpleasant effect.

11208
Goldberger, L., and R. R. Holt 1958
EXPERIMENTAL INTERFERENCE WITH REALITY CONTACT (PERCEPTUAL ISOLATION): METHOD AND GROUP RESULTS.—Jour. Nervous and Mental Disease, 127 (2): 99-112. Aug. 1958.

Fourteen male college students selected on the basis of intelligence, interest, and stability were exposed to isolation in a semisoundproof room for 8 hours. The subjects lay partially immobilized, wore translucent eyecups, and were exposed to a constant white noise. The subjects were asked to describe their thoughts and feelings to an examiner over an intercom system during exposure, were interviewed, and gave a written account of their experience following isolation. A battery of oral

and written cognitive tests were administered 2-3 weeks prior to the experiment, and at the termination of the isolation period. All subjects found the isolation situation frustrating, and three terminated the experiment after 1-3.5 hours. All subjects experienced unpleasant effects, and some experienced pleasurable effects. Some subjects persisted in stimulus-bound thinking, while others showed a greater amount of free secondary process or primary process thinking. Nine subjects reported the spontaneous occurrence of vivid visual imagery. A substantial loss in time-orientation was experienced during the session, but estimates of elapsed time near the end of the experiment were fairly accurate. Other phenomena experienced were body-image disturbances, depersonalization, and dreams. Only the written test of Logical Deduction showed an impairment of cognitive function, despite a reported decline in the ability to concentrate and engage in normal, directed thought. It is suggested that an absence of impairment of the judgmental aspect of reality-testing differentiates the vivid imagery associated with perceptual isolation from the clinical concept of hallucination.

11209

Goldberger, L. 1961

HOMOGENEOUS VISUAL STIMULATION (GANZFELD) AND IMAGERY. — Perceptual and Motor Skills, 12 (1): 91-93. Feb. 1961.

The application of a limited form of sensory deprivation (the wearing of translucent eye-cups for periods up to 40 minutes) to sixteen subjects revealed that such a brief Ganzfeld procedure is not a particularly potent method for promoting the kind of visual imagery obtained with eight hours of isolation (during which the subjects also wore translucent eye-cups). Whether or not a prolonged homogeneous visual field alone could account for the emergence of hallucination-like images in isolation experiments is still undecided. It is suggested that prolonged immobility, combined with the effects of a group of personality variables having to do with passivity, intellectual flexibility, and emotional freedom, participate with the factor of visual homogeneity in facilitating imagery in isolation experiments. (Quoted in part)

11210

Goldberger, L., and R. R. Holt 1961

STUDIES ON THE EFFECTS OF PERCEPTUAL ALTERATION.—N. Y. Univ. Research Center for Mental Health, New York (Contract AF 33(616)-6103); issued by Aeronautical Systems Div. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71745). Technical Report no. 61-416, Aug. 1961. iv+20 p.

This is a report of three separate studies which explored facets of sensory alteration (sensory deprivation). One study focused on the role of a diffuse, homogeneous visual field (Ganzfeld) in promoting visual images; the second compared performance on a cognitive test battery immediately following eight hours of perceptual isolation with performances under a drug (100 gamma of LSD-25) and a placebo condition; the third study dealt with the effects upon cognitive functioning of an eight-hour isolation experience, during which constant auditory vigilance was required of the subjects. (Authors' abstract)

11211

Griffiths, W. J. 1961

EFFECTS OF ISOLATION ON TREADMILL RUNNING IN THE ALBINO RAT. — Psychol. Reports, 8 (2): 243-250. April 1961.

A total of 80 male abino rats between the ages of 30 and 60 or 60 and 90 days, were subjected individually or in groups of two to the experiences of individual or group isolation, or individual or group laboratory cage living, in order to determine their subsequent tolerance to the stress of forced treadmill running. The results gave some support to the hypothesis that subjection of animals to reduced sensory input in the form of isolation is actually a form of stress and has the effect of raising tolerance thresholds to subsequently induced stress. The findings were discussed in terms of the critical periods hypothesis, the qualitative nature of the experiences, and the influence of social factors, relative to the effects of prior experiences on subsequent stress tolerance in animals. (Author's summary)

11212

Grunebaum, H. U., S. J. Freedman, and M. Greenblatt 1960

SENSORY DEPRIVATION AND PERSONALITY.— Amer. Jour. Psychiat., 116 (10): 878-882. April 1960.

The relationship between ego-integrity and changes induced by an 8-hour period of sensory deprivation was studied in 33 subjects. Each subject was evaluated and rated on overall ego-integrity on the basis of a structured psychiatric interview and a short autobiography prior to the experiment. The post-experimental interview elicited descriptions of thoughts, feelings, and experiences during the experiment. No relationship was found between the clinical ratings of ego-integrity and perceptual aberrations or sensory deprivation imagery. The latter occurred significantly more often in individuals who habitually have hypnagogic imagery, both healthy and unhealthy. Limitations of sense and touch are suggested as additional factors necessary for production of imagery. Ambiguity of the experiment was tolerated well by all healthy subjects and particularly well by three schizoid subjects in accordance with their habitual modes of adaptation and defense. It was not tolerated by subjects with imparied reality testing and a need to act out.

11213

Held, R. 1961

EXPOSURE-HISTORY AS A FACTOR IN MAINTAINING STABILITY OF PERCEPTION AND COORDINATION. — Jour. Nervous and Mental Disease, 132 (1): 26-32. Jan. 1961.

The stability of the visual distortion which follows rearrangement of the visual field indicates its production by training with the visual rearrangement itself, while the instability of distortion after visual deprivation suggests that it results from disruption by the spontaneous "noisy" discharge of sensory neurons of the internal schema responsible for ordered coordination. This hypothesis is supported by the marked reduction of the apparent speed of moving objects after exposure to a noisy visual display, and by the increase in apparent speed after exposure to a static patterned field.

A provisional neural model to account for the effects of deprivation and rearrangement is proposed, in which the central nervous system monitors efferent signals activating the skeletal musculature, and correlates and stores them for comparison with the delayed re-afferent signals from the sensory receptors stimulated by body movement. Thus motion of the visual field and movement of the body may be distinguished. When internally generated signals replace the normal re-afferent signals during deprivation, many combinations of efferent signals with concurrent afferent signals are stored, resulting in a progressive degradation of coordination.

11214
Henry, J. P. 1958
PSYCHO-PHYSIOLOGICAL HAZARDS OF SATELLITE FLIGHT.—In: High altitude and satellite rockets: a symposium held at Cranfield, England, 18th-20th July 1957, p. 107-110. London: Royal Aeronautical Society, etc., 1958.
Also republished in 1959, with identical pagination, by Philosophical Library, N. Y.

Previous work with animals in rockets and in a sealed environment showed that disturbance in sensory input may lead to abnormal behavior. The nature of the mental breakdown that follows severe sensory deprivation is being actively studied. The symptoms of sensory deprivation are discussed briefly in the light of recent psycho-physiological research and the importance of making further studies in this area is stressed. The observations imply that the human operator's task should be designed to avoid prolonged periods of exposure to an environment in which he can perceive nothing that he regards as significant. (Author's summary, modified)

11215
Heron, W. 1961
COGNITIVE AND PHYSIOLOGICAL EFFECTS OF PERCEPTUAL ISOLATION.—In: Sensory deprivation, p. 6-33. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

A summary of an experimental program dealing with the effects of perceptual isolation of human subjects is presented, and the results are grouped into (1) the effects of isolation on performance of various tests of intellectual function during and after isolation, (2) hallucinations, and (3) tests of visual perception, tactual form discrimination, and spatial orientation. The experimental subjects were inferior to the controls in 6 of the 7 intellectual tests and on both spatial orientation tasks. The onset of visual hallucinations varied from 20 min. to about 70 hours, and they were more vivid and more persistent with translucent than with opaque goggles. Most subjects reported gross disturbances in visual perception upon removal of the goggles. There were no consistent changes in the subjects' temperature, blood pressure, or basal metabolic rate, but bodily activity increased with time.

11216
Holt, R. R., 1961
and L. Goldberger
ASSESSMENT OF INDIVIDUAL RESISTANCE TO SENSORY ALTERATION.—In: Psychophysiological aspects of space flight, p. 248-262. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

The results of submitting two human subjects to sensory deprivation for eight hours are reported. Two principal conclusions are reached: (1) Reactions to an altered sensory environment may be predicted from a knowledge of the specific nature of the situation and personality variables that are meaningfully relevant to such alterations. (2) The exact pattern of correlations between personality and reactions to sensory alteration depends heavily on the nature of the sample of persons studied.

11217
Holt, R. R., 1959
and L. Goldberger
PERSONOLOGICAL CORRELATES OF REACTIONS TO PERCEPTUAL ISOLATION.—N. Y. Univ. Research Center for Mental Health (Contract AF 33 (616)-6103); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71745). WADC Technical Report no. 59-735, Nov. 1959. v+46 p.

This report describes the aspects of personality (independently measured by objective tests and by clinical Q-sort ratings) that were found to correlate with reactions to eight hours of experimental reality-deprivation (perceptual isolation, sensory deprivation). Fourteen male college students were subjected to an experimental deprivation situation similar to that used in the McGill studies, and from their behavior and verbalizations fourteen measures of reaction were derived. Most of these fell into two internally consistent, not significantly correlated patterns: an adaptive and a maladaptive syndrome. The findings reported and discussed were obtained by correlating rank orders on these syndromes and on each of the fourteen reaction-measures with the various measures of personality. It is hoped that these findings may be relevant to the problems of space-crew selection. (Authors' abstract)

11218
Holt, R. R., 1960
and L. Goldberger
RESEARCH ON THE EFFECTS OF ISOLATION ON COGNITIVE FUNCTIONING.—New York Univ. Research Center for Mental Health. (Contract AF 33 (616)-6103); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71745). WADD Technical Report no. 60-260, March 1960. iii+22 p.

The effects of the administration of 100 gamma of lysergic acid diethylamide (LSD) on the mental functions of 15 subjects were compared with the effects of eight hours of perceptual (visual, aural, and in some instances, tactual) isolation on the same subjects. Impairment was shown on only 1 of 9 cognitive tests after the 8-hour isolation. The same test (Robinson's Rhymes, which requires subjects to hold several things in mind at once) was not quite significantly impaired by LSD, but the time score for Serial Sevens (the subject was asked to count backwards by intervals of 7 from a specified number) was significantly impaired. On a questionnaire designed to elicit reports of the main symptoms of the drug, there was almost no overlap between the post-isolation and post-LSD scores, the latter being very much higher. The qualitative patterns of symptoms were quite different also. It was concluded that LSD produces a state subjectively more striking and qualitatively different from the effects of 8 hours of isola-

tion. A battery of cognitive tests did not prove differentially sensitive to the reported deleterious effects of both conditions on mental functions. (Authors' abstract, modified)

11219
Jones, Marshall, B. 1959
and J. E. Goodson
THE EFFECT OF BOREDOM ON SUGGESTIBILITY. —Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. NM 16 01 11, Subtask 16). Report no. 1, July 1, 1959. ii+10 p. AD 229 158
Also published in: Aerospace Med., 30 (10): 716-721. Oct. 1959.

An experimental group of 24 naval aviation cadets was deprived of all social contact for a period of time approximating eight hours and then tested individually for suggestibility by the Hull body-sway technique. When compared with a control group, also of 24 cadets, who had been taking routine psychologic tests for the same period of time, the experimental subjects were found to be more suggestible. However, when the study was repeated using arm levitation, which is a less sensitive response than body-sway, the effect was greatly reduced. When leg catalepsy, a still less sensitive response, was used, the difference between the two groups was abolished altogether. The possibility that the difference with body-sway was due to muscular inactivity or to special treatment was examined and found inadequate to account for the finding. (Authors' summary)

11220
Klosovskii, B. N., 1958
and E. N. Kosmarskaia
TOTAL SIMULTANEOUS EXCLUSION OF VISUAL, AUDITORY, OLFACTORY AND VESTIBULAR RECEPTORS IN ADULT ANIMALS.—Bull. Exper. Biol. and Med. (Consultants Bureau, New York), 43 (3): 282-286. 1958

English translation of item no. 7613, vol. VI, 1957.

11221
Kubie, L. S. 1961
THEORETICAL ASPECTS OF SENSORY DEPRIVATION.—In: Sensory deprivation, p. 208-220. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

The relations between isolation and the states of sleep, psychosis, psychotherapy, psychoanalysis, and others, are discussed. "Experimentally induced afferent isolation" is suggested to replace "sensory deprivation" since "sensory" suggests that fragment of total afferent experience which receives conscious symbolic representation, while the goal of experiments is to reduce or eliminate all afferents, whether conscious or unconscious, and "deprivation" carries the unproved implication that the central nervous system must have a certain minimal continuous inflow of afferent experience or a hunger arises in the central nervous system comparable to the "instinctual" demand of dehydrated or starved tissues for water or food.

11222
Leiderman, P. H., 1961
and R. Stern
SELECTED BIBLIOGRAPHY OF SENSORY DEPRIVATION AND RELATED SUBJECTS. — Harvard Univ. Medical School, Boston, Mass. (Contract AF 33 (616)-6110); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7220). ASD Technical Report 61-259, July 1961. v+28 p.

This bibliography compiles and classifies the available articles and books relevant to the field of sensory deprivation. The bibliography covers review articles, theoretical publications, anecdotal reports, experimental, clinical, developmental and social accounts, sleep deprivation, vigilance, level of activation and arousal, animal, and physiological studies. American and British publications in this field are reasonably well covered. A search of the literature of other countries did not yield any references specific to sensory deprivation. (Authors' abstract) (291 references)

11223
Levy, E. Z., 1959
G. E. Ruff, and V. H. Thaler
STUDIES IN HUMAN ISOLATION.—Jour. Amer. Med. Assoc., 169 (3): 236-239. Jan. 17, 1959.

The extension of flight range and the advent of space flight are subjecting man progressively to an isolated, restricted, and monotonous environment. This has stimulated a new type of research on the effect of such restrictions on physical and behavioral aspects of the human organism. Suggestions have been made that isolation may be a contributing factor in such phenomena as pilot disorientation or "high-altitude dissociation". For clarification and better control of the variables in experimental studies of isolation it is helpful to relate these variables to four dimensions: (1) the "microcosm", i.e., the environment apparent to the isolated subject; (2) the individual—his personality structure and ego strength; (3) the "macrocosm", a term comprising the reality factors surrounding the microcosm; and (4) communication, i.e., interaction between microcosm and macrocosm. The degree of contact between the isolated subject and his environment, especially his observers, must be defined in terms of distances, times, limitations of visual, auditory, and kinesthetic inputs, means available to the subject for structuring his isolated existence, and particularly his ability or inability to terminate isolation when he wishes. Communication of any kind counteracts the effects of isolation, and when subjects know they are being observed they do not feel truly isolated. Distortion of communication makes the situation more stressful to the subject, and may produce overwhelming feelings of anger and anxiety. (Authors' summary, modified)

11224
Lilly, J. C., 1961
and J. T. Shurley
EXPERIMENTS IN SOLITUDE, IN MAXIMUM ACHIEVABLE PHYSICAL ISOLATION WITH WATER SUSPENSION, OF INTACT HEALTHY PERSONS. — In: Psychophysiological aspects of space flight, p. 238-247. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

These experiments, in which subjects were suspended in water in a sound-proof chamber, were designed to establish methods of self-observation. The achievement of maximum physical and social isolation was found to depend upon: (1) simultaneous attenuation of external physical stimuli and intra-integumentary sources of stimuli; (2) maintenance of voluntary constraint and restraint; (3) isothermicity of the unclothed skin surface; (4)

comfortable body support; (5) mask and breathing apparatus designed for easy repair and maintenance; and (6) minimum involvement of the observer in the experiences of the subject. The studies gave evidence that: (a) the isolated and constrained ego provides sources of new information from within; (b) transference-related drives may become extremely intense; (c) positive, enjoyable results may be achieved only when levels of stimuli are minimal; and (d) basic satisfactions of needs felt in the tank require later exchanges with other persons and with physical reality.

11225
Lindsley, D. B. 1961
COMMON FACTORS IN SENSORY DEPRIVATION, SENSORY DISTORTION, AND SENSORY OVERLOAD.—In: Sensory deprivation, p. 174-194. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

The common basis by means of which the operationally different processes of sensory deprivation, sensory distortion, and sensory overload may be related appears to be the ascending reticular formation. The descending influences in the system and the corticofugal and centrifugal controlling influences may well play a significant role, also. It is proposed, from indirect evidence, that the reticular system is sufficiently differentiated in its responses to different sensory modalities, and, because there are different types of interaction which are believed to occur there, that the reticular system offers a mechanism which may account for the types of behavioral change seen in sensory deprivation and modification. If the reticular system is deprived of sensory input, it meets an unfamiliar situation, and only within limits can it adjust to the change. If the change is more persistent or more marked, it may lead to a completely different mode of reaction, and this may account for the more unusual features of sensory deprivation and modification. (Author's summary, modified)

11226
Lobanova, L. V. 1958
MOTOR-DEFENSIVE CONDITIONED REFLEXES IN SUCCESSIVE DEPRIVATION OF VISUAL, OLFACTORY, AUDITORY, AND VESTIBULAR FUNCTION IN DOGS. — Doklady, Biol. Sciences Sections (Amer. Inst. Biol. Sciences, Washington, D. C.), 115 (1-6): 761-767. 1958.

English translation of item no. 7614, vol. VI.

11227
McGuire, F., 1961
and S. Tolchin
GROUP ADJUSTMENT AT THE SOUTH POLE. — Jour. Mental Sci. (London), 107 (450): 954-960. Sept. 1961.

Psychological test data and personal observations were gathered concerning 17 men who wintered over at the geographical South Pole. From these data it became possible to sketch the general attitudes of men toward the Antarctic and each other; to describe some of the sources of group tension and morale; and to discriminate between the most successful and least successful members of the group. Psychiatric and psychological screenings were found not only to identify grossly disturbed men but also to have some value for predicting adjustment to group living in Antarctic isolation. (Authors' summary, modified)

11228
Mendelson, J. [H.], 1960
P. Kubzansky, P. H. Leiderman, D. Wexler, C. DuToit, and P. Solomon
CATECHOL AMINE EXCRETION AND BEHAVIOR DURING SENSORY DEPRIVATION.—A. M. A. Arch. Gen. Psychiat., 2 (2): 147-155. Feb. 1960.

The effects of sensory deprivation on urinary epinephrine and norepinephrine excretion were studied in 10 male volunteers. The subjects were placed in a tank-type respirator with a constant and monotonous visual and auditory input until the subject terminated the isolation or it was terminated after 36 hours. Behavioral measurement made during the experiment included length of stay, mental experiences, motor activity, amount of verbalization, somatic references and judgment of passage of time. The combined group data revealed a rise in epinephrine and norepinephrine excretion during the experiment, with a fall toward control values during the postexperimental period. There was a wide individual variation in the endocrine response, five categories being differentiated. Two statistically significant relations were found between the behavioral measures and changes in catechol amine excretion. The greater the change in epinephrine excretion under experimental stress the less error there was in time estimation. The greater the postexperimental fall in norepinephrine excretion, the fewer were the verbalizations and somatic references, and the smaller is the error in time estimate. The relevance of these findings to previous studies and the problems of relating biochemical indices to behavioral assessments are discussed. (Author's summary, modified)

11229
Mendelson, J. H., 1961
P. E. Kubzansky, P. H. Leiderman, D. Wexler, and P. Solomon
PHYSIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF SENSORY DEPRIVATION—A CASE ANALYSIS.—In: Sensory deprivation, p. 91-113. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

The results of studies on the two individuals presented suggest that the monotonous environment, social isolation, and physical immobility reduce secondary process thinking by failing to provide adequate sensory cues and thus permit latent primary process to emerge.

11230
Mullin, C. S., 1959
and J. M. Connery
PSYCHOLOGICAL STUDY AT AN ANTARCTIC IGY STATION.—U. S. Armed Forces Med. Jour., 10 (3): 290-296. Mar. 1959.

Thirty-nine men participating in the International Geophysical Year research program for one year at an isolated Antarctic station were subjected to a brief psychological study of their activities and interrelations. The principal objectives of the study were: (1) to determine the effectiveness of the Navy's screening program through which personnel of this station had been processed prior to their departure to the Antarctic a year before; (2) to study group and individual reactions occurring under conditions of comparative isolation and enforced

close personal association for 12 months; and (3) to make recommendations for improving screening procedures. No psychoses, disabling depressive states, obvious psychosomatic illness, or clear-cut neuroses developed at this station. Group responses to disappointment and disillusionment, stress of isolation, boredom, isomnia, cold, psychosomatic complaints, anxiety and hysteria, memory and concentration were studied. Also included were studies on group-leader tension, cohesiveness, subgroup expectations, meeting the basic objectives of the mission, and group reactions to cold, food and sex.

11231
Mundy-Castle, A. C. 1958
PSYCHOLOGICAL PROBLEMS OF SPACE FLIGHT.—South African Jour. Sci. (Cape Town), 54 (9): 225-230. Sept. 1958.

A discussion is presented of the effects of perceptual isolation to which a space traveler may be subjected in a space craft as a result of monotony or inadequate variation in his sensory influx. Laboratory experiments on perceptual isolation in humans indicated that inadequate variation in sensory input produced a progressively reduced activation of the brain-stem reticular formation, thus reducing the state of mental arousal or vigilance and inducing disorganization of cerebral processes. The bizarre visual hallucinations produced by the perceptual isolation are considered in relation to similar hallucinatory and other mental disorganizations induced by mescaline or lysergic acid; these stimulate the direct cortical response to stimuli while inhibiting the indirect reticular-formation response to the stimuli to induce a disorganized or nonintegrated mental state. This psychotic mental state is compared to the flight phenomenon of high-altitude "break-off"; pilot psychosis is suggested as a possible result of the stresses of space travel. Studies of psychogenic, or "voodoo" death as well as death in wild rats, after their whiskers have been clipped to deprive them of a primary contact with the external world, suggest such deaths to result from overstimulation of the parasympathetic nervous system; similar deaths could result on total separation from Earth by space travelers.

11232
Ormiston, D. W., and B. Finkelstein 1961
THE EFFECTS OF CONFINEMENT ON INTELLECTUAL AND PERCEPTUAL FUNCTIONING. —Aeronautical System Division. Behavioral Sciences Lab., Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171002). ASD Technical Report no. 61-577, Oct. 1961. iii+17 p.

Ten subjects were individually confined in a small capsule for 48 hours and required to work intermittently on intellectual (arithmetic, digit memory, confusing sentences, nonsense syllables, verbal analogies, same-opposite meanings, and logical reasoning), perceptual (warning-light monitoring, finding embedded figures, form discrimination, and aerial reconnaissance), and compensatory tracking tasks. Half of the subjects received conventional meals; the other half was provided a diet designed for consumption in a space vehicle. The normal cycle of sleep and wakefulness was maintained throughout the confinement period. Ten control subjects underwent the same conditions except they were confined only while eating or working. No decrement was observed in intellectual performance. Only one perceptual task, aerial reconnaissance, reflected any deterioration in performance. Tracking performance could not be evaluated because of apparatus difficulties. Comparisons revealed no significant effects of diet on performance. (Authors' abstract, modified)

11233
Ormiston, D. W. 1961
A METHODOLOGICAL STUDY OF CONFINEMENT. —Wright Air Development Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71582). WADD Technical Report no. 61-258, March 1961. iii+21 p.

Thirty-four subjects divided into two groups were confined for 8 hours in a lighted 5 by 8 foot cubicle where they worked occasionally on tracking, monitoring, and time estimation tasks and noted somatic complaints. Visual illusions were administered before and after confinement. Twenty subjects in another group underwent all of the tests but were not confined. A battery of personality tests was given to the subjects 1-3 months before they participated. Correlations among the personality test scores, the changes in the visual illusions, and the performance tasks were computed. The results of the performance tasks showed no significant differences between the confined and nonconfined groups. Time estimates did not vary significantly during confinement. Confirmatory evidence was gained favoring the use of the spiral aftereffect and rejecting the latency of autokinesis as criterion measures of confinement stress. The personality-performance relationships explored did not substantiate previous findings. Cautions that should be observed in selecting and instructing the subjects for experiments of this sort are discussed. (Author's abstract)

11234
Page, J. D. 1959
KAYAK HUNTING AND SPACE FLIGHT.—Amer. Psychologist, 14 (10): 655. Oct. 1959.

Semi-encased in his kayak and forced to remain motionless for hours in a highly constant stimulus field, the seal-hunting Eskimo faces many of the psychological stresses that will confront the astronauts of the future, who, restrained in a body-fitting mold, will be restricted in sensory stimulation to a few dials on the instrument panel and whose motor reactions will be limited to a simple hand movement. In view of the somewhat analogous conditions existing between kayak hunting and space flight, observations of the former activity on Eskimos may be of current interest in anticipating the possible hypnotic effect of space flight on humans and in suggesting corrective measures. The hunter in a kayak is subject to a special condition, known as "kayak dizziness". Sitting for long hours immobile in the kayak, the hunter becomes sleepy and then dizzy from the solar rays reflected from the calm sea. He forgets everything around him, loses the ability to move and experiences a feeling that his kayak is sinking and the water is rising around him. This state can be interrupted only by another hunter, or some change in environment. After a few such experiences the Eskimo becomes afraid to go out in a kayak.

11235
Randt, C. T., 1960
and W. F. Collins
SENSORY DEPRIVATION IN THE CAT.—A. M. A. Arch. Neurol., 2 (5): 565-572. May 1960.

Electroencephalograms of 17 locally anesthetized cats subjected to varying degrees of partial sensory deprivation showed spontaneous repetitive EEG arousal responses and arterial blood pressure evaluations increasing in frequency of occurrence in direct proportion to the degree and the duration that the afferent input was selectively restricted. Potentiation of the EEG activation and the hypertensive responses to various stimuli after periods of several hours of partial sensory deprivation was noted. Anesthetic agents and relatively mild degrees of hypoxia obliterated the EEG and blood pressure fluctuations. EEG records indicative of sleep were not obtained in submerged, blindfolded animals. Prolonged restriction of afferent stimuli is accompanied by an alteration of the modulating influence of the epinephrine-sensitive rostral midbrain tegmentum on the cerebral cortex and the sympathetic nervous system. These findings suggest that sensory deprivation results in elaboration of unusual amounts of epinephrine or increased neural responses to it. Marked sensitivity to anesthetic agents or hypoxia indicates that the EEG and blood pressure effects are mediated by small-fiber systems. (Authors' summary)

11236
Riesen, A. H. 1961
STUDYING PERCEPTUAL DEVELOPMENT USING THE TECHNIQUE OF SENSORY DEPRIVATION. —— Jour. Nervous and Mental Disease, 132 (1): 21-25. Jan. 1961.

The developmental approach to visual perception has demonstrated innate neural organizations governing reflex responses in higher mammalian species. However, the time required for kittens to develop a foot-placing response to visually-perceived objects after visual deprivation from birth has demonstrated that visually guided behavior develops by learning as a function of patterned visual stimulation. In addition, experiments with inversion of the visual field in growing kittens have shown that innate reflexes have only a slight effect on the development of visual-motor coordination. Other evidence suggests that active movement of the animal or its appendages is also essential during the early patterned light experience. The aftereffects of sensory deprivation in adult animals may be attributed to a decomposition of previously learned response associations.

11237
Robertson, M. H., 1961
and R. C. Martin
SENSORY DEPRIVATION AND ITS RELATION TO PROJECTION. —— Jour. Consulting Psychol., 25 (3): 274. July 1961.

Five male and five female subjects were individually tested for projection (productivity and originality of responses) following a 3-hour period of sensory deprivation wherein each person wore opaque goggles, cotton mittens, and cardboard cuffs while lying on a bed with his head in a foam rubber-lined box. In the tests, the subjects were presented with a dim point of moving light and asked to report what it suggested, looked like, or made them think of. The responses of the sensorily-deprived subjects and the responses of ten subjects who received no deprivation were compared in terms of total number of responses, number of stimulus-bound responses, original responses, and popular responses. No statistically-significant differences were found in the responses of the two groups, which is at variance with the hypothesis that sensory deprivation lowers the threshold for projection.

11238
Robertson, M. H. 1961
SENSORY DEPRIVATION AND SOME THERAPEUTIC CONSIDERATIONS. —— Psychol. Record, 11 (4): 343-347. Oct. 1961.

Sensory deprivation may be reproduced partially when preoccupation with a problem leads to exclusion of unrelated stimuli from awareness and withdrawal which in turn reduces the stimulus input and results in increased suggestibility to the internal stimuli. Therapeutic application of quantified sensory deprivation may act (1) to provide time for reorganization of thought and feelings and for development of a new perspective on life, (2) to produce general suggestibility and give access to the positive and constructive features of the unconscious (3) to reinforce isolation maximizing its unpleasant aspects which will create a desire for stimulation. Prophylactic use of sensory deprivation may be repeated exposure of the individual to graded amounts of sensory deprivation in order to raise his tolerance to a prolonged experience, e. g., space travel.

11239
Rosenbaum, G., 1959
S. I. Dobie, and D. B. Cohen
VISUAL RECOGNITIVE THRESHOLDS FOLLOWING SENSORY DEPRIVATION.—Amer. Jour. Psychol., 72 (3): 429-433. Sept. 1959.

A comparison was made of the effects of two different conditions of sensory deprivation upon perceptual functioning in vision: (a) total visual deprivation with blacked out rubber goggles and (b) partial deprivation by use of frosted goggles which permitted the perception of diffuse formless light. Other sensory stimulation was greatly reduced and kept constant. Recognitive time thresholds (in milliseconds) for 5-digit numbers were obtained tachistoscopically after periods of 0, 5, 15, and 30 min. of visual deprivation. It was anticipated that the recognitive threshold would be a sufficiently sensitive measure for the detection of small differences in visual responsiveness that might be produced by the two types of visual deprivation. Thirty-two adults with normal vision were used as subjects. The results indicate that periods of visual deprivation up to 30 min. produce no appreciable lowering in visual thresholds of recognition. Contrary to the hypothesis that the two types of deprivation would differentially affect visual efficiency, total deprivation of visual stimulation proved to be no different from partial deprivation in that both produced an improvement in visual efficiency following 5 min. of deprivation. Longer deprivation periods resulted in a return to normal efficiency. It is likely that increasing the duration of deprivation does not produce linear decreases in visual responsiveness. The visual impairements reported in previous studies of prolonged visual deprivation are a complex derivative of a prolonged isolation experience in which the reduced variation of all exteroceptive stimulation and the

stress effects of social isolation interact to produce the phenomena observed. It was also shown that visual deprivation within certain time limits serves to motivate visual responsiveness either by a cognitive expectation or deficit state to enhance visual efficiency.

11240
Ruff, G. E., 1961
E. Z. Levy, and V. H. Thaler
FACTORS INFLUENCING REACTIONS TO REDUCED SENSORY INPUT.—In: Sensory deprivation, p. 72-90. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

A program of isolation studies on a series of eight groups was initiated in an attempt to identify the variables involved in sensory deprivation studies. Emphasis was placed on differentiating variables related primarily to characteristic ego functions of the subjects from those imposed by experimental conditions. Of the many reactions to isolation, only the effects on physical activity, perception, thought, and emotion are discussed. It is suggested that isolation "destructures" the environment, and the subject restructures to create a sense of continuity with his previous existence and to restore meaning to the situation. The experiment is tolerable only as long as the sense of continuity is maintained.

11241
Ruff, G. E. 1959
ISOLATION.—Astronautics, 4 (2): 22-23, 110-111. Feb. 1959.

Isolation as a source of stress in space flight is discussed in relation to the following variable aspects: psychological distance ("aloneness"), geographical or physical distance, cultural or social distance, isolated group conflicts, adjustment to artificial environments, physiological and psychological reactions to enclosure and confinement, and behavioral changes which accompany sensory deprivations. All of these aspects are modified by the time variable, since effects depend on the length as well as on the degree of isolation. It has also been noted that subjects tolerate the isolation experiment best when they know its duration or are allowed to teminate it whenever they choose. To make the experiment meaningful in terms of their accustomed world, many subjects attempt to preserve their orientation in time. Others, seeking to maintain spatial orientation, repeatedly check the position of the bed and refrigerator or assure themselves of "which way is north". These findings suggest that the most important aspect of isolation is reduced information input rather than reduced sensory input. Results of such experiments, coupled with studies and accounts of solitary confinement, Arctic expeditions, and survival experiments, suggest that the quantity and variety of information inputs to space crew members should be adequate to provide a structured setting with ties to familiar customs and surroundings and to duplicate, as well as possible, the diversity of experience possible in life on Earth.

11242
Ruff, G. E., 1959
and E. Z. Levy
PSYCHIATRIC RESEARCH IN SPACE MEDICINE.—Amer. Jour. Psychiat., 115 (9): 793-797. March 1959.

Identification of psychological stresses in space flight is possible at present only by inference from analogous experiences. However, problems of existence in an artificial environment and crew selection may be investigated through studies on the effects of isolation, confinement, and sensory deprivation. Small groups of five subjects each were observed at the Aero Medical Laboratory under conditions of prolonged confinement (5 days) to a compartment designed to minimize monotony and physical discomforts. Physiological and psychological tests were administered before, during, and after the confinement. General features noted include the appearance of regressive behavior as shown by preoccupation with phallic, anal, and oral themes, and feeling of hostility towards fellow crew members. Growth toward a more mature, less rigid handling of certain conflict areas was seen in comparing the pre- and postexperimental test material. It was attributed to group support extended to the individual during regressive phases. Severe reactions were rare. A nonvolunteer group showed less verbal preoccupation and hostility, though the overall behavior pattern was similar to the volunteers. Seven classes of variables to be considered in planning isolation and sensory deprivation research are discussed. Behavior in individual isolation experiments is characterized by a brief phase of anxiety, followed by mobilization of ego defenses in an attempt to structure the experimental situation into a replica of familiar reality, and finally by impulsive termination of the experiment when unconscious material threatens to emerge. A sound ego which provides an effective frame of reference for meaningful structuring of experience is considered the best qualification for an astronaut. Both meaning and variety in sensory input have to be provided by the environment to prevent disorganization of the perceptual and thinking processes.

11243
Ruff, G. E., 1959
E. Z. Levy, and V. H. Thaler
STUDIES OF ISOLATION AND CONFINEMENT.—Aerospace Med., 30 (8): 599-604. Aug. 1959.

The physiological and psychological reactions of three groups of men to social isolation and confinement are analyzed briefly. Behavioral reactions of the groups differed, and each group seemed to have a characteristic "personality". Transient signs of ego impairment were occasionally noted. In general, each subject used effectively his characteristic methods of adaptation to handle conflicts. Individual physiological variations from day to day were common, but followed no pattern. Blood and urine samples remained within normal limits. In nine studies involving isolation of single individuals, it was determined that eight groups of variables influence behavior: (1) circumstances surrounding the experience; (2) variables related to the subject; (3) quality, modality, and pattern of sensory input; (4) restraint; (5) communication; (6) "aloneness"; (7) time factors; and (8) the subject's activities. The capacity to withstand isolation depends on the integrity of the subject's personality, but stress in isolation seems to increase with time.

11244
Scott, T. H., 1959
W. H. Bexton, W. Heron, and B. K. Doane
COGNITIVE EFFECTS OF PERCEPTUAL ISOLATION.—Canad. Jour. Psychol. (Toronto), 13 (3): 200-209. Sept. 1959.

Twenty-nine male subjects were placed in isolation for as long as they would stay (usually 3 to 4

days). Two batteries of tests were given to them, before, during, and after isolation. In addition, they were subjected to propaganda during the isolation period. Twenty-seven control subjects, who were not isolated, were given the same tests and propaganda material. The results indicate that the experimental subjects performed worse than the controls both during and after the isolation period on some tests, and that they were more susceptible to propaganda, though both groups showed a significant change in attitude. (Authors' summary)

11245
Sedman, G. 1961
"BRAIN-WASHING" AND "SENSORY DEPRIVATION" AS FACTORS IN THE PRODUCTION OF PSYCHIATRIC STATES: THE RELATION BETWEEN SUCH STATES AND SCHIZOPHRENIA. —— Confinia psychiatrica (Basel), 4 (1): 28-44. 1961. In English.

A woman, 52 years of age, developed symptoms of schizophrenia after being imprisoned and subjected to "brain-washing" procedures. Her psychosis is related to three causal processes: the effects (1) of severe physical stress, (2) of psychological stress, and (3) of sensory deprivation upon her mental state. On the basis of data gained from sensory deprivation studies it is suggested that individuals with an attention-seeking personality are less likely to counteract stresses of isolation and may develop hallucinations and possibly delusions.

11246
Sells, S. B. 1961
MILITARY SMALL GROUP PERFORMANCE UNDER ISOLATION AND STRESS: AN ANNOTATED BIBLIOGRAPHY. I. BASIC PSYCHOLOGY OF GROUP BEHAVIOR. —— Texas Christian Univ., Fort Worth, Tex. (Contract AF 41(657)-323); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8243-11). Technical Report no. 61-19, Oct. 1961. 184 p.

This annotated bibliography is part of a bibliographic series (of six parts) which investigates research related to factors contributing to the effectiveness of aircraft control and warning sites in Alaska. It has the following organization: (1) general studies and reviews, (2) roles, status and intra-group interactions, (3) communication and information, (4) individual perceptions in group behavior, (5) attitudes and attitude change, and (6) methodological studies. An author index is included.

11247
SENSORY DEPRIVATION: A SYMPOSIUM HELD AT HARVARD MEDICAL SCHOOL.—Edited by P. Solomon and others. xix+262 p. Cambridge, Mass.: Harvard Univ. Press, 1961.

This book is based on a symposium on sensory deprivation held at Harvard Medical School on June 20 and 21, 1958. The papers in this volume deal with experimental studies (on cognitive, physiological, arousal, and psychomotor effects), experimental-clinical studies (case histories and individual differences in response), clinical applications (for therapy and during aviation), and theoretical implications; 232 references are appended. Pertinent papers are abstracted separately, see items no. 11187, 11193, 11200, 11207, 11215, 11221, 11225, 11229, 11240, 11255.

11248
Shurley, J. T. 1960
PROFOUND EXPERIMENTAL SENSORY ISOLATION. —— Amer. Jour. Psychiat., 117 (6): 539-544, 2 plates; discussion, p. 544-545. Dec. 1960.

Sensory deprivation experiments carried out in a specially constructed laboratory at Oklahoma City Veterans Administration Hospital are described. Light, sound, vibration, odor, and taste inputs were highly restricted. Simulated weightlessness and a uniform tactile field were achieved by placing the subject in a large tank fitted with water slowly flowing at a constant temperature. Automatic controls and continouus tape recorders completed the system. The subjects were pre-selected volunteers on the basis of capacity for self-observation, memory, and ability to communicate freely. In each case several trial runs preceded the full-length experiment. A chronological report is presented based on tape recordings by a subject in isolation for 4½ hours. In regard to data collection, simultaneous tape recordings were found to be less inhibited, free from distortion, and more informative as to the actual experience than retrospective reports. In contrast to other methods of sensory deprivation, a water immersion situation was not perceived as unpleasant. Post-exposure feeling states varied with the subject. Certain hypotheses concerning the function of the human mind are proposed by the author and in the discussion following the paper.

11249
Silverman, A. J., 1961
S. I. Cohen, B. M. Shavonian, and G. Greenberg
PSYCHOPHYSIOLOGICAL INVESTIGATIONS IN SENSORY DEPRIVATION: THE BODY-FIELD DIMENSION. —— Psychosomatic Med., 23 (1): 48-61. Jan.-Feb. 1961.

Five body-oriented and six field-oriented subjects were exposed to a situation containing the elements of uncertainty, social isolation, low sensory input, and restraint from active movement to test the hypothesis that persons who rely more on external rather than internal cues would react differently to a situation in which external cues were lacking. The data tend to agree with the hypothesis. Field-dependent subjects initially and at the conclusion of the experiment revealed less of an ability to discriminate sensory cues, remained more aroused, were more uncomfortable about the experiment, and, when various interview responses were grouped to obtain a rough ego function index, showed a greater degree of disorientation.

11250
Smith, S[tanley], 1959
and W. Lewty
PERCEPTUAL ISOLATION USING A SILENT ROOM. —Lancet (London) 2 (7098): 342-345. Sept. 12, 1959.

A "silent room" was designed, constructed, and standardized up to a mean sound-pressure-level difference of 80 decibels. Twenty volunteers spent varying periods (from 5 hours and 50 minutes to 92 hours and 20 minutes) in the room under conditions of partial and complete sensory deprivation. Apart from many individual reactions, a general sequence of events was observed: increasing sleep, followed by restlessness and agitation, followed by thinking difficulties, and finally succeeded by panic. No post-

isolation phenomena were seen. In the group (11 women and 9 men) the women lasted longer than the men; but this may not be the general rule. (From the authors' summary)

11251
Smith, Stanley, H. Thakurdas, and T. G. G. Lawes 1961
PERCEPTUAL ISOLATION AND SCHIZOPHRENIA. —— Jour. Mental Sci. (London), 107 (450): 839-844. Sept. 1961.

Results of sensory deprivation experiments were compared for (a) 20 volunteers with deprivation times ranging between 29.24 and 48.70 hours, and (b) 6 chronic schizophrenics with deprivation times ranging between 431.59 and 486.40 hours. The experiments were conducted in a soundproof room with fur gloves over arms rather than cardboard gauntlets. In volunteers the general sequence of events was : increased sleep—then restlessness and agitation—thinking difficulties—panic. There were no post-isolation phenomena. Schizophrenics tolerated the sensory deprivation and isolation stress extremely well without any difficulties or lasting improvement. These results are at variance with work previouly published by other investigators.

11252
Solomon, P. 1958
SENSORY DEPRIVATION AND THE HUMAN MIND. —Office of Naval Research, Research Reviews, 1958 (April): 8-11.

Adult male subjects were submitted to sensory deprivation for up to 36 hours in a tank-type respirator. The situation acted as a severe stress on all subjects, and mental abnormalities appeared. Psychological tests indicate that an extrovert, one more motivated by a genuine interest in others and less by self-enhancement, tolerates sensory deprivation much better than a self-centered introvert.

11253
Thorpe, J. G. 1961
SENSORY DEPRIVATION. —— Jour. Mental Sci. (London), 107 (451): 1047-1059. Nov. 1961.

Literature on sensory deprivation is reviewed according to three main experimental techniques: (1) the reduction in patterning of stimuli (the subject is isolated in a room); (2) the reduction of absolute intensity of stimuli (the subject is suspended in a water tank); and (3) the structuring of stimuli (the subject is enclosed in a tank-type respirator). Sensory deprivation effects on cognition, perception, hallucination, suggestibility, physiology, and tolerance of deprivation are analyzed taking into consideration the technique employed in each study. Other variables which may affect sensory deprivation data are discussed grouped around selection of subjects, predeprivation experience, deprivation experience, and postdeprivation experience. At present it is impossible to decide on any of a variety of psychological, psychiatric, and neurological theories on sensory deprivation effects due to lack of systematic research in the field. Practical application of the results is as yet limited. (28 references)

11254
Tiller, P. R., and A. M. Figur 1959
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS; A SECOND STUDY. IV. CONCENTRATIONS OF EPINEPHRINE AND NOREPINEPHRINE IN URINE DURING CONFINEMENT IN A SIMULATED SPACE CHAMBER.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-1403). Report no. NAMC-ACEL-416, Nov. 17, 1959. iv+8 p.

The effect of confinement (8 days) in a simulated space chamber on epinephrine and norepinephrine concentrations in urine was studied in six men. Determinations were made prior to, during, and after confinement. Norepinephrine showed no significant increase, except for day 5, when an emergency situation was introduced. The values for epinephrine obtained during confinement were approximately 15 micrograms/24 hr. This was about twice those obtained in post-confinement determinations. It is concluded that such confinement, as a stress-provoking situation, has a significant effect on the excretion of epinephrine. (Authors' abstract)

11255
Vernon, J. A., T. E. McGill, W. L. Gulick, and D. R. Candland 1961
THE EFFECT OF HUMAN ISOLATION UPON SOME PERCEPTUAL AND MOTOR SKILLS.—In: Sensory deprivation, p. 41-57. Ed. by P. Solomon and others. Cambridge, Mass.: Harvard Univ. Press, 1961.

This paper defines the conditions of sensory deprivation in 18 human subjects, the nature and procedure of tests, and the effects of sensory deprivation on rotary pursuit ability, color perception, motor coordination, mirror tracing, depth perception, body weight, strength of grip, galvanic skin response, and delayed auditory feedback. Sensory deprivation had a significant deleterious effect on the subjects in all of these tests except depth perception, strength of grip, and delayed auditory feedback. The influence was usually greatest for the subjects confined for the 48-hour period. (Authors' summary)

11256
Vernon, J. [A.], T. Marton, and E. Peterson 1961
SENSORY DEPRIVATION AND HALLUCINATIONS. —— Science (Washington), 133 (3467): 1808-1812. June 9, 1961.

Fifty-five subjects were subjected to varying degrees of auditory and visual deprivation in order to determine the conditions of minimal or controlled sensory stimulation which will elicit hallucinations. The degrees of sensory deprivation ranged from constant total darkness and silence to constant exposure to diffuse, homogeneous illumination and monotonous sound. Only 10 of the subjects experienced visual hallucinations and none of them definite auditory hallucinations. It appears that complete sensory deprivation or controlled sensory stimulation are not necessarily hallucinogenic.

11257
Vernon, J. [A.], and T. E. McGill 1961
SENSORY DEPRIVATION AND PAIN THRESHOLDS.

—— Science (Washington), 133 (3449): 330-331. Feb. 3, 1961.

The confinement of nine adult male subjects for four days in a light-proof, soundproof cubicle resulted in a lowering (average of 0.108 milliamperes) of their thresholds for electrically induced pain. Nine control subjects (not exposed to any sensory deprivation) showed an insignificant average drop of 0.019 ma. after four days spent in normal activity. The effect of the reduction in sensory input on the action of the reticular formation of the brain stem is discussed.

11258
Vernon, J. A., 1960
and T. E. McGill
UTILIZATION OF VISUAL STIMULATION DURING SENSORY DEPRIVATION. —— Perceptual and Motor Skills, 11 (2): 214. Oct. 1960.

The voluntary use of a viewer, which provides a monotonous neutral stimulus in a very dim illumination, was timed for each subject participating in a 72-hr. sensory deprivation experiment. The utilization of the viewer divided the subjects into two groups, those who demanded early release, and those who completed the experiment. The former utilized the viewer significantly more than the latter.

11259
Vosburg, R., 1960
N. Fraser, and J. Guehl
IMAGERY SEQUENCE IN SENSORY DEPRIVATION. —A. M. A. Arch. Gen. Psychiat., 2 (3): 356-357. March 1960.

Subjects were isolated for three hours in successive conditions of total silence and darkness, total darkness with an ambiguous noise source, and total silence with homogeneous visual-field illumination. An early period of adaptation characterized by recollection of memories associated with the available sensory input was followed by the development of classic neurotic behavior, with decreasing associative ability, and finally by panic.

11260
Walters, R. H., 1960
and M. J. Quinn
THE EFFECTS OF SOCIAL AND SENSORY DEPRIVATION ON AUTOKINETIC JUDGMENTS.—Jour. Personality, 28 (2): 210-219. June 1960.

Forty male subjects, ten in each group, were exposed for 30 min. to one of the following conditions: combined social and sensory deprivation, social deprivation, sensory deprivation, and no deprivation. Immediately after this 30-min. period, subjects were exposed to the autokinetic effect. Initial latency of response (i.e., time elapsing from the switching on of the light to the subject's perception of movement) was shortest for subjects who had experienced both sensory and social deprivation, intermediate for those who had experienced social deprivation only or sensory deprivation only, and longest for those who had experienced neither kind of deprivation. In addition, subjects responded most strongly to the suggestion that they were underestimating distances if they had experienced both kinds of deprivation and least strongly if they had experienced no deprivation. No differences were found between the groups when an attempt was made in a further series of trials to condition them to reproduce only the most extreme judgments they had made up to that time. An incidental finding was that subjects who experienced sensory deprivation tended to make shorter estimates of lapse of time during the 30-min. period preceding exposure to the autokinetic effect than did subjects who did not experience sensory deprivation. Criticisms of the concept of a social drive and of social reinforcement are offered on the basis of this experiment and related studies. (Authors' summary)

11261
Walters, R. H., 1961
and G. B. Henning
ISOLATION, CONFINEMENT AND RELATED STRESS SITUATIONS: SOME CAUTIONS.—Aerospace Med., 32 (5): 431-434. May 1961.

Based on a literature survey, the author concludes that the problem with most sensory-deprivation studies is that they simultaneously manipulate the subjects' physical and social environments without simulating any real-life situation. (46 references)

11262
Wase, A. W., 1960
and J. Christensen
STIMULUS DEPRIVATION AND PHOSPHOLIPID METABOLISM IN CEREBRAL TISSUE.—A.M.A. Arch. Gen. Psychiat., 2 (2): 171-173. Feb. 1960.

Two experiments were conducted with adult male mice under isolation stress to determine whether there are biochemical changes in the cerebral phospholipid metabolism. In the first experiment the mice were divided into three sets of 10 each, and placed for fourteen days in individual isolation, grouped isolation, and grouped but not isolated, in laboratory conditions. In the second experiment the length of isolation was increased to 31 days. At the end of the isolation period in each case, the mice were injected with 100 micro-curies of P^{32}phosphate in 0.2 ml. of isotonic saline, killed by cervical dislocation 3 hours later, and the brains analyzed for phospholipid content. A significant depression of phospholipid turnover was seen in the brains of single-isolated mice as compared to brains of group-isolated or nonisolated grouped mice. The behavior of single-isolated mice was characteristically neurotic, agitated and hostile. Certain hypotheses relating the abnormal behavior induced by isolation stress to reduced biochemical and metabolic processes are discussed.

11263
Wexler, D., 1958
J. Mendelson, P. H. Leiderman, and P. Solomon
SENSORY DEPRIVATION: A TECHNIQUE FOR STUDYING PSYCHIATRIC ASPECTS OF STRESS.—A.M.A. Arch. Neurology and Psychiatry, 79 (2): 225-233. Feb. 1958.

Seventeen normal men were confined for up to 36 hours in a tank-type respirator under constant conditions of light, noise, and visual field. All subjects showed impaired ability to concentrate, distortions in time judgment, and degrees of anxiety. Eight subjects experienced psychosomatic delusions, illusions, or hallucinations. Four subjects terminated the experiment because of anxiety and panic, and seven because of somatic complaints. Various psychological tests showed a positive correlation of time in the respirator with need for affiliation, need for relief, and need to nurture. Subjects who remained longer

in the respirator also showed a significantly lower distortion in time estimates, and a lower rate of somatic complaints. It is suggested that the psychological stress of sensory deprivation is due to its effect on the subjective hold on external reality.

11264
Weybrew, B. B. 1960
BIBLIOGRAPHY OF SENSORY DEPRIVATION, ISOLATION AND CONFINEMENT.—Naval Medical Research Lab., New London, Conn. (Task no. MR005. 14-2100.03.04; Subtask no. 3, Report no. 4). Report no. 60-1, Jan. 1960. ii + 13 p.

The entries in this author-title-source listing of 146 references are grouped in the following categories: (1) Review Articles, (2) Anecdotal Literature, (3) Experimental Literature, (4) Studies of Confinement Peculiar to Space Flight, (5) Studies of Confinement Peculiar to Submarine Environment (6) Sociological and Prism Confinements, (7) Animal studies, (8) Theoretical Publications, and (9) Miscellaneous.

11265
Weybrew, B. B. 1961
THE IMPACT OF ISOLATION UPON PERSONNEL. —Jour. Occupational Med., 3 (6): 290-294. June 1961.

Research on the effects of prolonged confinement in a monotonous, impoverished environment (submarine) is surveyed in an effort to provide answers to (1) physiological and psychological changes occurring in individuals while in relative isolation, and (2) the most efficient methods in selecting individuals with high tolerance of isolation. Laboratory studies showed environmental feedback to be an important factor in maintaining vigilance in a repetitious activity during relative isolation, related to the arousal function of the reticular system. A second study indicated a significant correlation between the amount of change in skin resistance, the rate of return to the basal level following stress, and the presence of personality traits characteristic of emotional stability. Results of operational studies involving submarine confinements for periods of 11, 50, 60, and 83 days showed a decline in personal motivation and group morale, a rise in homesickness, and a disturbance of time perception. Selection techniques which include measures of aptitudes, reason for volunteering, motivation, psychiatric status, and the somatopsychological make-up have reduced the failures for psychological and/or psychiatric reasons in the submarine service to below 10%.

11266
Ziskind, E., 1960
Harold Jones, W. Filante, and J. Goldberg
OBSERVATIONS ON MENTAL SYMPTOMS IN EYE-PATCHED PATIENTS: HYPNAGOGIC SYMPTOMS IN SENSORY DEPRIVATION.—Amer. Jour. Psychiat., 116 (10): 893-900. April 1960.

Occurrence of mental disturbances was studied in ophthalmologic patients with bilateral eye patches and under a relative degree of social isolation and visual and proprioceptive deprivation for varying periods of time. Psychiatric interviews were carried out before, during, or after patching. Mental symptoms were observed in all patients whose eyes were covered for several weeks, and in 30% of patients with eye patches on for 24 hours. A new symptom—noncompliance with instructions—was identified as part of the sensory deprivation syndrome. It occurred mainly during periods of reduced awareness, i. e., in sleep or on awakening, and was manifested in involuntary acts of sitting up or unpatching contrary to instructions. The authors postulate periods of reduced awareness as a common basis for development of mental symptoms produced by sensory deprivation, isolation, sleep deprivation, hunger, and toxic states.

11267
Zubek, J. P., 1960
W. Sansom, and A. Prysiazniuk
INTELLECTUAL CHANGES DURING PROLONGED PERCEPTUAL ISOLATION (DARKNESS AND SILENCE). — Canad. Jour. Psychol. (Toronto), 14 (4): 233-243. Dec. 1960.

Sixteen subjects were placed in a dark and soundproofed chamber for a period of a week or longer. A battery of tests, measuring eleven different abilities, was administered before, during, and one day after isolation. A carefully matched group of 16 control subjects were given the same tests at the same time intervals. The results indicate that there is no significant difference in performance on tests measuring verbal fluency, verbal reasoning, number facility, numerical reasoning, abstract reasoning, space relations, and rote learning. Of the intellectual abilities, only recent memory (recall and recognition) was significantly impaired. This impairment was still present one day after emerging from isolation. Two other abilities, namely, dexterity and perceptual ability, were also significantly impaired. (Authors' summary)

m. Restraint

11268
Bartlett, R. G., 1959
and P. D. Altland
EFFECT OF RESTRAINT ON ALTITUDE TOLERANCE IN THE RAT.—Jour. Applied Physiol., 14 (3): 395-396. May 1959.

Young adult male and female Sprague-Dawley rats were exposed to a simulated altitude of 33,500 ft. both with and without restraint. The exposure was begun immediately upon the restraint of the experimental animals. The restrained animals died significantly sooner than did the nonrestrained controls. The possible relation of colonic temperature, oxygen consumption, and emotional stress to the decreased altitude tolerance is discussed. It is suggested that the data serve as a warning for caution in the use of restraint for convenience in altitude-tolerance experiments. (Authors' summary)

11269
Bartlett, R. G. 1959
EFFECTS OF RESTRAINT ON OXYGEN COMSUMPTION OF THE COLD EXPOSED GUINEA PIG.—Jour. Applied Physiol., 14 (1): 46-48. Jan. 1959.

The oxygen consumption of cold-exposed, restrained guinea pigs was significantly greater than that of cold-exposed, nonrestrainted controls. Similar observations were made for the rat. These data strongly suggest that heat production was greater in the restrained animal than in the nonrestrained control. Hypothermia accompanying restraint in the cold cannot be attributed to a decreased muscular activity (muscular activity was actually increased) and a consequently lessened heat production, as sug-

gested by some authors. It must be due, as demonstrated in the rat, to an increased rate of heat loss. (Author's abstract, modified)

11270
Bartlett, R. G., 1959
and M. W. Young
"FREE ROAMING" IN THE ALBINO RAT AND ITS EFFECT ON RESTRAINT HYPOTHERMIA.—Jour. Applied Physiol., 14 (3): 393-394. May 1959.

"Adaptation" to a large environment increased the resistance of young adult female (175-225 g.) Sprague-Dawley rats to restraint hypothermia. Two changes have occurred in the "free roaming" rats which rendered them less susceptible to restraint hypothermia: (1) emotional adaptation to the changing stimuli of the free roaming state may have lessened the emotional stress produced by restraint which would have reduced the hypothermic response; (2) a possible cross-resistance produced by adaptation to the non-specific stresses involved in the free roaming state which would have inhibited restraint-induced hypothermia. (From the authors' summary)

11271
Bartlett, R. G., 1958
and F. H. Quimby
HEAT BALANCE IN RESTRAINT (EMOTIONALLY) INDUCED HYPOTHERMIA.—Amer. Jour. Physiol., 193 (3): 557-559. June 1958.

The rate of fall of body temperature of rats restrained in an elongated position was found to be significantly greater during exposure to a temperature of 5° C. for 3 hours than that of rats restrained in a huddled position similar to that chosen by nonrestrained rats. The rate of heat loss per unit of effective body surface exposure was greater in restrained rats than in nonrestrained rats. It is concluded that the hypothermia produced by restraint is due to an increased rate of heat loss produced both by a greater body surface exposure and by a greater rate of heat loss per unit of body surface exposed.

11272
Frankel, H. M., 1958
G. E. Folk, and F. N. Craig
EFFECTS OF TYPE OF RESTRAINT UPON HEAT TOLERANCE IN MONKEYS.—Proc. Soc. Exper. Biol. and Med., 97 (2): 339-341. Feb. 1958.

The effect of two types of restraint on rectal temperature was determined in Macaca monkeys exposed to temperatures of 29° or 38° C. Monkeys tied to an animal board by the wrists and ankles, with arms extended, showed a steady increase in rectal temperature to over 43° during exposure for 3-5 hours to a temperature of 38°, with 45% humidity. Rectal temperature remained steady at about 40° for 5 hours at 38° when the animals were restrained on a wire mesh platform by a neck yoke, with arms tied along the side of the body. At 29°, rectal temperature was slightly decreased in both groups, and heart rate was increased. It is concluded that the physiologic response of monkeys to heat stress can be influenced by the type of restraint. The observed difference in response suggests that restraint on a wire-mesh screen may favor evaporative heat loss, while restraint with the arms extended may be less acceptable to the monkeys than restraint with the arms at the side.

11273
Gaito, J., 1958
T. D. Hanna, R. Bowe, and S. Greco
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS. III. PERFORMANCE AND HABITABILITY ASPECTS OF EXTENDED CONFINEMENT.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-1403). Report no. NAMC-ACEL-385, Sept. 26, 1958 [56] p.

Six men were isolated and confined in a limited space for seven days, breathing a relatively high oxygen concentration (equivalent to 55% at sea level). Performance on simple, routine psychomotor tasks was variable, while that on more complex tasks was consistent and sometimes increased in effectiveness toward the end of the confinement period. It is concluded that in spite of expressed limitations in the physical environment, intellectual and psychomotor performance of subjects should not deteriorate in conditions like those under test. It is suggested that simple routine tasks be made less so, and be supplemented with more complex tasks requiring higher level behavior. (Authors' summary and conclusions, modified)

11274
Hauty, G. T. 1960
PSYCHOLOGICAL PROBLEMS OF SPACE FLIGHT. —In: Physics and medicine of the atmosphere and space, p. 409-421. New York, etc.: John Wiley and Sons, 1960.

Among other psychological stresses, during extended space operations human operators will be subjected to severe conditions of confinement, disruption of diurnal activity rhythm, and fatigue. Confinement usually engenders irritability and even hostility. Even more serious is the disruption of the diurnal work-rest cycle, as shown in the results from experiments in simulated space flights. Approaches to this problem comprise the study of forced vs. self-determined modification of cycling, pre-exposure training, and possibilities of pharmacologically controlling both proficiency of performance and efficiency of sleep. The depreciative effects of sleep deprivation or prolonged commitment to a skilled or semi-skilled task are manifested in impaired judgment, slower decision time, decline in vigilance, increased variability of reliability, and degradation of attitudes and feelings.

11275
Hicks, S. A. 1960
THE EFFECTS OF FOUR HOURS CONFINEMENT IN MOBILE ARMORED PERSONNEL CARRIERS ON SELECTED COMBAT RELEVANT SKILLS: A PILOT STUDY.— Aberdeen Proving Ground. Army Ordnance Human Engineering Labs., Md. (OCO, Research Branch Project no. TB1-1000). Technical Memorandum Report no. 3-60, [1960]. vi+37 p. PB 147162

Studies were made of changes in general combat-relevant performance as a result of four hours of confinement in a maneuvering Armored Personnel Carrier (APC). Fifty enlisted men were tested both before and after confinement on tests designed to measure stamina, response time, gross motor coordination, arm steadiness, equilibrium, and eye-arm coordination. The four-hour confinement period resulted in losses in all areas. The losses were statistically significant in hand-arm steadiness,

eye-arm coordination, gross motor coordination, stamina, and equilibrium. Recommendations are included for future research. (Author's abstract, modified)

11276
Kraft, J. A. 1959
MEASUREMENT OF STRESS AND FATIGUE IN FLIGHT CREWS DURING CONFINEMENT.—Aerospace Med., 30 (6): 424-430. June 1959.

Laboratory facilities are described which are well suited for the experimental investigation of some problem areas during space flight, such as confinement and isolation, performance decrement, task loading, group behavior, physiological and psychological deprivation, performance scheduling, and reaction to stress. From a physiological harness attached to the subject, measures can be taken of skin temperature, heart rate, respiratory cycle, and skin conductance. Measurements of muscular tension can be obtained from thumb knobs which operate one of the tasks on an instrument panel. Measures of random body movements are revealed by strain gauges mounted in the bunks, gastrointestinal activity can be recorded, and analyses can be made of urine and blood samples.

11277
Menguy, R. 1960
EFFECTS OF RESTRAINT STRESS ON GASTRIC SECRETION IN THE RAT. — Amer. Jour. Digestive Diseases, 5 (11): 911-916. Nov. 1960.

When rats were stressed by restraint in a wire jacket for 20 hr., hemorrhagic gastric erosions consistently developed in the glandular mucosa. Previously vagotomized rats were partially protected from stress ulcers, whereas hypophysectomy or adrenalectomy was without effect. Measurement of 6-hr. gastric secretory output in rats submitted to the same restraint stress revealed a 94 per cent inhibition of gastric secretory activity in comparison with unstressed controls. (Author's summary)

11278
Nasledov, G. A., 1958
and V. N. Filippova
[DISTURBANCE OF COORDINATION OF THE MOTOR CENTERS IN MAN DUE TO LIMB IMMOBILIZATION] O narushenii koordinatsii dvigatel'nykh tsentrov cheloveka pri immobilizatsii konechnosti.—Fiziologicheskii zhurnal SSSR (Moskva), 44 (6): 526-533. June 1958. In Russian, with English summary (p. 533).
English translation: DISTURBED MOTOR CENTRE CO-ORDINATION RESULTING FROM IMMOBILIZATION OF A LIMB IN MAN.—Sechenov Physiol. Jour. U.S.S.R. (New York), 44 (5-6): 484-492. Dec. 1958.

Action potentials of the muscles rectus femoris and semitendinosus were investigated in normal human subjects and in patients with immobilized lower extremity. Normal subject showed some functional asymmetry in the interplay of the motor centers. Immobilization of a lower extremity caused an impairment in coordination between motor centers. A voluntarily induced strain of one muscle caused an involuntary contraction of the other. These aberrations were probably caused by a trauma, with a subsequent loss of reciprocal inhibition. After prolonged immobilization the action potentials were absent in all muscles tested, except those under voluntary strain. Direct muscle stimulation did not produce any significant changes of the voltage-time curve. It is concluded that the changes observed were due to processes occurring in the nerve centers.

11279
Renaud, S. 1959
IMPROVED RESTRAINT-TECHNIQUE FOR PRODUCING STRESS AND CARDIAC NECROSIS IN RATS.—Jour. Applied Physiol., 14 (5): 868-869. Sept. 1959.

An improved restraint board is described and diagrammed for use with experiments on rats of a body weight range from 90 to 110 gm. Using this board a typical alarm reaction is obtained in a few hours, characterized by enlargement of the adrenals, thymicolymphatic involution, and presence of gastric ulcers; this reaction is very marked after 24 hours. At this time and without other treatment, small foci of cardiac necrosis are rarely visible without pretreatment with corticoids. If NaH_2PO_4 plus certain corticoids are given a 7-hour period of restraint on the board is sufficient to induce large patches of cardiac necrosis.

11280
Sines, J. O. 1961
THE EFFECTS OF ELECTROCONVULSIVE SHOCK ON EMOTIONALITY AND AUTONOMIC RESPONSE TO SUBSEQUENT STRESS IN THE RAT. — Jour. Genetic Psychol., 99 (2): 261-267. Dec. 1961.

Thirty male rats were subjected to the stress of 24 hours of immobilization after 14 had been given a series of 15 daily electroconvulsive shocks. The shocked animals showed significantly less emotional behavior in an enclosed field than the non-convulsed controls, and they demonstrated less heart rate increase during the 24 hours of immobilization. The present findings do not appear to be consistent with a postulated debilitating effect of electroconvulsive shock. The relationships between both heart rate and body temperature changes and enclosed field data are interpreted as support for the validity of enclosed field measures as indicators of emotionality. (Author's summary, modified)

11281
Singh, H. 1961
A CASE OF PSYCHOSIS PRECIPITATED BY CONFINEMENT IN LONG DISTANCE TRAVEL BY TRAIN. — Amer. Jour. Psychiat., 117 (10): 936-937. April 1961.

Restriction to a traveling railway coach for 48 hours precipitated a psychotic episode with paranoidal delusions in a 64-year old man. The episode culminated when the man jumped from the train. Influential factors were close association with and caring for a blind and insecure wife who further confined his movements about the coach.

11282
Wilber, C. G., 1958
and P. F. Robinson
EFFECT OF RESTRAINT ON BODY TEMPERATURE IN GUINEA PIGS.—Jour. Applied Physiol., 12 (2): 214-216. March 1958.

The effect of restraint on body temperature was studied in guinea pigs exposed to ambient temperatures of 20-22° or 0° C. Clipped and unclipped restrained animals showed a maximum decrease in colonic temperature of 3° after 160 minutes at

room temperature, followed by a slow rise to control levels by 390 minutes. Restraint without clipping at 0° produced a steady fall in temperature to about 21° at 230 minutes, while restraint with clipping resulted in a decrease to 6° in 150 minutes. Unrestrained animals at 0° showed only a slight decrease in colonic temperature. The effect of restraint is attributed to decreased muscular activity, prevention of curling up, and possibly to an interference with blood circulation.

n. Radiation

11283
Andersen, C. E. 1960
THE CORPUSCULAR RAYS FROM THE SUN.—In: International Astronautical Congress, Xth (London, 1959), Proceedings, vol. 2, p. 786-789. Wien: Springer, 1960.

According to the theory proposed by the author, the Sun expels material occasionally as surge eruptions with speeds which may be greater than the minimum escape velocity. These polar plasma masses proceed as narrow streams which may hit the Earth's atmosphere near the magnetic poles with a particle energy and flux of the same order of magnitude as the charged particles in the beam from a cyclotron. They are fatally dangerous due to electromagnetic radiation of secondary nature. Charged particles with the same energy have been shown near the magnetic equatorial plane of the Earth. They are presumably deflected particles of the Sun plasma streams, which have long lifetimes near the Earth. The corpuscular radiation generally associated with the sunspots has also been indicated from the "unfriendly" side of the Sun, which has a revolution period of 26.88 days. It should be possible to prove both the stream particle theory and the one-face emission theory directly from experiments with artificial moons and planets. (Author's abstract, modified)

11284
Anderson, K. A. 1961
PREDICTION ASPECTS OF SOLAR PROTON EVENTS.—In: Discussion of solar proton events and manned space flight, p. 1-5. National Aeronautics and Space Administration, Washington, D.C. NASA Technical Note no. D-671, March 1961.

A considerable reduction in the radiation hazard in space due to solar protons can be achieved through forecasts based on solar observations. The long-term outlook over the next 50 years is that emissions of solar protons may be comparatively infrequent, but that there will be a great hazard to space travel from high-energy solar cosmic ray emissions, such as that which occurred on February 23, 1956. Their hazard is due in large measure to the difficulty of shielding against them, since the first 100 g./cm.^{2} of absorber will only increase the potential dose. From the 5 or 6 high-energy events which have occurred since 1942, the impression is gained that they are not related to the peaks of the 11-year cycle. The flares do occur in solar active regions, and warnings based on the presence of the latter should reduce the hazard.

11285
Appleman, H. S. 1961
RADIATION EFFECTS ON MANNED SPACE FLIGHTS. — Air Weather Service (MATS), Scott Air Force Base, Ill. Technical Report no. 156, Aug. 1961. i+9 p.
Also published in: Jour. Environmental Sci., 4 (6): 10-13. Dec. 1961.

A general survey is presented of the problem of radiation effects on space flights. The hazards considered are galactic cosmic rays, radiation from a quiescent sun, from solar flares, and from the Van Allen belts. Various characteristics of solar flares and the chances of exposure during space flights are discussed. Shielding requirements for these conditions are stated. The physical properties of the Van Allen belts and their relationship to moon flights and orbital trips around the earth are discussed. Actual dosages from these exposures and a guide to the maximum permissible dosages are given.

11286
ARE MICROWAVES DANGEROUS?—Brit. Medical Jour., 1958 (5103): 1030. Oct. 25, 1958.

A brief discussion is presented of the potential medical hazards associated with microwave radiations. It is suggested that the crystalline lens and tastes are the tissues most vulnerable to the heating effects of microwaves, since they are the most sensitive to temperature and are not effectively cooled by the blood stream. Evidence of damage occurring after exposure to relatively high intensities of radiation is briefly reviewed. It is concluded that the exposure limit adopted by the North Atlantic Treaty Organization (0.0005 watts per sq. cm.) is well below the level at which damage may be expected, despite the possibility of summation of effects over long periods of exposure.

11287
Barnes, C. M., 1960
A REVIEW OF THE BIO-MEDICAL ASPECTS OF NUCLEAR POWERED AIRCRAFT. — Military Med., 125 (10): 681-684. Oct. 1960.

Unique aspects of the radiation environment in manned nuclear aircraft present problems to the health and maintenance of aircrew and ground support personnel. Compromise is necessary between the amount of shielding required to provide adequate protection to personnel and the aerodynamic requirements of high-performance systems. Other problems of nuclear aircraft include the psychological stress of extended flight, the radiation hazards of bailout, and the ground contamination resulting from aircraft crash. Research conducted by the Atomic Energy Commission includes study of the effects of exposure to radiation in the expected doses, search for a compound which will alleviate radiation damage, studies of crew stress and fatigue, experiments with the fission products of a simulated air crash, and development of remote equipment maintenance procedures.

11288
Barron, C. I., 1958
and A. A. Baraff
MEDICAL CONSIDERATIONS OF EXPOSURE TO MICROWAVES (RADAR).—Jour. Amer. Med. Assoc., 168 (9): 1194-1199. Nov. 1, 1958.

A total of 335 employees worked with or were exposed to microwaves in an airframe manufacturing company. Tests were carried out after 6, 12, and 24

months in an effort to detect acute or cumulative biological effects of exposure to energized radar beams in the 400 to 9000 megacycle range and with peak power output exceeding one megawatt. Identical examinations were made on a nonexposed control group. Incidence of death, chronic disease, sick leave, and subjective complaints was comparable in both groups. Total red and white blood cell counts and differential counts, urinalyses, chest x-rays, and electrophoretic serum protein level determinations did not reveal any acute, transient, or cumulative physiological or pathological changes attributed to microwaves. Safe maximum exposure standards were impossible to define. Because increasingly high-powered radar transmitters are being developed, it will be necessary to determine more precisely human tolerance to microwave exposure.

11289
Barron, R. D. 1960
OCCUPATIONAL INJURIES TO THE EYE RESULTING FROM EXPOSURE TO THE ELECTROMAGNETIC SPECTRUM. —— Med. Services Jour. Canada (Ottawa), 16 (6): 487-500, 1 folding leaf. June 1960.

The physical properties of the major divisions of the electromagnetic spectrum are reviewed. Known hazards to the visual organs from these major divisions (cosmic, nuclear, ultraviolet, visible light, infrared, and microwave radiations) are related to current occupational problems and injuries. Methods are suggested to prevent and control these injuries.

11290
Barton, J. A. 1961
AN ESTIMATE OF THE NUCLEAR RADIATION AT THE LUNAR SURFACE. —— Advances Astronaut. Sci., 6: 794-804. 1961.

In order to provide suggestions for lunar probe instrumentation, a basis for the interpretation of lunar probe data, and a preliminary guide for lunar manned exploration and lunar base design, an estimate of the lunar surface radiation is made. Consideration is given to the various sources of radiation including decay of radioactive elements in the lunar crust, activation of lunar crust by primary cosmic and solar radiation, and direct cosmic and solar radiation. Based on the results obtained for the lunar surface radiation, the biological dosages were determined for the various sources. It is concluded that the biological dosages from lunar crust activation are small compared to the direct radiation and that the direct-radiation dose is greatly enhanced during periods of solar activity. (From the author's abstract)

11291
Boiteau, H. 1960
[THE BIOLOGICAL EFFECTS OF RADAR WAVES] Les effets biologiques des ondes radar. —— Revue des Corps de santé des armées (Paris), 1 (5): 637-652. Oct. 1960. In French.

Radar waves have been shown in research on animals to have a pathological effect on living tissues through induction of hyperthermia, particularly in organs susceptible to heat, such as the eyes, the brain, and the genital organs. The degree of hyperthermia produced by radar waves is dependent on the intensity and frequency of radiation, the duration of exposure, and the efficiency of thermal regulation in the affected organ. Clinical observations of personnel engaged in radar work have revealed only one case of injury which could be related to radar exposure (bilateral cataracts). The maximum permissible intensity of radiation on radar personnel has been empirically established at 0.01 watts/sq. cm. for prolonged exposure, and 3 watts/sq. cm. for one minute.

11292
Bond, A. F., 1961
M. G. DelDuca, and A. D. Babinsky
METHODS OF PREDICTING RADIATION DOSAGE IN SPACE FLIGHTS. —— Advances Astronaut. Sci., 6: 302-316. 1961.

Two computational methods are discussed which have been used to predict total radiation dosages received in passing through the Van Allen radiation belts in flights departing from Earth. A fully automatic analog computer technique is presented which can be used for computation of radiation doses received in trajectories in the equatorial plane. For trajectories inclined to the equator, a combined mechanical and electronic system is described in which instantaneous trajectory parameters are inserted manually. Preliminary results of the total integrated radiation dose received in various low thrust and ballistic trajectories inclined to the equator are also presented and discussed. The results suggest the possibility of developing devices which may aid safe navigation through radiation fields. (Authors' abstract)

11293
Brown, W. Lynn, 1959
R. M. Carr, and J. E. Overall
THE EFFECT OF CHRONIC WHOLE-BODY IRRADIATION ON PERIPHERAL CUE ASSOCIATIONS.—Jour. Gen. Psychol., 61(1): 113-119. July 1959.

Nine normal, 9 low-dose whole-body irradiated (10 to 16 neutron rep plus 70 to 140 gamma roentgens), and 9 high-dose (27 to 54 neutron rep plus 284 to 557 gamma roentgens) whole-body irradiated adult rhesus monkeys were randomly assigned to three groups. Group I received two successive discrimination problems each day for five consecutive days. Group II also received two successive discrimination problems each day; however, the positive and negative stimuli of the second pair were presented 6 inches behind the positive and negative stimuli of the other pair for the first problem each day. For Group III, the stimuli for the second problem were also presented six inches behind the primary discrimindanda during training on the first problem, but the significance of the stimuli was reversed. Trials to criterion on the first and second problems were averaged, and an analysis of variance was employed to determine whether the subjects associated the peripherally placed stimuli and to determine whether there was a significant difference in the extent to which normal and irradiated subjects associated these peripheral stimuli. The results indicated that the second problem performance of nonirradiated subjects was significantly affected by associations formed with the peripherally placed stimuli of the first problem. No significant evidence of association of the peripherally placed stimuli was found for either the low- or high-dose irradiated monkeys. The results are interpreted as supporting

(a) a shift in response thresholds to extraneous stimuli, (b) a narrowing of attention in the irradiated subjects, and (c) damage to central nervous system due to vascular degeneration in the chronic stage, since a constriction of the peripheral visual fields is pathognomic of damage of CNS, except where it is functional. (Authors' summary, modified)

11294
Brown, W. Lynn, 1958
R. M. Carr, and J. E. Overall
THE EFFECT OF WHOLE-BODY IRRADIATION UPON ASSOCIATION OF PERIPHERAL CUES.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-47, March 1958. 4 p.

Object-quality visual stimuli were presented as discrimination problems to 27 rhesus monkeys of three treatment groups: nonirradiated, low-dose irradiated, and high-dose irradiated. The experiment was designed to determine whether the subjects associated peripherally placed stimuli and whether normal and irradiated subjects differed in the extent to which such association was made. The performance of nonirradiated subjects gave evidence of association of peripherally placed stimuli; no significant evidence of such association was observed in the performance of the irradiated monkeys. The results are interpreted as supporting the hypothesis of a shift in response thresholds to extraneous stimuli and the hypothesis of a narrowing of attention in irradiated subjects. (Authors' summary)

11295
Brown, W. Lynn, 1960
J. E. Overall, L. C. Logie, and J. E. Wicker
LEVER-PRESSING BEHAVIOR OF ALBINO RATS DURING PROLONGED EXPOSURES TO X-RADIATION.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-36, Feb. 1960. 10 p. AD 235 227

Thirty-six male albino rats were first trained to respond to a 20-to-1 reinforcement ratio in a Skinner box. Following the attainment of a high response rate, the rats were randomly divided into six groups corresponding to six treatment conditions. Subsequently, the animals in the six groups were exposed to 0 r/hr., 25 r/hr., 50 r/hr., 100 r/hr., or 125 r/hr. during a one-hour period in the Skinner -box apparatus each day. Changes in response rate as a function of dose rate, number of exposures, and the interaction between these variables were recorded. The largest source of variance in response rate was found to be the cumulative total dose received by the organism. A simple linear function relating the square root of response rate to the cumulative total dose was found to account for over 86 percent of the variance in average daily performance for the six groups. (Authors' summary)

11296
Brown, W. Lynn, 1958
and A. A. McDowell
VISUAL ACUITY PERFORMANCE OF NORMAL AND CHRONIC IRRADIATED MONKEYS.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-149, Nov. 1958. 4 p.

Six normal rhesus monkeys and 23 irradiated (between 77 and 616 rep) were tested to a criterion of 21 correct responses (24 trials a day) for two successive days on each of eight visual acuity problems presented in order of increasing difficulty. Previous visual acuity testing had shown a deficit only in the high-dose irradiated group during the first year following the radiation exposure to which the experimental animals had been subjected three years prior to the initiation of the present study. The results of the present study demonstrated that: (1) The visual acuity deficit noted during the first year after exposure in the high-dose irradiated monkeys (616 rep) was still manifested three years after exposure. (2) Monkeys in the intermediate-dose group (308 rep), that had shown no visual acuity deficit during the first year after exposure, manifested such a deficit three years after exposure. (3) An interpretation of the results in terms of a basic deficit in learning ability for the monkeys of these two groups is contraindicated by their superiority over normal and low-dose irradiated monkeys on the initial and easiest problem. (Authors' summary)

11297
Brustad, T. 1961
MOLECULAR AND CELLULAR EFFECTS OF FAST CHARGED PARTICLES. —Radiation Research, 15 (2): 139-158. Aug. 1961.

The radiosensitivity of enzymes, bacteriophages, bacteria, and yeast to charged particles with atomic numbers up through 10 was studied as a function of the linear energy transfer (LET). The radiosensitivity of dry enzymes could be increased and decreased when exposed to heavy ions, as is possible for radiation of smaller LET. This variation in sensitivity can be attributed to intermolecular energy transfer processes. The relative biological effectiveness (RBE) for inactivation of enzymes and bacteriophages decreases with increasing LET. The RBE for inactivation of haploid yeast and the mutation induction in diploid yeast increases with increasing LET. Various mutants of yeast also differ in their RBE requirements. In all of the material tested the RBE declined after the LET exceeded 3000 Mev $g.^{-1}cm.^{2}$. A more detailed understanding of the delta-ray effect is required for an unequivocal test of the existing radiobiological theories when heavy ions are used. (Author's abstract, modified) (38 references)

11298
Buchanan, A. R., 1960
H. C. Heim, and D. W. Stilson
BIOMEDICAL EFFECTS OF EXPOSURE TO ELECTROMAGNETIC RADIATION. I. ULTRAVIOLET. —Physics, Engineering, Chemistry Corp., Boulder, Colo. (Contract AF 33(616)-6305); issued by Wright Air Development Division. Life Support Systems Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71823). WADD Technical Report no. 60-376, May 1960. v+181 p.

Literature concerning the biomedical effects of ultraviolet radiation is reviewed. Ultraviolet absorption results in mitotic alterations and abnormal cell divisions, regressive changes in the somatic structures of some lower animals, and skin and eye tumors in mammals. Damage to the eye from high intensity ultraviolet is probably limited to the cornea and, to a slight extent, the lens. The effects elicited by ultraviolte irradiation of certain proteins, nucleotides, enzymes, hormones, and amino acids are reviewed.

Literature pertinent to the visibility and hue of ultraviolet, and the effects of ultraviolet wave-lengths on scotopic and photopic visual sensitivity and on the "reactivity" of the organism is surveyed. (Authors' abstract) (565 references)

11299
Buchanan, A. R. 1961
OCULAR EFFECTS OF RADIANT ENERGY, EXCLUSIVE OF THE ULTRAVIOLET BAND OF THE ELECTROMAGNETIC SPECTRUM.—In: Biomedical effects of exposure to electromagnetic radiation. II. Biomedical effects on the eye from exposure to microwaves and ionizing radiations, p. 1-114. Physics Engineering Chemistry Corp., Boulder, Colo. (Contract AF 33(616)-6305); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71823). ASD Technical Report no. 61-195, June 1961.

A search of the literature has revealed that ionizing radiations produce deleterious ocular effects, the most prominent being the development of cataracts. Retinal damage has also been reported. The threshold dose for ocular damage has not been definitely established but a single large dose of radiation seems more harmful to the lens than an equivalent amount of small radiation doses. (Author's abstract) (86 references)

11300
Calkins, K. 1960
SHIELDS FOR SPACE TRAVELERS. — Boeing Mag., 30 (11): 10-11. Nov. 1960.

The following approaches of protecting a space crew from the effects of natural radiation encountered in space flight were investigated by Boeing scientists: (1) avoidance of the inner and outer Van Allen belts and advance prediction of solar flares, (2) increasing man's resistance to radiation by pharmacological means, and (3) use of shields. Advanced work on shielding includes development of mathematical models to predict shield sizes and weights, research on shielding effectiveness of various materials from gamma rays, electrons, protons, and neutrons, coupled with economy of weight and mass, and creation of an electrostatic field around the satellite.

11301
Campbell, P. A. 1960
MEDICAL ASPECTS OF AMBIENT RADIATIONS OF EXTRATERRESTRIAL SPACE.—Jour. Amer. Med. Assoc., 172 (7): 668-671. Feb. 13, 1960.

If man is to travel above and beyond the Earth's atmosphere he will have to shield himself from radiations to which he is not ordinarily exposed. Three types of radiation here described are primary cosmic radiation, secondary cosmic radiation, and the two Van Allen bands of high-speed particles circulating about the Earth's geo-magnetic equator. Beginning at about 650 km. (400 miles) above the Earth, radiation of the Van Allen type reaches intensities of 10 to 100 roentgens per hour, which would be fatal within 30 days to more than half of a number of human subjects exposed to it for two days. An important problem in space travel, therefore, is that of circumnavigating the two zones of Van Allen radiation or of devising shields within allowable weight limits. (Author's summary)

11302
Chabowski, M. 1960
[FLIGHTS ACROSS RADIOACTIVE CLOUDS] O niebezpieczénstwie przelotu przez obłok promieniotwórczy. — Wojskowy przegląd lotniczy (Warszawa), 13 (8): 27-31. Aug. 1960. In Polish.

Danger to personnel and equipment arising from radioactive contamination of aircraft after flying across radioactive clouds is discussed. Flights performed 20-30 minutes after an atomic bomb explosion are no longer dangerous. Radioactive dust penetrating into the aircraft constitutes a serious danger. Formation of nitrate in the aircraft decreases the radioactivity. Immediate decontamination of the aircraft upon landing is advised.

11303
Chase, H. B., 1961
W. E. Straile, and C. Arsenault
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. V. HEAVY ION AND MILLIBEAM IRRADIATIONS ON MAMMALIAN TISSUE.—Aerospace Med., 32 (10): 921-924. Oct. 1961.

Based on literature, the effects of heavy ions and electron beams on mammalian tissue are reported. The more common results include temporary epilation, graying of mouse hair, epidermal hyperplasia, and ulceration. The graying response is not solely a cellular damage but reflects to some extent an effect on the upper follicle. (20 references)

11304
Cogan, D. G., 1958
S. J. Fricker, M. Lubin, D. D. Donaldson, and H. Hardy
CATARACTS AND ULTRA-HIGH-FREQUENCY RADIATION.—A. M. A. Arch. Ind. Health, 18 (4): 299-302. Oct. 1958.

Rabbits were exposed to whole-body microwave radiations at frequencies of 385 and 468 megacycles per second and dosage levels of 30 to 60 milliwatts per square centimeter for 15-20 minute periods every 1-7 days, for a total of 5-10 exposures. Examination of the eyes of irradiated rabbits showed no indication of cataracts.

11305
Connor, J. A. 1960
AEROSPACE NUCLEAR SAFETY.—Aerospace Med., 31 (10): 797-806. Oct. 1960.

Aerospace nuclear safety is intimately interwoven with nuclear and flight technology, health considerations, and a host of complex human relationships. These are briefly surveyed. The role of aerospace nuclear power (converted to propulsive or electrical power) in the realization and furtherance of major national goals is examined. An acceptable, biologically insignificant amount of radiation may be tolerated by humans while deriving the manifest benefits from nuclear power. It is believed that present standards provide the guidelines for protecting the population and for achieving and maintaining it at reasonable cost. An appraisal of the risks involved in the development of the energy reveals them to be usually less than the risks encountered in the progressive development of steam and electric power, the airplane, or the automobile. (Author's summary, modified)

11306
Corkhill, DeP. T., 1959
and R. A. Hoffman
DETECTION AND EVALUATION OF SPACE RADIATIONS.—IRE Trans. Military Electronics, MIL-3 (4): 160-162. Oct. 1959.

A proposed electronic space-radiation detection system, capable of detecting and identifying several forms of space radiation and the intensity of each form, is described. Information concerning types of radiation and energy levels obtained from initial flights will be used as the basis for additional laboratory studies on the biological effects of radiations. Establishment of realistic relative biological effectiveness values from these studies and incorporation of these values into the detection system will provide a manner by which the dose rate and total accumulated dosage will be available to the future space passenger at all times. The author concludes that a radiation survey or monitoring system will not necessarily be a prerequisite for initial manned space voyages at altitudes of 100 to 500 miles, but it will form an integral part of future space vehicles undertaking bolder journeys.

11307
Curtis, H. J. 1961
LIMITATIONS ON SPACE FLIGHT DUE TO COSMIC RADIATIONS. — Science (Washington), 133 (3449): 312-316. Feb. 3, 1961.

The differences in origin, physical characteristics, and biological aspects of cosmic rays and Van Allen radiation belts are discussed. From the known and postulated theories about these radiations, the following conclusions are reached: (1) flight below the Van Allen belts seems reasonably safe without radiation shielding; (2) it is probably impractical to shield a rocket sufficiently to permit a man to remain in the inner Van Allen belt for more than about an hour, but it should be possible for him to go through it without serious harm; (3) shielding for the outer Van Allen belt is possible but would have to be quite heavy if a stay of more than a few hours were contemplated; (4) the primary cosmic radiation is not intense enough to deliver a serious radiation dose, even for exposures of a few weeks, and the heavy cosmic ray primaries do not seem to present an unusual hazard. (Quoted in part)

11308
David, H. 1960
DRUGS MAY HALVE RADIATION DAMAGE.—Missiles and Rockets, 7 (13): 39-40. Sept. 26, 1960.

Among potential methods of protecting against the damaging effects of radiation is the administration of chemical derivatives of the protein-bonding elements, which protect the cell by (1) trapping free radicals through lack of oxygen; (2) inhibiting the formation of free radicals; and (3) shielding of proteins by the diversion of energy and change of metabolic activity resulting from the combination of proteins and chemicals. Other potential methods of protection against radiation damage which are being considered for use in space flight include the induction of hibernation and the use of bone marrow, spleen, and liver extracts.

11309
Davis, D. M., 1961
J. C. Hart, and A. D. Warden
RADIATION DOSE RECEIVED BY PASSENGERS AND CREW ON PLANES CARRYING THE MAXIMUM NUMBER OF RADIATION UNITS. — Indus. Hygiene Jour., 22 (6): 497-503. Dec. 1961.

Tariff regulations permit the air transport of 40 units of radioactive materials (one unit representing a quantity of radioisotopes which when packaged delivers a dose rate of one milliroentgen/hour at a distance of one meter from the center of the package). Using five different types of commercial aircraft, shipments of radioisotopes (Co^{60} and Cs^{137}) were simulated and the dose levels determined at various locations in the aircraft under conditions normal to commercial travel. The readings were the maximum for a shipment of 40 units regardless of the packaging arrangement. A distance of several meters is sufficient to reduce the radiation dose rate to an insignificant level. The survey indicates that the tariff regulations should be amended giving consideration to the type of aircraft involved. An appendix includes excerpts from the tariff regulations. (Authors' abstract, modified)

11310
Deering, R. A., 1961
F. Hutchinson, and P. E. Schambra
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. IV. BIOLOGICAL EFFECTS OF ACCELERATED HEAVY IONS.—Aerospace Med., 32 (10): 915-920. Oct. 1961.

Results of the effects of 10 Mev/nucleon heavy ions on enzymes, deoxyribonucleic acid, virus particles, bacteria, yeast, mammalian (HeLa) cells, and Artemia salina eggs are presented. Three different situations relating to Relative Biological Efficiency (RBE) determinations are discussed: (1) exponential survivals from both gamma rays and heavy ions; (2) sigmoidal survivals, related by dose reduction factors, for all radiation studied; and (3) sigmoidal survival from X- or gamma-rays but exponential survivals from heavy ions. For all systems studied, except HeLa cells and A. salina eggs, definite RBE's can be determined. These RBE's are quite small in general and are tabulated in the text. For HeLa cells and A. salina eggs, the survival curves change from sigmoidal at very low LET (linear energy transfer) to exponential at LET's of carbon ions, or above. For these, the RBE's are functions of radiation dose. For these systems, the most important effect of the heavy ions is to decrease or eliminate the low dose shoulder on the survival curves that is observed for low LET radiations. When compared in terms of equal energy absorption (rads), this makes the heavy ions much more effective than gamma or X-rays at doses where X-rays would normally give no or little inactivation. (Authors' summary)

11311
Deichmann, W. B., 1959
E. Barnal, and M. Keplinger
EFFECTS OF ENVIRONMENTAL TEMPERATURE AND AIR VOLUME EXCHANGE ON SURVIVAL OF RATS EXPOSED TO MICROWAVE RADIATION OF 24,000 MEGACYCLES.—Rome Air Development Center, Griffiss Air Force Base, N. Y. (Project no. 5545). Report no. RADC-TN-59-303, Oct. 1959. [25] p. AD 228 993

The environmental temperature was found to influence considerably the systemic effects of micro-

wave radiation of 24,000 megacycles (1.25 cm). The period of survival of a rat was more than doubled (from 17.4 to 47.0 min) by a drop of environmental temperature from 35° C. (95° F.) to 15° C. (59° F.). A most remarkable prolongation of life was brought about by an effective air volume exchange. Rats exposed continuously to 250 mw/cm.^{2} at 15° C. lived for 47 minutes (40 to 63.5 min.). Rats exposed similarly but aided by air (15° C.) from a blower in losing microwave-induced heat energy survived for 14 to 24 hours. Local effects were influenced similarly. However, at death, the severity of local damage (first to third degree burn) was essentially the same, whether a rat was exposed for 17 minutes at 35° C., or for 20 hours at 15° C. when benefited by circulating air. While the temperature control of the rat and man differs, the physiological mechanisms are sufficiently alike to postulate that local and systemic effects of microwave radiation are least likely to occur in man if he is exposed under conditions of optimal ventilation and low environmental temperature. (Authors' conclusions)

11312
Deichmann, W. B., and F. H. Stephens 1961
MICROWAVE RADIATION OF 10 MW/CM AND FACTORS THAT INFLUENCE BIOLOGICAL EFFECTS AT VARIOUS POWER DENSITIES. —— Indus. Med. and Surg., 30 (6): 221-228. June 1961.

In 1953, it was recommended that microwave radiation of 10 mw./cm.^{2} be accepted as a tolerance dose. In 1956, the U. S. Air Force disseminated this level to interested agencies. Experimental microwave studies have demonstrated that a number of factors must be closely controlled in order to obtain reproducible results with experimental animals. These same factors can be expected to modify significantly what may be considered, under certain conditions, a safe exposure level. They include: (a) the frequency or wave length of the generating equipment, (b) the period of time of exposure in hours, minutes, or seconds, (c) the irradiation cycle rate, referring to the individual on-off periods during a unit time interval (a minute), when total time of irradiation per minute is kept constant, (d) air currents, (e) environmental temperature, (f) body weight, type or mass, and covering in relation to the exposed area, (g) orientation or position of an individual influencing resonant conditions and standing waves, (h) differences in sensitivity of organs and tissues, and (i) effect of reflections. (Authors' summary)

11313
Deichmann, W. B., M. Keplinger, and E. Bernal 1959
RELATION OF INTERRUPTED PULSED MICROWAVES TO BIOLOGICAL HAZARDS.——Rome Air Development Center, Griffiss Air Force Base, N. Y. (Project no. 5545). Report no. RADC-TN-59-302, Oct. 1959. [7] p. AD 228 987

By choosing a certain cycle for interruption of transmission—without altering the output of microwave energy per unit of time—it is possible to reduce the hazard from microwave exposure. The significance of these observations is obvious. (For instance, a rapidly versus a slowly rotating antenna.) Although only one frequency was used, it seems reasonable to assume that this finding will also apply to other wave lengths of either pulsed or CW microwaves. (Authors' conclusions)

11314
Dick, J. L., M. C. Gaske, and L. A. Kiley 1960
EVALUATION OF PERSONNEL EXPOSURE FROM STRATOSPHERIC FISSION FRAGMENT CONTAMINATION ON AIRCRAFT.——Aerospace Med., 31 (5): 353-371. May 1960.

The radiation hazard to maintenance personnel who work on aircraft contaminated with mixed fission products can be defined adequately by a simple beta-gamma survey of the immediate area. The contribution to total radiation dose from inhalation of the resuspended debris or ingestion from hand contamination are unimportant, ranging from factors of 100 or more below that contributed by external dose. Aircraft which fly in the regions of the stratospheric contamination reservoir will encounter some contamination build-up. The levels will be such that it is highly improbable that anyone will ever receive exposure in excess of the permissible limits, whether from external radiation or from internal uptake of radioactive isotopes. In the present situation, it is inconceivable that decontamination will ever be required on the basis that the existing radiation levels represent a health hazard. (Authors' summary)

11315
Dow, N. F. 1960
STRUCTURAL IMPLICATIONS OF THE IONIZING RADIATION IN SPACE. —— In: Proceedings of the Manned Space Stations Symposium, Los Angeles, Calif., April 20-22, 1960. p. 128-136. New York: Institute of the Aeronautical Sciences, 1960.

This review emphasizes the fact that the most important structural implication is concerned with the protection of human occupants, particularly for vehicles which are to remain in space for long periods of time. The ionizing radiation which a space vehicle may encounter consists of at least three types: (1) cosmic rays, (2) radiation resulting from solar flares, and (3) the trapped particles in the radiation belts around the earth. The background radiation dosage from cosmic rays alone is shown to be high enough to make shielding against any additional radiation essential. The protection of human beings in space during a possible solar flare may require shielding equivalent to 100 pounds per square foot of lead. At the peak intensities of the inner Van Allen belt an unshielded man will receive the maximum permissible weekly dose in slightly over one minute, and will have exceeded the emergency dose in ten minutes. Design principles involved in both active (electrostatic and electromagnetic) and passive (composite materials) shielding are discussed. The protection of the occupants from the hazards of ionizing radiation may require more weight than any other structural requirement for manned space stations.

11316
Dreyer, J. F. 1959
FEASIBILITY STUDY AND DESIGN OF A SELF-ATTENUATING LIGHT VALVE.——Polacoat Incorporated, Blue Ash, Ohio (Contract AF 33(616)-5469); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71839). WADC Technical Report no. 59-81, Oct. 1959. iv+15 p.

The phototropic phenomenon, known since 1881, is defined as that in which a material not only changes color when exposed to light (the change depending on

wavelength and amount of light) but also reverts to its original color following removal of the light. Investigation of the phototropic phenomenon to determine the feasibility of phototropic material as a protective, self-attenuating light valve against the energy yields of high-intensity light sources has been accomplished. Although it has been found that the practical utilization of phototropic material as a protective eye device against an atomic flash is marginal its use as a sunglass appears to be feasible. (Author's abstract)

11317
Dye, D. L., 1960
and J. C. Noyes
BIOLOGICAL SHIELDING FOR RADIATION BELT PARTICLES. — Jour. Astronautical Sci., 7 (3): 64-70. Fall 1960.

Calculations are made, for the particle spectra in the most intense regions of the radiation belts, of the attenuation of the particle flux by shielding on a space vehicle, and of the biological dose rate due to the flux which has penetrated the shielding. Both protons and electrons are considered in the inner belt, but only electrons in the outer belt. Secondary particles and bremsstrahlung produced by these particles on interacting with a shield are also considered. It is shown that, despite the much higher electron fluxes, the protons are of much greater biological significance. (Authors' abstract)

11318
Eugster, J., 1960
and D. G. Simons
EFFECTS OF HIGH-ALTITUDE COSMIC RADIATION ON BARLEY SEEDS.—In: Physics and medicine of the atmosphere and space, p. 182-192. New York, etc.: John Wiley and Sons, 1960.

After exposure to cosmic radiation on aircraft at altitudes of over 80,000 ft., 280 barley seeds were bred to the fifth generation. A sterility rate of 5.7% was seen. Centrally-hit seeds showed a heritable reduction in number and size of grain-bearing heads. Color mutations were observed in three seeds which had suffered central hits by heavy primaries.

11319
Eugster, J. 1959
R. Koblet, and D. Simons
[RESULTS OF EXPERIMENTS ON THE BIOLOGICAL EFFECTS OF COSMIC RADIATION ON SEEDS OF HORDEUM (GOLDEN BARLEY) BONUS 01518/B 19 (GUSTAFSSON), WITH PARTICULAR REGARD TO HEAVY PRIMARIES] Untersuchungsergebnisse der biologischen Wirkung der kosmischen Strahlung auf Samen von Hordeum (Goldgerste) Bonus 01518/B 19 (Gustafsson) mit besonderer Berücksichtigung der schweren Primären.—In: International Astronautical Congress, IXth (Amsterdam, 1956), Proceedings, vol. 1, p. 222-224. 1959. In German and English.

Essentially the same, with added table: RESULTS OF EXPERIMENTS ON THE BIOLOGICAL EFFECTS OF COSMIC RADIATION ON SEEDS OF HORDEUM (GOLD BARLEY) BONUS 01518/B 19 (GUSTAFSSON), WITH SPECIAL CONSIDERATION OF HEAVY PRIMARY EFFECTS.—In: International Astronautical Congress, Xth, Proceedings, vol. 1, p. 113-116. Wien: Springer-Verlag, 1960.

Hordeum seeds enclosed between nuclear plates were exposed to cosmic radiation during several flights at altitudes of 30,000 to 40,000 meters for an average period of 32 hours, and the filial generations observed. Offspring of seeds having suffered central hits demonstrated a 30-40% reduction in number of sprouts, and the number of grains yielded per plant was diminished in comparison to the controls. It is concluded that the decreased yield is related only to the number of grains, the weight and size of the grains remaining constant. Offspring of three seeds having suffered central hits by heavy radiation primaries showed a mutation in color. This mutation remained constant in 3 filial generations.

11320
Foelsche, T. 1959
ESTIMATE OF THE SPECIFIC IONIZATION CAUSED BY HEAVY COSMIC RAY PRIMARIES IN TISSUE OR WATER.—Air Force Missile Development Center, Holloman Air Force Base, New Mexico. Report no. AFMDC-TN-59-7, April 1959. vii+19 p. AD 212 421

The specific ionization caused by the primary particles of carbon, neon, iron, and niobium along their paths in water is calculated by use of the formulae of Bohr, Bethe and Bloch, for the average stopping power. The maximum specific ionization and shape and also half width of the maximum on the end of the path of the particles is estimated according to the considerations about capture and loss of electrons made by Bohr, Brunings, Knipp and Teller, and Bell. (Author's abstract)

11321
Gaspa, 1958
and Colin
[PROBLEMS PRESENTED BY HIGH ATMOSPHERE COSMIC RADIATION AND MEANS OF PROTECTION] Problèmes posés par le rayonnement cosmique en haute atmosphère et protection.—Fusées (Paris), 3 (4): 187-195. 1958. In French.

The hazards of cosmic radiations, encountered by occupants of aircraft and rockets in the upper strata of the atmosphere, are discussed. Experimental and theoretical studies of the biological effects of primary cosmic radiations are reviewed, including general effects, effects on specific tissues (skin of intact animals, nervous tissue, tissue cultures, and crystalline lens of mice), and genetic effects (growth-tracing and mutation studies). The protective power of various shielding substances (aluminum, plastic materials, and paraffin) are evaluated. The authors conclude that the radiation doses are below the tolerable dose for short-duration exposures, but that for durations exceeding 24 hours in regions above 55° N the hazards remain and still necessitate long and numerous experiments.

11322
Gentry, G., 1958
W. Lynn Brown, and J. E. Overall
THE EFFECTS OF IONIZING RADIATION UPON THE TRANSPORTATION OF DISCRIMINATION HABITS OF RHESUS MONKEYS.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-142, Nov. 1958. 5 p.

Thirty-three rhesus monkeys, representing five radiation-dose levels given three years previously (77 to 616 rep), were trained on intermediate-size

discrimination problems. A test of transposition was employed to determine the extent to which subjects of the different dose groups utilized relationships between the stimuli as a basis for problem solution. Relational learning was found to decrease as a linear function of radiation dosage. (Authors' summary)

11323
Gib De Busk, A. 1961
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. VI. GENETIC STUDIES IN THE LOWER RADIATION BELT: PRELIMINARY ASSAY OF NERV NO. 1 SAMPLES.—Aerospace Med., 32 (10): 925-931. Oct. 1961.

Preliminary genetic and physiological studies of Neurospora crassa conidia exposed to the lower radiation belt at an altitude of 1180 miles for 26 minutes are reported. Two phenomena were observed which may have had the same or separate origins: (1) the increase in frequency of mutation in cells from the experimental capsule, and (2) the increase in physiologically damaged cells from the experimental population. The physiological damage was at least partially recovered under various conditions, including exposure to complete media. More specific recovery took place in mixtures of Krebs' Cycle intermediates, which presumably served as energy sources.

11324
Goldman, D. E. 1960
SHORT WAVE ELECTROMAGNETIC RADIATION AS A HAZARD TO PERSONNEL.—Naval Medical Research Inst., Bethesda, Md. Lecture and Review Series no. 60-6, Sept. 17, 1960. p. 249-255.

Some of the problems encountered in dealing with the effects of intense short-wave electromagnetic radiation on human beings are outlined. In biological materials, the absorption of radio-frequency energy varies from tissue to tissue and is rather frequency-dependent. Graphs are given of the conductivity and dielectric constant of skin, fat, muscle, and blood from 200 to 10,000 megacycles. Since radio-frequency energy is converted to heat by both ohmic and dielectric loss mechanisms in biological material, the heat loss rate of the body must be able to cope with the heat increase. Heat tolerance curves are given for three regions of interest, skin, eyes, and testes. For protection, the man can be kept away from radio-frequency energy, shielded by metallic coatings, or warning devices can be used. All the means of protection have certain limitations.

11325
Grishina, K. F. 1958
[THE IMPORTANCE OF SOME EXPERIMENTAL CONDITIONS IN THE REACTION OF TISSUES TO LOCAL ACTION OF CENTIMETER WAVES] Znacheniia nekotorykh metodicheskikh uslovii v reaktsii tkanei na mestnoe deistvie santimetrovykh voln.—Biofizika (Moskva), 3 (3): 358-362. 1958. In Russian, with English summary (p. 362).
English translation: THE IMPORTANCE OF CERTAIN POINTS OF METHOD IN THE LOCAL RESPONSE OF TISSUES TO CENTIMETRE WAVES.—Biophysics (New York), 3 (3): 339-344. Jan. 1959.

Skin heating and vascular reactions were measured in 82 adults following local irradiation on the middle joint of the forefinger by centimeter waves. The reactions were dependent on power density, exposure time, and the air gap between instrument and skin. At 3.6 W/cm^2, vascular contraction caused ischemia and skin heating followed by prolonged dilatation. Lower powers caused dilatation of the vessels of the finger extremity. Reduction of air gap produced stronger heating which lasted longer due to hindrance of heat loss. Raising the exposure time caused a slight but extended increase in skin temperature.

11326
Gunn, S. A., 1961
T. C. Gould, and W. A. D. Anderson
THE EFFECT OF MICROWAVE RADIATION (24,000 MC) ON THE MALE ENDOCRINE SYSTEM OF THE RAT [Abstract]. —— Indus. Med. and Surg., 30 (7): 295. July 1961.

Exposure of the testes of rats to 1.25 cm. microwaves resulted in diminished androgen levels evident for a period of 2 to 3 weeks. The only microscopic change in the testes was a moderate to severe edema. In order to determine whether these disturbances were due only to the thermal effects of the microwaves, another group of animals was exposed to infra-red over the same time period with the same production of intratesticular temperature as in the microwave-exposed rats. There was no endocrine disturbance in the infra-red-exposed group. (Authors' abstract, modified)

11327
Gunn, S. A., 1961
T. C. Gould, and W. A. D. Anderson
THE EFFECT OF MICROWAVE RADIATION ON MORPHOLOGY AND FUNCTION OF RAT TESTIS. —— Lab. Investigation, 10 (2, Part I): 303-314. March-April 1961.

Exposure of the scrota of rats to microwaves (24,000 megacycles, 1.5 cm. wave length) at a distance of 7.6 cm. from the antenna for 5, 10, and 15 minutes resulted in minimal, moderate, and severe microscopic testicular damage, respectively. Androgen levels were diminished, as indicated by the failure of the dorsolateral prostate to concentrate Zn^{65} at normal levels. In the 5-minute exposure studies the cause of the diminished androgen output 6 and 13 days after exposure appears to be insufficient luteinizing hormone (LH) output by the pituitary. In the 10-minute exposure studies the cause of diminished androgen output appeared to be twofold: (1) a lack of sufficient LH output by the pituitary, and (2) failure of the testicular interstitial tissue to respond fully to whatever trophic hormone was being elaborated, even though histologically the interstitial cells appeared normal. In the 10- and 15-minute exposures severe scrotal burns were produced, the protective function of the scrotum was lost, allowing thermal damage of the testis. (From the authors' summary)

11328
Haberle, J. E., 1959
K. Perlman, and W. Sunkes
IMPROVEMENT OF PHYSICAL PROPERTIES OF CREAMS FOR THE PROTECTION OF NORMALLY EXPOSED SKIN TO THERMAL RADIATION.—Purdue Univ. School of Pharmacy, Lafayette, Ind. (Contract DA 19-129-QM-1079); sponsored by Quartermaster Research and Engineering Command, Natick, Mass. (Project no. 7-12-01-002). Final Report for

Feb. 1, 1958 - July 31, 1959. [1959]. 56 p.
AD 229 807

Major efforts were directed towards increasing the adhesiveness of the Quartermaster Thermal Protective Cream 305X when applied to human subjects and improving its resistance to the effects of perspiration. Attempts were made to incorporate selected additives into the original formula without materially changing the concentration of the ingredients known to afford thermal protection. Materials studied were water-dispersible resins, plastics, latex compounds, celluloses, water-absorbent material and the polyvinyl methyl ethers. Over 400 different creams were prepared, evaluated for their physical properties, and tested on human subjects. The most promising creams were submitted for testing of thermal protective properties and for field testing. The two creams chosen as the best ones were (1) a modification of Formula 305X in which a combination of latices plus an absorbent were added and (2) a modification of QM Cream 343X in which a polyvinyl methyl ether was incorporated, and the formulas are submitted for consideration. (Authors' abstract)

11329
Haduch, S., 1960
S. Baranski, and P. Czerski
[STUDY OF THE EFFECT OF ELECTROMAGNETIC FIELDS OF HIGH FREQUENCY ON THE HUMAN BODY] Badania nad wpływem pola elektromagnetycznego wysokiej częstotliwości na ustrój ludzki. — Lekarz wojskowy (Warszawa), 38 (2): 119-125. 1960. In Polish, with English summary (p. 125).

The peripheral blood of young persons exposed to electromagnetic fields of high frequency exhibited eosinophilia with lymphocytosis, neutropenia, and monocytosis. Most of the subjects showed symptoms of insignificant hypochromic anemia. (Authors' summary, modified)

11330
Harris, P. S. 1961
SPACE RADIATIONS: NATURAL AND MAN-MADE. — Radiology, 76 (4): 532-539. April 1961.

A general review of the physical and medical concepts of naturally occurring and man-made space radiations and their sources and effects is presented. Naturally occurring space radiations include cosmic rays, geomagnetically-trapped corpuscular radiations (the Van Allen belts), and solar flare radiations. Man may modify the radiation environment of space through the use of nuclear reactor rocket propulsion systems, nuclear auxiliary power systems as sources of electrical energy in space, and atomic explosion propulsion systems. The use of space as a proving ground for scientific experiments and proof tests using nuclear explosives has also been suggested. The necessity for establishing standards of protection and acceptable levels of risk for space exploration is an indication for continued study in this field.

11331
Hartwig, Q. L., 1958
G. S. Melville, T. P. Leffingwell, and R. J. Young
IRON-59 METABOLISM AS AN INDEX OF HEMATOPOIETIC DAMAGE AND RECOVERY IN MONKEYS EXPOSED TO NUCLEAR RADIATION.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-59, March 1958. 6 p.

Monkeys exposed to ionizing nuclear radiations were studied for changes in iron metabolism. Twenty-eight hours after exposure iron-59 was injected, and 24 hours later the first blood sample was drawn. Iron uptake in the irradiated animals reflected marked depression of erythropoiesis. The average uptake in all irradiates 48 hours postexposure was 2.1% as compared to 10.7% in the controls. Only 3 of the original 10 irradiates survived. Repeating the iron-59 injection technique 34 days after exposure indicated repair and active erythropoiesis in survivors. Plasma iron exhibited periods of both hyper- and hypoferremia. Those animals destined to die were consistently hypoferremic for 2 to 3 days prior to death. (Authors' summary)

11332
Hartwig, Q. L., 1958
G. S. Melville, and T. P. Leffingwell
LETHALITY IN THE RAT AS A FUNCTION OF DOSE PATTERN.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-51, March 1958. 3 p.

Rats exposed 7 days to a chronic field of 2 roentgens/hour of cobalt-60 gamma rays immediately prior to or immediately after an acute dose of 800 roentgens of cobalt-60 gamma rays failed to exhibit a significant difference in either a 30-day or 90-day mortality. When compared to a group of rats receiving only an acute dose of 800 roentgens of cobalt-60 gamma rays, both acute and chronic groups showed different mortalities, but the differences were not statistically significant. (Authors' summary)

11333
Hawkes, R. 1959
SCIENTISTS STUDY SPACECRAFT SHIELDING.—Aviation Week, 71 (8): 118-119, 121-122. Aug. 24, 1959.

The utilization of the sustenance materials in the closed-loop ecological system as shielding against ionizing radiations in a nuclear-powered spacecraft is discussed. Sustenance requirements and shield replacement within the closed-loop ecological system are evaluated in terms of payload weight economy. The author also discusses a proposed reaction control simulator as a flight trainer for manned orbital and space vehicles. Possible applications of such a simulator to physiological testing, and to crew selection and training programs are indicated.

11334
Heim, H. C. 1961
THE EFFECT OF IONIZING RADIATIONS ON BIOCHEMICAL PROCESSES OF THE EYE.—In: Biomedical Effects of exposure to electromagnetic radiation. II. Biomedical effects on the eye from exposure to microwave and ionizing radiation, p. 115-143. Physics Engineering Chemistry Corp., Boulder, Colo. (Contract AF 33(616)-6305); issued by Aeronautical Systems Division. Life Support Systems Div., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71823). ASD Technical Report no. 61-195, June 1961.

A considerable number of studies have been devoted to the effects of ionizing radiation upon biochemical processes of the eye. The effects of X-rays have been studied in some detail, but almost no information exists on the effects of neutrons, protons, mesons, microwaves, and ultrasonic radiation. Much

more effort must be expended on dose measurements and their interpretation before a full understanding of the problem of the effects of radiation on the eye can be achieved. Experiments should express their results in terms of energy absorbed by the ocular tissue so there will be a basis for deriving the RBE (Relative Biological Effectiveness). (Author's abstract)

11335
Hekhuis, G. L. 1961
RADIOBIOLOGY AND THE ENVIRONMENT OF FLIGHT.—In: Human factors in jet and space travel, p. 41-60. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

A résumé is provided of some of the basic concepts of interaction of radiation with matter, including biological tissue, and guide lines for the evaluation of the hazards of radiations are furnished. Radiation sources are categorized into two main types: particulate and electromagnetic (such as alpha particles and X-rays, respectively). The net result of ionizing and penetrating radiation in interaction with matter is the transfer of energy and the resulting process of ionization. The measurement of effective ionization essentially consists of measuring the effective ionization of a given radiation by detecting the ion pairs produced and equating the produced charges to a given energy transfer. A wide range of doses is required to produce an effect in different kinds of living tissues. Radiation sources may be either environmental (from industrial, power, or propulsion sources) or space and cosmic radiation. The somatic and genetic effects of radiation, which have been observed, are briefly discussed.

11336
Hendler, E., and J. D. Hardy 1960
INFRARED AND MICROWAVE EFFECTS ON SKIN HEATING AND TEMPERATURE SENSATION.—IRE Transactions on Med. Electronics, ME-7 (July): 143-152. July 1960.

In order to study the physiological mechanisms of temperature sensation, the forehead area of seven subjects was exposed to controlled heating while the skin temperature was radiometrically measured and recorded. Continuous exposure to variations in far infrared radiation produced temperature sensations which could best be correlated with rates of change of skin temperature. Warmth threshold was accompanied by a rate of rise of skin temperature of 0.001° C./second; cool threshold was accompanied by a rate of fall of skin temperature of 0.005° to 0.006° second. Reports of temperature sensation continued to be given when no changes in skin temperature could be measured, Small, rapid fluctuations in skin temperature, exceeding the rates of rise and fall just given, evoked no reports of sensation. It was postulated that the temperature changes involved were confined to the most superficial layers of the skin, and therefore did not stimulate the cutaneous temperature receptors. The same sequence of sensation reports resulted from preliminary heating or cooling the skin, and then allowing it to return spontaneously to its normal temperature level. Cool sensations accompanying rapidly rising skin temperature change rates are believed to be due to simultaneous inhibition of warmth receptors and excitation of cold receptors. Exposure of blackened and unblackened forehead skin to various pulse duration-intensity combinations of near infrared radiation sufficient to evoke threshold warmth sensation permitted intracutaneous temperature changes to be calculated. All such changes producing a threshold warmth sensation caused a temperature rise of about 0.02°C. at a depth of 150-200 microns below the skin surface. Exposure of the skin to free-field, 3-cm. microwave radiation produced initial changes in skin temperature compatible with primary heating of the tissues by the absorbed energy. Response times to onset and offset of stimuli were characterized by their variability. Persistence of warmth sensation of microwave irradiation was a consistent finding. Stimulation of warmth receptors by slowly dissipated heat retained in the tissues was believed responsible. (Authors' summary)

11337
Holmes, J. 1961
NERV DATA ALTERS THINKING ON SHIELDING. — Missiles and Rockets, 8 (8): 28-29. Feb. 20, 1961.

Results of the NERV (nuclear emulsion recovery vehicle) experiment conducted by NASA in September 1960 indicate the presence of more low-energy protons in the near Van Allen belt than had been believed, necessitating more shielding for electronic components of spacecraft. Projected shielding for manned spacecraft is not affected by these results. Testing of the effects of exposure to radiation on biological specimens passing below the Van Allen belts and in deeper space is planned by NASA.

11338
Howarth, J. L. 1958
DOSIMETRY OF IONIZING RADIATIONS.—In: Aviation medicine — selected reviews, p. 59-84. Edited by C. S. White and others. London, etc.: Pergamon Press, 1958.

The general significance in science and medicine of the expanding activities in the field of nuclear energy is mentioned initially, as is the importance of detecting and measuring the several varieties of radiations in aviation medicine, specifically. Hazards from the use of nuclear weapons, cosmic rays, nuclear power plants for manned aircraft and the wide employment of radioisotopes are cited as particularly pertinent to aviation biologists. As background to discussions of dosimetry, an informative summary of the interaction processes between ionizing radiations and matter is presented, following which the fundamental principles of dosimetry, including definition of physical and biological units, is discussed in some detail. Lastly, the general principles of ionization instruments are covered, along with references to the literature adequate for orienting the reader to all but highly specialized detection and measuring techniques. (Summary by C. S. White) (79 references)

11339
Kaufman, W. C., A. G. Swan, and H. T. Davis 1961
SKIN TEMPERATURE RESPONSES TO SIMULATED THERMONUCLEAR FLASH.—Aeronautical System Div. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Report no. 61-510, Sept. 1961. vi + 5 p.

Skin temperatures and radiant energy were measured on a subject wearing flight clothing, sitting in a tactical aircraft exposed to thermal energy characteristic of thermonuclear weapons. Radiant energy source was 960 lamps at power levels up to 4000 kw.

After exposures of increasing severity subject tolerance was attained in a 3 cal./cm.^{2} pulse of 3.7 seconds duration. This pulse charred paint on the fuselage and headrest and seared the subject's glove. Bare forehead skin temperature reached 126° F. resulting in distinct pain. The data provide a basis for calculating the nearest safe distance of aircrew members to a nuclear explosion. (Authors' abstract)

11340
Kaulbersz, J., 1958
R. Bilski, I. Kocyan, A. Ogiński, D. Wiecha, and J. Zbiegień
ALTERATIONS IN SOME BLOOD REACTIONS AND IN THE WHITE CELL COUNT DURING THE TOTAL ECLIPSE OF THE SUN IN POLAND, 1954.—In: International Astronautical Congress, VIIIth (Barcelona, 1957), Proceedings, p. 236-240. Wien: Springer, 1959.

The total eclipse of the Sun, visible in Poland on June 30, 1954, gave some opportunity to investigate the influence of the disappearance of the Sun's rays on the human body. An attempt was made to confirm or disprove the results obtained by Takata, concerning the changes of human serum flocculation related directly to an unidentified component of solar radiation. Also the blood clotting time was observed and white cells were counted. The average values of the Takata reaction showed the greatest decline when investigated 17 minutes after the total eclipse. In comparison with those obtained before and after that time the result was close to the statistical significance. The number of lymphocytes decreased slightly, that of the segmented leukocytes rose insignificantly. The blood coagulation time was decreased, but in comparison with the daily variations no significant changes could be established. Low activity of the Sun in 1954 and a small number of investigated persons (3 to 6) might have been responsible for the failure to confirm the decisive influence of a total eclipse of the Sun on the Takata reaction and to find some indisputable changes in the results of other blood investigations. (Authors' abstract)

11341
Knauf, G. M. 1960
THE BIO-EFFECTS OF RADAR ENERGY: A RESEARCH PROGRESS REPORT.—Aerospace Med., 31 (3): 225-228. March 1960.

A survey is presented of work done on the effects of radar microwave energy. The maximum permissible exposure level promulgated for personnel is .01 w./cm.^{2}. Progress is being made in the fields of protective clothing and devices to protect personnel from power levels which exceed the established safe exposure levels. By a study of radar energy at 200, 3,000, 10,000, and 24,500 megacycles, it was determined that no known serious injuries, certainly no deaths, can be attributed to exposure to the beam of any radar set in operation today. Studies of the effects of such energy on enzymes, cellular physics, cellular physiology, and biochemistry are in progress.

11342
Knauf, G. M. 1958
THE BIOLOGICAL EFFECTS OF MICROWAVE RADIATION ON AIR FORCE PERSONNEL.—A.M.A. Arch. Ind. Health, 17 (1): 48-52. Jan. 1958.

Reviews of research concerning the biological effects of microwave radiation have revealed estimates of the power density above which damage can be expected, ranging from 0.0001 to 0.2 w./cm.^{2}. The Air Force has therefore embarked on a long-range program of research to determine the biological effects of varying frequency levels of radiation and of the pulse rate of radar equipment. Research projects have been designed to provide quantitative data on the penetration, absorption, and reflection characteristics of microwave energy in all tissues explored, and on temperature changes at each level of penetration. An arbitrary maximum ambient power level of 0.01 w./cm.^{2} has temporarily been established in Air Force laboratories, along with other protective measures.

11343
Konecci, E. B., 1959
and R. Trapp
CALCULATIONS OF THE RADIOBIOLOGIC RISK FACTORS IN NUCLEAR-POWERED SPACE VEHICLES.—Aerospace Med., 30 (7): 487-506. July 1959.

The biological aspects of ionizing radiation are reviewed. In general, the rapidly proliferating tissues (e.g., blood-forming tissues and intestinal and germinal epithelia) are usually the most radiosensitive, while nerves and muscles are relatively radioresistant. Acute radiation syndrome depends primarily on the dose and the exposed organs. The effects at dose ranges of 0 to 6000 roentgens are enumerated. For given dose rates, survival time is inversely related to the amount of radiation energy absorbed. Radiations and shielding calculations for the operation of a nuclear rocket propulsion system are presented, and an example of shielding in a 3-man sealed nuclear vehicle is given. Preliminary analysis indicates the possibility of utilizing the basic requirements of oxygen, food, water, and CO_2 absorber to sustain the crew in the sealed cabin as shielding material. Two examples of missions to Mars illustrate the radiation doses and shield weights involved in a round trip. (31 references)

11344
Konecci, E. B., 1960
R. F. Trapp, and M W. Hunter
MANNED NUCLEAR SPACE SYSTEMS. I. HIGH-THRUST NUCLEAR SYSTEMS.—Aero Space Eng., 19 (1): 34-41. Jan. 1960.

The requirements for a three-man expedition to Mars are elaborated using a two-stage nuclear powered, high-thrust vehicle. The sustenance materials are calculated for a 421-day mission with a safety factor extending the time limit to 675 days. These materials plus waste and fuel will be utilized for radiation shielding; a scatter shield of uranium will be provided around the crew compartment for protection from solar radiations, cosmic rays, or radiation belts. Genetic effects can be disregarded through proper selection of the crew; therefore the shielding is required only for protection from somatic radiation damage. By restriction of movement to a small adequately shielded area with limited exposure to the rest of the compartment, it is possible to keep the radiation to less than the 12 rem permissible dose per year. Increase in crew size without increasing the payload weight is possible by reducing the weight of sustenance material through utilization of a partially regenerative ecological system and by exceeding the permissible radiation dose.

11345
Konstantinova, M. M. 1961
[HYPOXIA AS THE CAUSE OF THE INCREASE IN RADIATION RESISTANCE PRODUCED BY HYPOTHERMIA] Protivoluchevoe deistvie snizheniia temperatury tela—resul'tat voznikaiushchei pri etom gipoksii. —— Doklady Akademii nauk SSSR (Moskva), 138 (1): 223-226. May 1961. In Russian.

English translation in: Dokladv, Biological Sciences Sections (Washington), 138 (1-6): 359-361. Nov.-Dec. 1961.

The effects of hypothermia and of irradiation with γ-rays (dosage, 900 r) on the survival rate were studied in mice. Hypothermia alone resulted in a considerable mortality during the 30-day observation period: after cooling to 18° C. the mortality was 9.5%; after 12°, 65%; and after 6°, 48.7%. In the hypothermic state the tissue oxygen tension was greatly reduced, the reduction amounting to 50% of the initial value at a body temperature of 15-18° and to 85-90% at 6° C. Hypothermia increased the radiation tolerance of the mice provided that their tissue oxygen tension had fallen below 50%. Thus 10% of the mice cooled to 18° survived the irradiation (while all animals irradiated at normal body temperature died); when cooled to 12°, survival after irradiation was 16%; and at 6°, 36%. It is concluded that the tissue hypoxia accompanying the hypothermia exerts a protective effect against radiation injury. Below a certain degree of cooling, however, the hypothermia itself reduces the survival rate.

11346
Kuskin, S. M., 1959
S. C. Wang, and R. Rugh
PROTECTIVE EFFECT OF ARTIFICIALLY INDUCED "HIBERNATION" AGAINST LETHAL DOSES OF WHOLE BODY X-IRRADIATION IN CF_1 MALE MICE.—Amer. Jour. Physiol., 196 (6): 1211-1213. June 1959.

Hypothermia induced by the use of neuroplegic drugs such as Hydergine, chlorpromazine or promethazine, followed by refrigeration, does not significantly enhance the protective action afforded by refrigeration alone against the lethal dose of whole body X-irradiation in CF_1 male mice. Neuroplegic drugs, without refrigeration, provide a slight degree of protection, probably due to the slight reduction in the body temperature. It appears that the action of hypothermia as a protective mechanism depends not on depression of metabolism alone, but on a general depression of bodily processes. Urethane, in conjunction with refrigeration, appears to augment the lethal effect of X-irradiation in the CF_1 strain of male mice. (Authors' abstract)

11347
Langham, W. H. 1959
IMPLICATIONS OF SPACE RADIATIONS IN MANNED SPACE FLIGHTS.—Aerospace Med., 30 (6): 410-417. June 1959.

Present physical measurements of ionizing radiations in space suggest two major potential radiobiological problem areas in manned space flight: from densely ionizing heavy primary cosmic ray particles, and from particulate radiation belts, or Van Allen layers. Inasmuch as the brain of a man at 120,000 feet would receive only about 50 hits per hour from particles of atomic number of 6 or greater, the probability of a vital hit occurring during flights of short duration would seem quite low, especially in view of the particle energy distribution. Avoidance of radiation from the Van Allen layers may consist of rapid traversal of high-intensity radiation fields, exit via the magnetic polar regions, or provision of adequate radiation shielding in space capsule shielding.

11348
Langham, W. H. 1961
SOME RADIATION PROBLEMS OF SPACE CONQUEST. —— In: Space medical symposium. Astronautik (Stockholm), 2 (4): 272-294. 1961.

Deleterious effects of ionizing radiation on man and materials necessitate its consideration as a potential problem area in manned space conquest. Radiation sources that must be considered are: (a) heavy primary cosmic rays, (b) geomagnetically trapped corpuscular radiations surrounding the earth and other astronomical bodies, (c) solar flare radiations, and (d) radiations inherent in nuclear propulsion systems and nuclear auxiliary power supplies. The expected infrequency of heavy primary-cosmic ray interactions with vital areas of the body, dependence of their biological effect on volume of tissue affected, and the redundancy inherent in most body tissues and organs suggest that their potential hazard to manned space exploration is probably well within limits of an acceptable calculated risk. Development and use of nuclear rocket propulsion systems will create some formidable radiation problems. Neutron and gamma radiation will produce potential hazards to launching and flight crews, and residual fission products must be considered as a possible hazard to the public domain in the event of mission failure and reactor re-entry and impact. (From the author's abstract) (32 references)

11349
Lebish, I. J., 1959
D. G. Simons, H. Yagoda, P. Janssen, and W. Haymaker
OBSERVATIONS ON MICE EXPOSED TO COSMIC RADIATION IN THE STRATOSPHERE: A LONGEVITY AND PATHOLOGICAL STUDY OF 85 MICE.—Military Med., 124 (12): 835-847. Dec. 1959.

Eighty-five mice were kept for approximately 24 hours at 80,000 feet or above in a capsule suspended from a giant polyethylene balloon. The maximal altitude reached was approximately 109,000 ft. Analysis of the balloon altitude trajectory indicates that the mice received collectively a total of 7,350 thindown hits by heavy primaries of which 59 hits were by members of the calcium-iron group. Control mice on the ground were subjected to the same rigors as experimental mice. Both groups were allowed to live out their life span. There was no definite evidence of a difference in the average longevity of the two groups. The average monthly death rate was statistically higher in the experimental group, but spontaneous disease early in the experiment was regarded as the primary cause for the difference. Examination of the gonads microscopically revealed no alterations. Active spermatogenesis and oogensis were encountered even in animals living long past their normal breeding age. The incidence of mammary adenocarcinoma, lung tumors, and other neoplasms was approximately the same in the two groups. No significant brain changes were found. It is concluded that a day's

exposure to light and medium weight primary cosmic particles in the stratosphere has no adverse long-term effect. (Authors' summary and conclusions, modified)

11350
Leffingwell, T. P., 1960
G. S. Melville, and Q. L. Hartwig
THE EFFECT OF ACUTE DOSES OF NUCLEAR RADIATIONS OF THE PERIPHERAL BLOOD PICTURE OF THE MONKEY (MACACA MULATTA). —School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-43, April 1960. 12 p.

Male Macaca mulatta monkeys were exposed to three different doses of combined neutron and gamma radiations which derived from an uncontrolled nuclear reaction. Changes which were observed in the peripheral blood picture may be attributed solely to the effects of the ionizing radiations to the 1 percent confidence limit. Results, compared with those obtained by other investigators, show the hematologic effects of neutron-gamma exposure to be similar to those resulting from exposure to X-radiation. (Authors' summary)

11351
Leites, F. L., 1961
and L. A. Skurikhina
[THE EFFECT OF MICROWAVES ON THE HORMONAL ACTIVITY OF THE ADRENAL CORTEX] Vliianie mikrovoln na gormonal'nuiu aktivnost' kory nadpochechnikov. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 52 (12): 47-50. Dec. 1961. In Russian, with English summary (p. 49-50).

Twenty white rats were exposed for 10 minutes to irradiation with microwaves of 12.62 cm. wave length (2375 megacycles). Adrenocortical activity was studied by histochemical methods (silver impregnation according to Girond and Leblond for ascorbic acid, sudan staining of lipoids) and polarization microscopy. Statistically significant changes were shown in the ascorbic acid and sudanophilic lipoid content of different zones of the adrenal cortex. Adrenocortical response to microwave exposure appeared 2 to 3 hours after irradiation, with the maximum reaction in the first phase 24 hours later (increased release of adrenocortical hormones in the blood stream). The second phase of the adrenocortical response a week after the exposure was characterized by increased ascorbic acid and sudanophilic lipoid contents in the adrenal cortex, which suggests augmented synthesis of cortical steroids.

11352
Livshits, N. N. 1958
[THE EFFECT OF AN ULTRA-HIGH FREQUENCY FIELD ON THE FUNCTIONS OF THE NERVOUS SYSTEM] Deistvie polia ul'travysokoi chastoty na funktsii nervnoi sistemy. — Biofizika (Moskva), 3 (4): 426-437. 1958. In Russian
English translation in: Biophysics (New York), 3 (4): 409-421. March 1959.

This article is a survey of research done on the effects of ultrahigh frequency (u.h.f.) on the cortex of the cerebral hemisphere, the cerebellum, the intermediate brain, the spinal cord, the motor nerves (in myoneural preparations), the sympathetic innervation of the skeletal muscles, the sensory nerve functions, and some of the factors affecting the reaction of the nervous system (such as administration of strychnine, potassium bromide, alcohol, caffeine, continuous or pulsed u.h.f., and degree of exposure). (91 references)

11353
Livshits, N. N. 1958
THE ROLL OF THE NERVOUS SYSTEM IN REACTIONS TO UHF ELECTROMAGNETIC FIELDS. — Biophysics (New York: Pergamon Press), 2 (3): 372-384. 1958.
English translation of item no. 7625, vol. VI.

11354
Lysakov, N. A. 1959
[THE LEVEL OF RADIATION IN AIRPLANE REPAIR SHOPS AND IN AIRPLANE CABINS] Ob urovne radiatsii v rabochikh pomeshcheniiakh aviaremont masterskikh i v kabinakh samoletov. — Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 75. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 124-125. New York: U.S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U.S. Dept. Commerce)

An investigation of sanitary conditions and radiation levels in the work rooms of airplane repair shops conducted in 1957 uncovered violations of the rules for handling radioactive substances. The radiation levels considerably exceeded the allowable limits on workbenches where luminous paint was applied, and in storage cases for aircraft instruments. Prophylactic measures include: installation of exhaust fans, collection and burial of wastes, provision of special containers and use of storing systems for dry luminous paint, etc. The radiation level in cabins of various aircraft did not exceed the safety limits. However, the consequences of prolonged irradiation during flight should be investigated with respect to the total dose of radiation.

11355
McDowell, A. A., 1958
and W. Lynn Brown
A COMPARISON OF NORMAL AND IRRADIATED MONKEYS ON AN ODDITY-REVERSAL PROBLEM. — University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-73, April 1958. 4 p.

Eight normal, 13 low-dose irradiated, and 13 high-dose irradiated monkeys were tested on an oddity-reversal problem which required the utilization of the same stimulus cues in antagonistic response patterns for correct solution. The present study was carried on two years after irradiation. In the original training, each animal was tested 24 trials a day to the criterion of two successive days with two errors or fewer a day in response to the object which was odd in color. In reversal training, each animal was tested to the same criterion in response to the object which was odd in form. These results were obtained: (1) No consistent differences were observed in the number of errors recorded by the three groups to reach either the pre- or postreversal criterion. (2) All groups showed a statistically significant increase in errors to criterion on reversal learning over errors to criterion on original learning. (3) The groups showed a statistically significant difference in negative saving scores, indicating the superiority of the irradiated animal over the normal animal with respect

to reversal problems of this type. (Authors' summary, modified)

11356
McDowell, A. A., 1958
and W. Lynn Brown
SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON THE BEHAVIOR OF THE RHESUS MONKEY.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-58, April 1958. 4 p.

The behavior of 19 rhesus monkeys was studied after they had been exposed to nuclear radiation ranging from 544 to 709 rem. Deficits were shown in nondirected locomotor activity and in object-directed activity. An increment was shown in self-directed activity. This behavioral syndrome is comparable to that produced in monkeys by laboratory exposure to radiation. (Authors' summary)

11357
McDowell, A. A., 1958
and W. Lynn Brown
LATENT EFFECTS OF CHRONIC WHOLE-BODY IRRADIATION ON THE PERFORMANCE OF MONKEYS ON THE SPATIAL DELAYED-RESPONSE PROBLEM.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-50, April 1958. 3 p.
Also published in: Jour. General Psychol., 61 (1): 61-64. July 1959.

Eight normal, 13 low-dose irradiated (10 to 16 neutron rep plus 70 to 140 gamma roentgens), and 13 high-dose irradiated rhesus monkeys (27 to 54 neutron rep plus 284 to 557 gamma roentgens) were tested in 24 trials a day over a 16-day period on a 10-second spatial delayed-response problem. Previous delayed-response testing had failed to differentiate these groups during the first 100 days following the radiation exposure to which the experimental animals had been subjected two years prior to the initiation of the present experiment. The results of the present experiment show a gradual, consistent elimination of errors by the subjects in both of the irradiated groups, as contrasted to controls, which had the most efficient initial level of performance followed by increased error scores which only decreased to the approximate levels of the irradiated groups late in practice. It is concluded that the hypothesis of a facilitation of delayed-response performance by monkeys as a latent effect of whole-body irradiation is tenable. Normal monkeys can and do perform as efficiently at some points in time as chronic-irradiated monkeys, but they appear to suffer interference from stimulus factors extraneous to solution of the problem at hand. (Authors' summary, modified)

11358
McDowell, A. A., 1959
and W. Lynn Brown
PERIPHERAL CUE LEARNING SET IN RHESUS MONKEYS.—Univ. of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-4, Feb. 1959. 3 p.

Four control and nine chronic whole-body irradiated rhesus monkeys, with previous experience on standardized learning set problems and in the utilization of peripheral cues to procure food rewards, were tested on six four-trial peripheral cue learning set problems per day for 39 days. The results of the experiment were that: (1) The irradiated subjects did not differ significantly from the control subjects with respect to performance on this training. (2) There was no significant interproblem improvement in performance over the periods of testing. (3) There was statistically significant intraproblem improvement in the performance which was consistent over the periods of testing. (Authors' abstract)

11359
McDowell, A. A., 1958
and W. Lynn Brown
SOME PERSISTING EFFECTS OF NUCLEAR RADIATION EXPOSURE ON THE BEHAVIOR OF THE RHESUS MONKEY.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-63, April 1958. 3 p.

Ten 10-minute observations were made of the free-cage behavior of each of 48 monkeys during days 31 through 60 following exposure of 40 of the monkeys to a nuclear detonation (dose levels ranging from 273 to 670 rem). The frequency of responses to body parts was significantly greater for the irradiated animals than for the control animals. The frequency of defecation under the experimental conditions was also greater for the irradiated animals than for the control animals. (Authors' summary)

11360
McDowell, A. A., 1959
and W. Lynn Brown
RUNNING WHEEL ACTIVITY OF RATS TESTED UNDER VARYING CONDITIONS OF FOOD DEPRIVATION THIRTY-THREE DAYS AFTER ACUTE EXPOSURE TO 1,050 R OF GAMMA RADIATION.—Univ. of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 58-143, March 1959. 3 p.
Also published in: Jour. Genetic Psychol., 96 (1): 79-83. March 1960.

Four normal and five acutely irradiated male Sprague-Dawley rats, all of the same age, were compared with respect to running-wheel activity under four food deprivation schedules introduced in the following order: (a) 4 days of total food deprivation; (b) 20 days of 23-hour food deprivation; (c) 4 days of total food deprivation; and (d) 5 days of ad libitum feeding. Irradiates were compared with controls 33 days following acute exposure to 1,050 r of Co^{60} gamma radiation. The following results were obtained: The mean running-wheel activity for the animals of the normal group over the four deprivation schedules was significantly greater than that for the animals of the irradiated group. Running wheel activity varied significantly with deprivation schedules. The interaction between groups and deprivation schedules was significant. A significantly greater gain in running wheel activity during the second than during the first 4-day period of total food deprivation was noted. (Authors' summary and conclusions)

11361
McDowell, A. A., 1959
and W. Lynn Brown
TRANSFER BY NORMAL AND CHRONIC FOCAL-HEAD IRRADIATED MONKEYS OF A SINGLE LEARNED DISCRIMINATION ALONG A PERIPHERAL CUE GRADIENT.—Univ. of Tex., Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-18, Feb. 1959. 3 p.

Nine normal monkeys, three monkeys with previous focal-head irradiation of the posterior association areas, and two monkeys with previous focal-head irradiation of the frontal association areas were tested for transfer of a simple learned discrimination along a peripheral cue gradient. The results of the study demonstrated that: (1) There was no significant difference in performance between normal and chronic focal-head irradiated monkeys. (2) There was a significant change in performance as a function of degree of spatial separation between the relevant discriminanda and site of food reward. (Authors' abstract)

11362
McDowell, A. A., 1958
and W. Lynn Brown
VISUAL ACUITY PERFORMANCE OF NORMAL AND CHRONIC FOCAL-HEAD IRRADIATED MONKEYS.—The University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 59-5, Dec. 1958. 4 p.

Nine normal monkeys, 4 monkeys with previous focal-head X-irradiation of the posterior associal areas, and 2 monkeys with previous focal-head X-irradiation of the frontal association areas were tested on each of 8 visual acuity problems presented in order of increasing difficulty. The results of the study showed that: (1) Normal animals showed gradual improvement in performance from problem to problem and manifested no loss in efficiency as the most difficult problems were presented. (2) Animals with previous focal-head irradiation of the posterior association areas showed gradual improvement in efficiency of performance through the first four problems with gradual decline in efficiency through the last four problems; these results suggested a visual acuity deficit. (3) Animals with previous focal-head irradiation of the frontal association areas showed no improvement from problem to problem. These results suggested either a basic deficit in learning ability with respect to planometric discriminations or a severe deficit in visual acuity, or both factors. (Authors' summary)

11363
Meldolesi, U., 1961
G. Mazzella, and G. Paolucci
[EFFECT OF ANOXIA ON GUINEA PIGS SUBJECTED TO A SEMILETHAL DOSE OF ROENTGEN RADIATIONS. I. STUDY ON SURVIVAL, BODY WEIGHT, WEIGHT VARIATIONS, AND HISTOLOGICAL CHANGES OF SOME ORGANS] L'influenze dell'anossia su cavie sottoposte a dose emiletale di radiazioni roentgen. I. Studio della sopravvivenza e del peso corporeo, delle variazioni ponderali e delle alterazioni istologiche di alcuni organi. —— Rivista di medicina aeronautica e spaziale (Roma), 24 (3): 407-423. July-Sept. 1961. In Italian, with English summary (p. 420-421).

Anoxic guinea pigs were exposed to a dose of 360 Roentgen rays, corresponding to $LD_{50}/30$ days for the strain used. Observations were made of survival, variations in body weight, and histological changes in the liver, spleen, and testes. Anoxia failed to provide effective radiation protection demonstrable by the method used. Experiments of the same nature recently made on guinea pigs using different research methods showed even more clearly that anoxic anoxia does not protect guinea pigs from radiation damage.

11364
Melville, G. S., 1961
R. E. Benson, T. P. Leffingwell, and G. W. Harrison
RADIOPROTECTION IN PRIMATES: A PRELIMINARY REPORT. —— School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 61-3, Jan. 1961. 8 p.

In preliminary studies, the radioprotective drug S,beta-aminoethylisothiuronium dibromide (AET) was administered to Macaca mulatta monkeys receiving four distinct acute doses of X-irradiation which would be 75 to 100% lethal in untreated animals. AET was given intravenously, intraperitoneally, and orally. In spite of the small numbers of animals studied, the results indicated the following conclusions: (1) AET given intraperitoneally is not effective at doses above 625 r. (2) AET given intravenously is 50% effective at 700 r. (3) Pentobarbital sodium in combination with buffered AET (oral), under certain experimental conditions, may be more effective than either drug alone. (4) The use of cysteine hydrochloride in conjunction with AET appears to potentiate the action of the isothiuronium compound. (Authors' abstract)

11365
Michaelson, S. M., 1961
R. A. E. Thomson, and J. W. Howland
PHYSIOLOGIC ASPECTS OF MICROWAVE IRRADIATION OF MAMMALS. —— Amer. Jour. Physiol., 201 (2): 351-356. Aug. 1961.

Dogs, rabbits, and rats exposed to pulsed 2800 Mcycle/sec. microwave (radar) radiation displayed characteristic physiologic responses, some of which were related to heating of superficial tissues. Specific changes in leukocyte levels occurred which were independent of hematocrit or temperature increase. Postexposure lymphocytopenia and eosinopenia appeared to be related to duration of exposure. Anesthetization of the dog resulted in an increased thermal susceptibility which was not evident in the rabbit or rat. Water consumption during exposure depressed the thermal response. Exposure at increased ambient temperature resulted in a synergism of thermal effect reducing the tolerance to microwaves. Vasomotor integrity appeared to be a critical factor in regulating the thermal response to microwaves. No specific long-term effects such as cataracts were observed in animals held for more than one year postexposure. (Authors' abstract)

11366
Michaelson, S. V., 1961
R. A. E. Thomson, L. T. Odland, W. Krasavage, and J. W. Howland
TOLERANCE OF DOGS TO MICROWAVE EXPOSURE UNDER VARIOUS CONDITIONS [Abstract]. —— Indus. Med. and Surg., 30 (7): 298. July 1961.

Assessment of the physiological response resulting from microwave exposure indicates that ionizing radiation survivor dogs are more sensitive to microwave exposure than normal dogs. Water taken ad lib during exposures to microwaves can depress the thermal response and permit prolongation of exposure. Burns may occur in specific areas whether or not the animal is hydrated. Daily exposure to 165 mw./cm.^{2} of 2800 mc. microwaves results in adaptation. Thermal response to microwaves is aggravated while under

the influence of chlorpromazine, morphine sulfate or pentobarbital sodium. Exposures at the various temperatures emphasize the importance of ambient temperature on the ability of the dog to tolerate microwave radiation. (Authors' abstract, modified)

11367
Newell, H. E., and J. E. Naugle 1960
RADIATION ENVIRONMENT IN SPACE. —— Science (Washington), 132 (3438): 1465-1472. Nov. 18, 1960.

The physical nature of solar and electromagnetic radiations, cosmic rays, and the Van Allen radiation belts, and the mechanisms whereby they react with matter are discussed. Intensity levels for each type of radiation are defined and the salient factors in the choice of shielding are given. The principal hazard from electromagnetic radiations may be expected from those X-rays and gamma rays generated by the interaction of charged particles with material of the satellite or spacecraft. The radiation dosage to be expected from cosmic radiation is small (5 to 12 roentgens per year). The principal hazard in the inner Van Allen radiation belt is from ionization produced by the high-energy protons. In the outer belt, the principal hazard is due to the soft X-rays produced as the electrons decelerate in the shell of a satellite or spacecraft. An assessment is made of the importance of radiations in space to various missions such as Project Mercury, circumlunar flights, and the operation of unmanned satellites and space probes.

11368
Newell, H. E., and J. E. Naugle 1961
RADIATION—MAJOR FACTOR IN SPACE TRAVEL. —— SAE Jour., 69 (2): 65-66. Feb. 1961.

The hazards of radiation on space missions and the need for research and development to determine required shielding and produce long-lived solar power supplies for spacecraft are briefly discussed.

11369
Nieset, R. T., R. Baus, R. D. McAfee, J. D. Fleming, and L. R. Pinneo 1959
THE NEURAL EFFECTS OF MICROWAVE RADIATION.——Tulane Univ. Biophysics Lab., New Orleans, La. (Contract AF 30(602)-1965); issued by Rome Air Development Center, Griffis Air Force Base, New York. (Project no. 5545, Task no. 45466). RADC Technical Note no. 59-311, June, 1959. iii+29 p. AD 229 023

Major effort was concentrated on the design of experiments to determine the neural effects of microwaves. Experiments, based on previous work, are being conducted to determine peripheral neural effects using animal subjects and to provide data on steady (d.c.) potential as related to integrated activity or behavior using human subjects. Microwave equipment employed include sources operating at 1.25 cm., 3.0 cm., and 10 cm. wavelengths. Initial results from the peripheral nerve experiments indicate that previous reports of neural effects by various investigators may be explainable as effects due to local heating of peripheral nerves rather than to excitation of the central nervous system. (Authors' abstract)

11370
Paul, J. S. 1959
RADIATION IN SPACE TRAVEL.——Space Jour., 1 (5): 42-43. March-May 1959.

The National Committee on Radiation Exposure has set the permissible radiation dose at 15 roentgens per year, or 0.3 roentgen per week, based on the curie system of measurement (3.700 x 10^{10} disintegrations per second). In such cases, 15 roentgens is the maximum safety factor for which space engineers must plan, design, and build. Beyond this limit, animal experiments have revealed the following facts: (1) an excess overall total dose of 1000 roentgens produces a shortening of average life expectancy by five years; (2) an excess dose of 100 to 1000 roentgens causes marked decrease in the weight of the spleen and thymus; (3) the kidneys are affected by excess doses of 100 to 500 roentgens and excess doses of 50 to 300 roentgens affect the sex organs; and (4) a dose of 12.5 roentgens could cause cataracts.

11371
Payne, R. B. 1959
EFFECTS OF IONIZING RADIATION ON HUMAN PSYCHOMOTOR SKILLS.——U. S. Armed Forces Med. Jour., 10 (9): 1009-1021. Sept. 1959.

Adult male patients, in advanced stages of neoplastic diseases, were administered psychomotor performance tests after having been exposed to two therapeutically different types of ionizing radiation. One group was treated with whole-body doses delivered in single exposures (nine levels, ranging from 0-200 r), and the other group received equivalent total exposures in five equal increments separated by intervals of one hour (three levels: 15, 25, and 50 r). All levels were as measured in air at the position of a plane which bisected the patient. The U. S. Air Force School of Aviation Medicine (USAF SAM) complex coordination test, the USAF SAM two-hand coordination test, and the USAF SAM rotary pursuit test served as criteria of treatment effects. There was no evidence that psychomotor performance was affected by exposure to ionizing radiation.

11372
Pervushin, V. Yu. 1958
CHANGES OCCURRING IN THE CARDIAC NERVOUS APPARATUS DUE TO THE ACTION OF ULTRA-HIGH FREQUENCY FIELD.——Bull. Exper. Biol. and Med. (Consultants Bureau, New York), 43 (6): 734-740. 1958.
English translation of item, no. 7630, vol. VI, 1957.

11373
Pickering, J. E. 1961
ANIMAL AND MAN IN THE SPACE ENVIRONMENT. ——In: Escape and survival, p. 104-107. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

Radiations found in space may be of galactic, solar or Van Allen belt origin. Radiation effects are most pronounced in tissues with a high rate of mitotic cell divisions and nerve tissue. A sufficient dose of radiation produces specific responses, such as decrease in white blood cells, erythema, epilation, desquamation, pigment proliferation, and cataracts. In analyzing examples of galactic and solar cosmic rays as measured with balloons and space probes, the particle flux and dose rate for galactic cosmic rays appears well below doses that would produce any demonstrable detrimental biological effects.

11374
Pickering, J. E. 1960
BIOLOGICAL ASPECTS OF NUCLEAR PROPULSION.—In: Physics and medicine of the atmosphere and space, p. 435-446. New York, etc.: John Wiley and Sons, 1960.

The use of nuclear energy to increase airspeed may also increase the hazards of ionizing radiation. Exposure to ionizing radiation of sufficient dosage produces well-defined responses, such as decrease in white blood cells, erythema, desquamation, pigment proliferation, lens opacities, and definite reduction of life span.

11375
Pipkin, S. B., 1959
and W. N. Sullivan
A SEARCH FOR GENETIC CHANGE IN DROSOPHILA MELANOGASTER EXPOSED TO COSMIC RADIATION AT EXTREME ALTITUDE.—Aerospace Med., 30 (8): 585-598. Aug. 1959.

A total of 10,761 Drosophila melanogaster larvae were exposed to primary cosmic radiation during a balloon flight (StratoLab III) which remained at 78,000 to 82,000 feet for 16 hours. The control series at ground level included 7,742 larvae. No demonstration of X-chromosome breakage or gene mutation at specific X-chromosome loci was evident, because of the rarity of thindown hits or nuclear collisions, or lethal effect of thindown hits. (Authors' summary, modified) (26 references)

11376
Povzhitkov, V. A., 1961
N. V. Tiagin, and A. M. Grebeshechnikova
[THE EFFECT OF ULTRAHIGH FREQUENCY-IMPULSE ELECTROMAGNETIC FIELD ON CONCEPTION AND THE COURSE OF PREGNANCY IN ALBINO MICE] Vliianie sverkhvysokochastotnogo impul'snogo elektromagnitnogo polia na zachatie i techenie beremennosti u belykh myshei. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 51 (5): 103-107. May 1961. In Russian, with English summary (p. 107).

There was a delay in the development and weight gain of offspring of white mice when the maternal animals were subjected to the action of a high-frequency electromagnetic field during pregnancy. There were many stillbirths and deaths during the 3rd week of life among the offspring of these mice. The weight of the ovaries and uterine cornua was reduced in the experimental animals. Mild histological changes in the ovaries and uterine cornua were not constant and occurred mainly during the heat period. (Authors' summary, modified)

11377
Presman, A. S. 1958
TEMPERATURE CHANGES OF THE HUMAN SKIN IRRADIATED WITH LOW INTENSITY WAVES SEVERAL CENTIMETERS IN LENGTH. — Bulletin Exper. Biol. and Med. (Consultants Bureau, New York), 43 (2): 180-184. 1958.
English translation of item no. 7631, Vol. VI, 1957.

11378
PROCEEDINGS OF CONFERENCE ON RADIATION PROBLEMS IN MANNED SPACE FLIGHT, JUNE 21, 1960, WASHINGTON, D. C.—Ed. by G. J. Jacobs. National Aeronautics and Space Administration. Office of Life Sciences Programs, Washington, D. C. NASA Technical Note no. D-588, Dec. 1960. 99 p.

Four problem areas were discussed: (1) the present status of physical measurements of radiation in space, (2) the interpretation of these measurements in terms of biological effectiveness, (3) further studies needed to define the radiation problems in manned space flight, and (4) how these additional studies may best be accomplished. (Editor's abstract)

11379
Richardson, A. W. 1959
BLOOD COAGULATION CHANGES DUE TO ELECTROMAGNETIC MICROWAVE IRRADIATIONS.—Blood, 14 (11): 1237-1243. Nov. 1959.

The blood coagulation time of dogs is altered after exposure to relatively high energy electromagnetic microwaves. The coagulation time may be significantly increased, or decreased, depending on the exposure dosage. A 2450-megacycle frequency was selected for these studies, but it is not known whether this action is common to all microwaves, singular to this frequency, or whether these findings represent as yet not understood phenomena of liver and blood heating. (Author's abstract)

11380
Ritter, O. L. 1961
THE SUN'S RETINA-BURNING POWER IN SPACE. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 300-309. 1961.

The eye's susceptibility to chorio-retinal burn is considered in dependence on the eye's optical and thermal properties, size of the image, and radiance and spectral characteristics of the sun. Outside the atmosphere, not only the visual range but the total range of wave length for which the eye's media are transparent must be taken into account. Due to the existence of irradiance thresholds for damage to the retina, the increased radiation intensity outside the atmosphere can cause foveal burns to insufficiently protected eyes in a disproportionately shortened time. A very dangerous situation would prevail if it should be found that the extrafoveal burning threshold is exceeded outside the atmosphere. There exists a large region in space, probably extending well into the realm of the outer planets, where the retina-burning power of the sun is approximately unchanged. Two burning zones are distinguished, applying to foveal and extrafoveal injury. Precise predictions of danger conditions and necessary protective requirements call for more experimental data; research areas are indicated. The burning zones of other stars are considered briefly. (Author's abstract)

11381
Robey, D. H. 1960
RADIATION SHIELD REQUIREMENTS FOR TWO LARGE SOLAR FLARES. — Astronautica acta (Wien), 6 (4): 206-224. 1960. In English.

The class 3+ flare of May 10, 1959, and the class 4 flare of February 23, 1956, were analyzed in order to determine the magnitude of radiation shielding required for man in space. The former was probably the largest flare of the year and the latter the largest flare on record. Carbon was selected for the shielding material. A spherical carbon shield configuration with an inside cavity of 90 cm. radius was used for both events. It was found

that for the class 4 flare, all protons with energies below 1.4 Bev must be stopped in order to reduce the proton radiation dose to the order of 25 rem (RBE = 1). An optimistic estimate of the shield weight gave about 379 metric tons (834,000 pounds), neglecting nuclear reactions. (Author's abstract)

11382
Ross, M. D. 1959
THREAT TO MANNED SPACE FLIGHT.—Naval Research Rev. (Washington), 1959 (Oct.): [ii].

A new solar-linked radiation which may impose a serious threat to manned space flight is briefly noted.

11383
Rossi, M. 1961
[A NEW HYPOTHESIS OF THE BIOLOGICAL EFFECT OF IONIZING RADIATIONS] Una nuova ipotesi dell'azione biologica delle radiazioni ionizzanti. — Rivista di medicina aeronautica e spaziale (Roma), 24 (4): 586-620. Oct.-Dec. 1961. In Italian, with English summary (p. 616-617).

Although man in space is protected against primary cosmic rays by the walls of the space vehicle, he is vulnerable to secondary X and gamma radiations. Theories concerning the injurious effects of these radiations are presented as related to the field of biochemistry: the theory of direct radiant activity on organic molecules and the theory of indirect action on water followed by the release of toxic radicals. A new theory is proposed which stipulates that the primary injurious effect of radiant particles consists of the degradation and abnormal activation of oxidation-reduction enzymes, especially those containing porphyrin. This mechanism is apparent during massive-dose global body irradiation. According to the hypothesis, toxic substances form which are comparable to those induced by the so-called photodynamic phenomenon of photosensitization. Various theoretical considerations are given according to which the radiobiological process can be interpreted as a photodynamic process. Results are also presented of some experimental observations which are favorable to the new hypothesis. (47 references)

11384
Sander, E. G., 1961
and M. George
THE RADIOPROTECTIVE EFFECT OF MIXTURES OF AET AND SEROTONIN.—Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71826). ASD Technical Report no. 61-221, June 1961. iii+8 p.

Experiments were conducted to determine the protection provided the erythropoietic system of rats against whole-body, gamma radiation by mixtures of AET (2-aminoethylisothiouronium bromide) and serotonin (5-hydroxytryptamine). The incorporation of iron-59 (Fe-59) into newly formed red blood cells was used as the criterion of the radioprotection afforded. Two concentrations of AET plus serotonin (40 micromoles AET, 20 μM serotonin and 20 μM AET, 10 μM serotonin) offered initial protection against the depression of the erythropoietic rate associated with radiation exposure. The higher concentration of this mixture produced mortality due to the toxicity of the compounds. AET and serotonin mixtures did not alter the initial radiation-induced leucopenia. However, the protected rats had higher white blood cell counts 18 days after radiation exposure. Daily gains in body weight appeared somewhat greater in the rats injected with AET and serotonin than in the nonprotected, irradiated animals. (Authors' abstract)

11385
Schaefer, H. J. 1958
APPRAISAL OF COSMIC-RAY HAZARDS IN EXTRA-ATMOSPHERIC FLIGHT.—In: Vistas in astronautics, p. 291-298. Ed. by M. Alperin, M. Stern, and H. Wooster. N. Y.: Pergamon Press, 1958.

The mode of action of heavy cosmic-ray primaries on living matter was clarified in recent years by exposing various biological specimens to high altitude in pressurized capsules. High-density ionization as it occurs in the absorption events of some constituents of the primary radiation can cause severe damage and complete destruction on the cellular level in living tissue. Effects of heavy nuclei damage on living adult and embryonic tissues are surveyed.

11386
Schaefer, H. J. 1961
CURRENT PROBLEMS IN ASTRORADIOBIOLOGY.—Aerospace Med., 32 (5): 435-441. May 1961.

The radiobiological problems concerning irradiation with heavy nuclei are discussed. The radiation hazard presents itself as a major obstacle for man's venture into space. The particular challenge rests in the unpredictability and the everchanging conditions with regard to time and location of high-intensity proton fluxes. While, for an Earth-circling satellite, it seems safe to state that the radiation hazard will not be an insurmountable impasse, quite serious doubts must be voiced as far as manned missions deeper into space are concerned.

11387
Schaefer, H. J. 1961
DOSIMETRY OF PROTON RADIATION IN SPACE.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 19, June 6, 1961. 23 p.

The energy spectra of the proton radiation in the inner Van Allen Belt and of the proton flux after large solar flares are selected as representative examples for an analysis of the intratarget distribution of the relative biologic effectiveness (RBE) dose in rem. It is shown that greatly different depth doses ranging from 0.6% to 64% of the surface dose are obtained depending on types of spectrum and shielding thicknesses. Because of this extreme variation in the depth-dose pattern, a concise and general determination of the total body radiation burden seems impossible. Mitigating is the fact that, due to the comparatively small share of low energy particles in the local spectrum, the mean RBE never exceeds the value 1.5. This distinguishes proton beams in space from neutron-produced recoil protons of reactors which are exclusively of low energy and have a mean RBE of 10.0. (Author's abstract)

11388
Schaefer, H. J. 1960
FURTHER EVALUATION OF TISSUE DEPTH DOSES IN PROTON RADIATION FIELDS IN SPACE. — Naval School of Aviation Medicine. Naval Aviation Medical Center, Pensacola, Fla. (Research

Project no. MR005.13-1002, Subtask no. 1). Report no. 17, May 24, 1960. ii+14 p.

Strong additional proton fluxes are superimposed upon the ordinary cosmic ray beam at certain times and in certain regions of space. Four basic types of such transitory radiation fields are selected and the intratarget dosage distribution for a tissue sphere of 75 kg. weight is evaluated. The large heterogeneity of the four spectra reflects in highly structured depth dose patterns which differ greatly and show a strong dependence on prefiltration. Present classifications in dosimetry, with regard to penetrating power and total body radiation burden for different radiations, seem inadequate for proton beams in space. Additional provisions appear mandatory, particularly for the region of low penetrating power in view of the high radiosensitivity of the lens of the eye. (Author's abstract)

11389
Schaefer, H. J. 1958
IONIZATION DOSAGE FROM X- AND BETA RAYS IN FLIGHT THROUGH AURORAL DISPLAYS.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 12 01 11, Subtask 1). Report no. 15, June 2, 1958. ii+11 p.

Measurements of auroral X- and beta rays by Van Allen and by Winckler are evaluated in terms of tissue ionization dosages. Values of up to 500 millirad per hour are obtained. The exposure hazard seems greatly alleviated because of the low penetration of the radiation corresponding to a quantum energy of 10 to 100 kV and because of the limitation of the phenomenon with regard to duration and location. No explanation is readily available as to how low energy electrons, which presumably are the cause of the X-rays, can reach the ionosphere without being deflected in the geomagnetic field. The observations indicate the dire need for further measurements before the order of magnitude for the intensity of the extra-atmospheric radiation field can be appraised.

11390
Schaefer, H. J. 1958
NEW KNOWLEDGE OF THE EXTRA-ATMOSPHERIC RADIATION FIELD.—Jour. Aviation Med., 29 (7): 492-500. July 1958.

The problem of a quantitative appraisal of the effects of extra-atmospheric radiation on man has not been solved, with available information incomplete on the mode of action of heavy nuclei or large disintegration stars on living matter, and the intensity and composition of the ionizing radiation in space. Phenomena which require investigation are (1) the periodic change in high-altitude low-energy radiation intensity in correlation with the 11-year cycle of solar activity; (2) the increase in cosmic ray emission during solar flares; and (3) the radiation field from X- and beta rays in auroral displays, which is not cut off by the geomagnetic field, and may be produced by moving clouds of ionized gases from the sun.

11391
Schaefer, H. J. 1961
A NOTE ON THE RBE OF PROTON RADIATION IN SPACE.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 18, Jan. 10, 1961. 11 p.

The energy spectrum of the protons in the inner Van Allen belt and of flare-produced protons differ greatly and therefore are separately analyzed. The changes in both spectra which occur when the radiation penetrates a human target are investigated. It is shown that the relative share of protons in the energy interval from zero to a few Mev never exceeds a few per cent of the total particle flux. This distinguishes these spectra basically from that of recoil protons found in hydrogenous material (tissue) under exposure to neutrons from thermal fission of U-235. In the latter case the particle flux shows a steep and high maximum just below 1 Mev. Converting energy spectra into linear energy transfer spectra and applying the upper contour of the RBE corridor as recommended by the National Committee on Radiation Protection leads, for the proton beams in space, to a highest relative biologic effectiveness (RBE) of 1.46. It occurs in the surface of a spherical tissue phantom for low prefiltration exposed to the flare-produced radiation. It seems safe to assume that for a minimum prefiltration of 2 g./cm.^{2} this maximum RBE value will not be significantly exceeded by any other conceivable type of proton spectrum in space. In the very surface of targets freely exposed in the near vacuum of space to proton beams, significantly higher RBE values can be expected. (Author's summary)

11392
Schaefer, H. J. 1960
RADIATION DANGER IN SPACE.—Astronautics, 5 (7): 36, 42-45. July 1960.

A discussion is presented of the data recorded by a nuclear emulsion package recovered from the nose cone of a Thor-Able missile which flew through the lower fringes of the Van Allen radiation belt. The significance of the data is evaluated by recapitulating the mechanism of proton attenuation in an absorbing medium and correlating this information with the penetration behavior of a pencil beam of monoenergetic protons in living tissue. The author expresses certain cautions to be observed in assessing the relative biological effectiveness of the proton beam in the Van Allen belt, and states that close attention must be paid, in particular, to the eyes of a human target, since the lenses of the eyes will be exposed to the full body entrance dose, and will show a greater radiation sensitivity than the skin to permanent, progressing injury.

11393
Schaefer, H. J. 1959
RADIATION DOSAGE IN FLIGHT THROUGH THE VAN ALLEN BELT.—Aerospace Med., 30 (9): 631-639. Sept. 1959.

The characteristics and the types of radiation found in the Van Allen belt are stated. The first zone consists of protons exhibiting a very broad energy spectrum with a tremendous particle flux of low penetrating power. The intensity declines toward spectral sections of higher penetration. The second zone consists of electrons. Although they are completely absorbed in any wall of minimum structural stability, the shielding problem is complicated by the production of secondary X-rays. The most radical solution of the radiation issue is the complete avoidance of the Van Allen belt by choosing a polar escape route. A vehicle can be launched on this route from any latitude including the equator and still clear both radiation zones by a large distance. The navigational disadvantages of the radial shot and the polar transfer ellipse consist in higher fuel requirements because the rotation of the Earth cannot be utilized for propulsion and in smaller aiming accuracy because the

Moon is a smaller target for these trajectories. (Author's summary, modified)

11394
Schaefer, H. J. 1961
RADIATION TOLERANCE CRITERIA IN SPACE OPERATIONS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 20, Sept. 1, 1961. 16 p.

Effective coping with emergency conditions in space flight due to unexpected radiation surges from solar activity requires exact information on the critical dose level at which acute effects would develop in man. Review of data in the literature shows that this dose depends strongly on dose rate and fractionation of exposure. Extrapolation of pertinent animal data to man is problematic. A comprehensive study by Blair suggests for acute exposures a nonrecoverable injury of 10% and an exponential recovery of the remaining 90% with a half time of 25 days. The implications of this model for permissible repeat exposures are discussed. (Author's abstract)

11395
Schaefer, H. J. 1961
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. III. THE ROLE OF THE TIME FACTOR IN THE DOSIMETRY OF IONIZING RADIATION IN SPACE.—Aerospace Med., 32 (10): 909-914. Oct. 1961.

Many reactions of living matter to ionizing radiation show a reduced effect for the same total dose if the rate of administration is diminished, i.e., the exposure time increased. The phenomenon is usually called the time factor effect. Closely related to the time factor influence acting during exposure is the recovery process acting after termination of exposure. The recovery process operates on a much slower time scale with an estimated "recovery half life" of 25 days for man. Its alleviating influence, therefore, would be felt only on missions of longer duration. A third factor to be considered in assessing radiation hazards in space is that from low-level exposure to heavy nuclei. In this case, the time factor acts in the direction of increasing the damage from small doses of heavy nuclei as compared to X- or gamma-rays. In the long run, the time factor influence concerning heavy-nuclei effects seems to carry the greater practical significance since its long-term effects will be hard to identify, yet will have to be considered in such projects as manned orbiting satellites and space platforms, or passenger transportation in the heavy-nuclei region. (Author's summary, modified)

11396
Schaefer, H. J. 1960
TISSUE IONIZATION DOSAGES IN PROTON RADIATION FIELDS IN SPACE.—Aerospace Med., 31 (10): 807-816. Oct. 1960.

Additional radiation fluxes are superimposed on ordinary cosmic rays at certain times and in certain regions of space, apparently correlated with solar activity. Although protons, electrons, and X-rays have been identified as constituents of these fluxes, for possible exposure hazard to man, interest centers on protons because of their high intensity and depth of penetration. Four representative proton spectra are analyzed with respect to intratarget dosage distribution in the human body: the inner Van Allen belt, the proton radiation after the giant solar flare of May 10, 1959, and two theoretical spectra based on a synoptic evaluation of observations. The depth dose in the center of the target changes from 0.6% of the skin dose for the flare-produced radiation at low prefiltration to 64% for the radiation in the Van Allen Belt at high prefiltration. The extreme heterogeneity of each individual type of radiation and the great differences between them make it impossible to determine the radiation burden for a human target in terms of a general total body dose in rep or rem. Quotation of the integral dose in kg. rep or kg. rem implies the danger that, especially for the flare-produced radiation, an objectionably high skin dose remains hidden behind an apparently low integral dose. (Author's summary, modified)

11397
Schwan, H. P., and H. Pauly 1959
EFFECTS OF MICROWAVE ON MANKIND. — [No contractor given] (Contract AF 41(657)129); issued by Rome Air Development Center, Griffis Air Force Base, N. Y. Second Annual Progress Report April 1, 1958 to March 1, 1959. Report no. RADC-TN-59-199, [1959]. 42 p. AD 217 618

Four topics are discussed which are considered as important prerequisites to an understanding of the interaction of microwaves with biological material: (1) the development of electrical substitutes for body tissues in the microwave range which must be available in solution, permit continuous variation for dielectric constant throughout the range from 5 to 70, and permit independent adjustment of the dielectric variation; (2) the development of a technique for relative absorption cross-section determination; (3) the development of a microwave test chamber; and (4) theoretical considerations pertaining to thermal dose meters.

11398
Schwartz, E. E., and B. Shapiro 1960
THE PROTECTION OF MICE AGAINST RADIATION BY 2-MERCAPTOETHYLGUANIDINE AND ITS DISULFIDE.—Albert Einstein Medical Center. Depts. of Radiology, Philadelphia, Pa.; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 61-15, Nov. 1960. 6 p.

The ability of 2-mercaptoethylguanidine (MEG) to protect X-irradiated mice was compared with that of its oxidized form, bis(2-guanidoethyl) disulfide (GED). When administered intraperitoneally, 100 and 140 mg./kg. of each form gave comparable $LD_{50/30}$ results. However, GED in doses of 200 mg./kg. and above gave rise to signs of drug toxicity which apparently prevented a further increase in protection such as was obtained with equivalent doses of MEG. The therapeutic efficiency of GED, as compared with MEG, was not increased by use of the oral route, despite the increased tolerance to the disulfide. (Authors' abstract)

11399
SEMIANNUAL PROGRESS REPORT OF THE RADIOBIOLOGICAL LABORATORY OF THE UNIVERSITY OF TEXAS AND THE UNITED STATES AIR FORCE, AUSTIN, TEXAS.—Univ. of Texas. Radiobiological Lab., Austin (Contract AF 41(657)-149); and School of Aviation Medicine, Randolph Air Force Base, Tex. [Unnumbered report], [1958]. 100 p.

This is a collection of 46 short papers by various authors on radiobiological experiments in the fields

of experimental biology, medicine, physics, psychology, and veterinary medicine. The papers present long-term observations on the effects of acute and chronic irradiation of rodents and monkeys, and therapeutic aspects of radiation

11400
Shen, S. P. 1961
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. II. ON THE SHIELDING OF COSMIC RAYS.—Aerospace Med., 32 (10): 901-908. Oct. 1961.

The nuclear physics aspect of shielding is considered, with particular emphasis on the shielding of nuclear-powered spacecraft. Non-solar cosmic rays may require little shielding on short trips, but considerably more shielding will be required against solar cosmic-ray events. (34 references)

11401
Shepherd, L. R. 1958
COSMIC RADIATION AND SPACE-FLIGHT.—In: Space research and exploration, p. 84-102. New York: William Sloane, 1958.

The nature of cosmic radiation and its effect on living cells are examined. The basic properties of cosmic ray primaries, the effect of the Earth's atmosphere, and the methods of study are surveyed.

11402
Simons, D. G., and J. E. Hewitt 1961
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. VII. REVIEW OF BIOLOGICAL EFFECTS OF GALACTIC COSMIC RADIATION.—Aerospace Med., 32 (10): 932-941. Oct. 1961.

The high correlation between the heavy primary tracks observed in monitoring track plates and the position of loci of graying in black mice reported by Chase suggests that heavy particles of higher energy and lower total specific ionization are more responsible than was previously expected. Comparison of heavy primary exposures observed in rocket, balloon, and satellite flights clearly indicates that for this type of experiment balloon flights at a minimum altitude of 140,000 feet provide the most desirable type of exposure. (Authors' summary, modified) (27 references)

11403
Singer, S. F. 1958
SOME CONSEQUENCES OF A THEORY OF THE RADIATION BELT.—Jour. Brit. Interplanetary Soc. (London), 16 (10): 558-564. Nov.-Dec. 1958.

A theory developed to account for the radiation belt reported by the Explorer and Sputnik satellites is summarized, giving the origin of radiation, its nature and energy, and its distribution around the Earth according to latitude and altitude. The theory is considered in terms of its application to studies of the outer atmosphere of the Earth, the planets and Moon, space medicine, and means of protection against radiation (avoidance, shadow shielding, magnetic screening, sweeping-out radiation).

11404
Stoll, A. M., L. C. Greene, and J. D. Hardy 1959
PRODUCTION OF PAIN AND THERMAL BURNS IN SKIN AREAS PREVIOUSLY EXPOSED TO ULTRAVIOLET RADIATION.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. NM 19 01 12.1, Report no. 19). Report no. NADC-MA-5915, Sept. 21, 1959. ii+10 p.

In order to evaluate the relationship of tissue damage to pain sensation in areas of hyperalgesia, the skin of three subjects was irradiated with erythemal doses of ultraviolet radiation and then exposed to thermal radiation. Measurements were made of the pain threshold lowering effect of the ultraviolet radiation and, following the development of the hyperalgesia, of the lowering of the blister threshold to thermal radiation. Lowering of the pain threshold of 4-7° C. was observed, while the lowering of the blister threshold (i.e., the temperature at which blistering was produced) was of the order of 0.5° C. The ultraviolet-irradiated hyperalgesic skin is therefore not more fragile as regards moderately high temperature (50° C.) and high temperature burns than is normal undamaged skin. This finding is in keeping with the previously proposed theory that the intensity of pain is a function of the relative reaction rates at the thermal threshold and at skin temperatures above this threshold. Theory predicts, however, that ultraviolet irradiated skin heated to, and maintained at, relatively low temperatures (40-45° C.) will be more easily blistered than will undamaged skin. This possibility has not been investigated as yet. The promising possibility of testing the analgetic action of the weak analgesics, such as the salycilates by experimental procedures in areas of induced hyperalgesia in noted. (Authors' abstract)

11405
Stoll, A. M. and L. C. Greene 1959
RADIATION BURNS.—Mechanical Eng., 81 (8): 74-76. Aug. 1959.
Condensed from: THE PRODUCTION OF BURNS OF THERMAL RADIATION OF MEDIUM SENSITIVITY.—ASME Paper no. 58—A-219.

The relationship between exposure time productive of pain and tissue injury, and degree of thermal irradiation was determined by measuring radiant intensity, time, and temperature of the skin before and after exposure during the production of a threshold blister on a blackened area of the human forearm. The data were used in the evaluation of the thermal radiation burn protective qualities of various samples of military fabrics. A white burn appearing on the skin of the albino rat was utilized as the end-point in this study. It was found that black fabric tended to make the skin burn more quickly. Cotton anti-G suit material offered considerable protection but its nylon lining contributed to the burning process. A portable apparatus for the measuring of thermal radiation effects on simulated skin is under development.

11406
Stoll, A. M., and L. C. Greene 1958
THE RELATIONSHIP BETWEEN PAIN AND TISSUE DAMAGE DUE TO THERMAL RADIATION.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. NM 19 01 12.1, Report no. 15). Report no. NADC-MA-5808, June 11, 1958. vi+36 p. AD 202 823
Also published in: Jour. Applied Physiol., 14 (3): 373-382. May 1959.

Sites on the volar surface of the forearm of three human subjects were blackened with India Ink and

exposed to thermal irradiances of from 50 to 400 mcal./cm.^{2}/sec. for a total of 257 exposures. Surface temperatures were measured before, during, and after irradiation. The exposure time and skin temperature productive of minimal blistering occurring within 24 hours after exposure were bracketed. From these data tissue damage rates with respect to temperature were derived empirically such that damage integrated over the time for which skin temperature was elevated over the pain threshold was equated to unity. The substitution of the ratio of these rates with respect to temperature for the stimulus ratio in the prediction of the observed discriminable steps in pain sensation intensity yielded faithful reproduction of the just noticeable differences observed for pain through the range of this sensation. Thus, in normal skin, either the level of pain sensation or the skin temperature sustained may be used to predict irradiation exposure time productive to destruction of the epidermis. (Authors' abstract, modified)

11407
Straile, W. E., and H. B. Chase 1960
DEVELOPMENT, DOSIMETRY, AND USE OF MICRO-BEAMS OF X-RAYS FOR SIMULATING MICRO-LESIONS PRODUCED IN ANIMAL TISSUES BY HEAVY COSMIC RAY PRIMARIES.—Brown Univ., Providence, R. I.; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-70, Oct. 1960. 9 p.

Three methods which have been developed for the collimation of X-rays are described which make use of micro-apertures and crossed slits. A system for the photographic dosimetry of X-ray microbeams is described. A 150-micron-wide elongate microbeam of X-rays was used for the irradiation of mouse skin at 4000, 6000, and 8000 roentgens. Although, 18 days later, the dermal, epidermal, and adipose layers had either healed or had not been severely damaged by the X-rays, there was evidence of destruction of hair follicles but the areas were neither hypertrophied nor hyperplastic, and they contained no keratogenous cysts.

11408
Strughold, H., and O. L. Ritter 1960
EYE HAZARDS AND PROTECTION IN SPACE.—Aerospace Med., 31 (8): 670-673. Aug. 1960.

When an astronaut's eyes are adapted to the darkness of space, he may experience a blinding glare or even structural damage to the retina by glancing upon the solar disk. A retinal burn, acquired during observation of a solar eclipse, is pictured. An exposure to solar radiation in space at a distance just beyond the Earth's atmosphere lasting ten seconds or less will be sufficient to cause retinal burn, according to calculations. The size of the burn will change in inverse proportion to the distance from the Sun but the critical time of exposure will remain nearly the same. For the astronauts, protection of the eyes is necessary, at least in the domain of the inner planets and on the Moon. Such protection can be provided by light-absorbing glasses, light-scattering ceilings on a lunar base, and retractable light-scattering visors attached to the helmet of the astronaut.

11409
Strughold, H. 1960
THE HUMAN EYE IN SPACE (PHYSIOLOGIC ASPECT).—In: International Astronautics Congress, Xth (London, 1959), Proceedings, vol 2, p. 715-722. Wien: Springer, 1960.

Visible radiation or light as it is found in nearby space is discussed from a physiological point of view, with emphasis upon the luminance of the sky and the illumination from the Sun. The difference between the darkness of a moonless sky on earth and the blackness of the sky in space is analyzed. The visual appearance of the Moon and Earth to an orbiting astronaut and the strange spatial light distribution is examined with regard to his orientation in a weightless state. Attention is given to a possible hazard in space in the form of a retinal burn resulting from observing the Sun with unprotected eyes (helioscotoma retinae). The illumination from the Sun is studied for the range from Mercury to Pluto, which may justify a subdivision of space into photic zones, namely an euphotic zone (favorable to space operations and to life on planets) surrounded by a hyperphotic and a hypophotic region. Finally, in the weakly illuminated region far beyond Pluto (about three times its distance from the Sun), color discrimination becomes difficult for an astronaut and from here on the colorless dim-lighted world of interstellar space with its black, star-studded sky begins. (Author's abstract) (30 references)

11410
Strughold, H., and O. L. Ritter 1960
SOLAR IRRADIANCE FROM MERCURY TO PLUTO.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-39, Feb. 1960. 5 p.
Also published in: Aerospace Med., 31 (2): 127-130. Feb. 1960.

The penetration of space by probes requires a thorough knowledge of solar irradiance at various solar distances. Since solar irradiance varies with the inverse square of the distance from the Sun, its variations throughout the solar system are quite large. In an extensive table, values are given for total solar irradiance (energy flux throughout the electromagnetic spectrum) and illuminance (light irradiation) for distances within the orbit of Mercury to the orbit of Pluto. For the inner planets, Mercury, Earth, and Mars, the values for the perihelion (nearest point to the Sun) and aphelion (farthest point from the Sun) are added to the mean orbital distance values.

11411
Subbota, A. G. 1958
THE EFFECT OF A PULSED SUPER-HIGH FREQUENCY (SHF) ELECTROMAGNETIC FIELD ON THE HIGHER NERVOUS ACTIVITY OF DOGS.—Bull. Exper. Biol. and Med., 46 (10): 1206-1211. Oct. 1958.

A study was made of the effect of exposure to microwave radiation on the conditioned reflex salivation of dogs. Irradiation for 1-2 hours at a field intensity of 0.005 watt/cm.^{2} produced an increase in the secretion of saliva in response to positive stimuli, relatively little change in differentiation between stimuli, and a decrease in most cases in the latent period of reflex salivation. Repeated daily exposures produced fluctuations in reflex activity, with incomplete adaptation to irradiation. Exposure to radiation at a field intensity of 0.1 watt/cm.^{2} (causing heating of animals) generally resulted in de-

pression of reflex activity and lengthening of the latent period of salivation.

11412
Taylor, J. W., 1960
E. Reeves, and E. I. Fessenden
THE HEALTH HAZARDS OF RADIOACTIVATED MATERIALS IN NUCLEAR POWERED SEAPLANES. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. Report no. NADC-MA-6039, Dec. 31, 1960. iv+24 p.

A preliminary study was made of the possible general health hazards of operating a nuclear-powered aircraft. Proper shielding design will limit the direct radiation from the reactor to a safe, predetermined level, but will not determine what hazards might result from the intake of radioactivated gaseous and particulate matter in the breathing air supply. Navy P5M seaplanes were used as prototypes of a possible nuclear aircraft, and the dust samples collected from these seaplanes were analyzed for gross particulate nature, molecular constituents and particle size below one micron, and for activation possibilities. The results were then extrapolated to an assumed nuclear-powered aircraft. Indications are that no special problem exists in connection with the occupied areas of a seaplane; in the event that a nuclear-powered plane becomes available, more detailed and specific studies would be required to assess the hazard. (43 references)

11413
Tiagin, N. V. 1958
THE THERMAL EFFECT OF THE SUPERHIGH FREQUENCY ELECTROMAGNETIC FIELD.—Bull. Exper. Biol. and Med., 46 (8): 963-966. August 1958.

The temperature of various body tissues was measured in dogs, cats, rabbits, rats, and frogs during exposure to microwave radiations ranging in intensity from 0.01 to 0.3 watt/cm.^{2}. The time curves of body temperature rise and survival time were dependent on the size of animals and on radiation intensity. Differences in survival time were also seen in different species of the same size (cats and rabbits). The greatest temperature rise was observed under the skin. Lethal effects of radiation were not observed at energies below 0.05 watt/cm.^{2}, and heating effects were not observed below 0.01 watt/cm.^{2}.

11414
Tobias, C. A. 1959
RADIATION AND LIFE IN SPACE.—In: Fenn, W. O., Symposium on Life in Space. Federation Proceedings, 18 (4): 1242-1249. Dec. 1959.

Radiation encountered in outer space, including ultraviolet rays, X-rays, primary cosmic rays (chiefly atomic nuclei), and secondaries (resulting from the breakup of primary particles in the Earth's atmosphere) are described and discussed briefly in relation to their physiological effect on man traveling in space. Some specifications for the path of a space rocket are enumerated. Heavy primary components, cosmic-ray variations due to solar flares, and magnetic storms are also considered. The necessity for the determination of the effects of radiation on man and for the development of adequate shielding devices is stressed.

11415
Tobias, C. A., 1960
and T. Brustad
RADIOBIOLOGICAL STUDIES WITH ACCELERATED HEAVY IONS.—In: Physics and medicine of the atmosphere and space, p. 193-208. New York, etc.: John Wiley and Sons, 1960.

To assess the biological hazards in space flight, it is necessary to know the frequency, energy, distribution, and charge of radiation particles as completely as possible. The basic properties and experiments done with heavy ions are examined. In general, over most of their range, the heavy particles affect animal tissues similarly to X-rays, and the relative biological effectiveness as compared to 250 kv X-rays is close to one. From considerable irradiation work on the vertebrate brain and spinal cord, these conclusions are drawn: (1) The "threshold dose" must be exceeded. (2) Irreversible damage is a function of dose as well as volume of the irradiated region. (3) White matter and hypothalamus are more sensitive to protons, deuterons, and alpha rays than gray matter. (4) When synaptic transfer is involved, nerve tissue is very sensitive. (5) Electroencephalographic changes resembling epileptic seizures are shown after localized irradiation. The necessity for shielding space travelers and various shielding materials are reviewed.

11416
Trapp, R. F., 1960
and E. B. Konecci
SHIELDING AND NUCLEAR PROPULSION. — Advances in the Astronautical Sciences, 5: 25-32. 1960.

The probable radiation environment associated with the utilization of nuclear propulsion systems is presented. Shield requirements are given which should provide habitable conditions for man. Ecological requirements for a space crew are also presented for various degrees of approach to the homeostatic concept. These ecological requirements are, in turn, coupled to the radiation environment in the determination of the shield replacement capability of ecological materials. The major conclusion derived from the study is that the vital sustenance material serves best as shielding from direct radiations and may provide considerable weight saving. (Authors' abstract)

11417
Travers, S. 1959
[WOULD THE CIRCUMTERRESTRIAL RADIATION BELTS BE A MORTAL DANGER FOR OUR FUTURE ASTRONAUTS? AMERICAN, RUSSIAN, AND FRENCH EXPERIENCES AND THEORIES] Les ceintures radiatives circumterrestres seraient-elles danger mortel pour nos futurs astronautes? Expériences et théories américaines, russes et françaises.—Fusées (Paris), (14): 155-162. Nov. 1959. In French.

A discussion of the nature of ionizing radiations surrounding the Earth is presented as a conceptual foundation for the prediction of hazards to future astronauts. Subjects considered include the protective effect of the Earth's atmosphere, the role of the Earth's magnetic field in the formation of the Van Allen radiation belts, and the calculated spatial density and electric potential of ionizing particles. Assuming a 1% rate of absorption of high energy particles by the body, maximum exposure is anticipated to be 0.01 roentgen per second, allowing an

exposure time of less than one day. Maintenance of a manned space station is thus precluded unless it can be placed immediately above the atmosphere (400 km.) or between the radiation belts (5,000 km.). It is suggested that a hazard of importance equal to that of cosmic radiation may be produced by high-altitude atomic explosions.

11418
Ubisch, H. von 1961
[TECHNICAL AND MEDICAL ASPECTS OF NUCLEAR-POWERED AIRPLANES: THE ROLE OF NUCLEAR POWER IN THE ATMOSPHERE AND IN SPACE] Tekniska och medicinska aspekter på atomdrivna flygplan. Atomdriftens roll i luften och i rymden. — Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 10 (2): 9-15. 1961. In Swedish.

An evaluation is given of the merits of potential nuclear propulsion systems for aircraft and rockets as well as of small nuclear power plants for auxiliary use in space exploration. The protection of personnel and passengers against gamma and high-velocity radiation is discussed, and the shielding properties of various materials are analysed. Mobile shielding would be required for airplanes even when landed and the reactor is shut down. No significant pollution of the atmosphere is expected from leaking reactors, but accidents constitute a real danger. The prospects of realizing the ion motor and the photon motor are speculated upon.

11419
(USAF Radiation Lab.) 1958
[PHYSIOLOGICAL EFFECTS OF IONIZING RADIATIONS AND PROTECTIVE AGENTS]. — Univ. of Chicago. USAF Radiation Lab., Ill. (Contract AF 41 (657)-25). Quarterly Progress Report no. 26, Jan. 15, 1958. i+126 p.

This is a collection of five papers by various authors concerned with (1) the effects of ionizing radiations on the biochemistry of mammalian tissues; (2) pharmacological and toxicological compounds as protective or therapeutic agents against radiation injury and experimental animals; and (3) the influence of exposure to low levels of gamma and fast neutron radiation on the life span of mice. References are given after each paper.

11420
(USAF Radiation Lab.) 1958
[PHYSIOLOGICAL EFFECTS OF IONIZING RADIATIONS AND PROTECTIVE AGENTS]. — Univ. of Chicago. USAF Radiation Lab., Ill. (Contract AF 41 (657)-25). Quarterly Progress Report no. 28, July 15, 1958. i+170 p.

This is a collection of six papers by various authors concerned with (1) pharmacological and toxicological compounds as protective or therapeutic agents against radiation injury in experimental animals; (2) the influence of exposure to low levels of gamma and fast neutron irradiation on the life span of mice; and (3) the effects of ionizing radiations on the biochemistry of mammalian tissues. References are given after each paper.

11421
Van Allen, J. A. 1961
CORPUSCULAR RADIATIONS IN SPACE. — Radiation Research, 14 (5): 540-550. May 1961.

This study is devoted in particular to geomagnetically trapped corpuscular radiations, the Van Allen Belts. These radiations occur in two belts bisected by the magnetic equator. Their centers lie at approximately 1.6 and 3.4 earth radii respectively. The radiations are typically electron and proton types occurring in fluxes as high as 50 ergs/cm.^{2}/sec. steradian through a 1 mg./cm.^{2} absorber (about 20 r/hr. through 1 g./cm.^{2} of shielding). Space flights within the limits of 40° N. and 40° S. latitude will encounter negligible radiation below 400 km. altitude. Flights above this altitude must use the "cones of escape" over the geomagnetic poles if radiation hazard is to be avoided. The half-angle of these outward-opening cones is about 20°.

11422
Van Allen, J. A. 1960
ON THE RADIATION HAZARDS OF SPACE FLIGHT. — In: Physics and Medicine of the Atmosphere and Space, p. 1-13. Ed. by O. O. Benson and H. Strughold. New York: John Wiley and Sons, 1960.

A discussion is presented of the radiation hazards of space and orbital flight. The principal types of radiation surrounding the Earth are described, including (1) the auroral soft radiation, composed of primary electrons in the energy range below 100 kev. and of the bremsstrahlung which is formed by collision of electrons with the atmosphere which extends to altitudes as low as 50 km. and occasionally 25 km.; and (2) the geomagnetically-trapped corpuscular radiation formed in two principal belts around the Earth, the inner zone consisting of high-energy protons and electrons, with a wide integral range spectrum, and the outer zone of electrons, with an energy spectrum similar to that of the auroral soft radiation. The origin of the inner zone is tentatively attributed to neutron disintegration, and that of the outer zone to the injection and trapping of solar gas into the geomagnetic field. Consideration is given to the following aspects: practical possibilities of manned space flight near the Earth; questions of avoidance of trapped radiation during escape and during orbit; evidence of occurrence of intense radiation showers in a circular 24-hour orbit; significance of the slot between inner and outer radiation belts for short missions; and absence of significant trapped radiation in orbits with a perigee more than 10 to 15 earth radii from the center of the Earth. (37 references).

11423
Vartbaronov, R. A. 1961
[ON RADIATION IN THE AIRPLANE CABIN] O radiatsii v kabine samoleta [Abstract]. — Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 83-84. Feb. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (2): 136. New York: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

The radiation level in a jetplane cockpit was measured by a DP-11-B radiometer attached (a) to the face of the instrument board; (b) to the head, trunk, knee joint, and hand level of the pilot while in the operating position; and (c) to the control wheel in the neutral position. The average total

dose of whole-body irradiation per five-hour flight was between 2.5 to 7 milliroentgens, while that of the hands was 20 mr., which is considerably below the maximum permissible dose. However, in view of the cumulative effects of ionizing radiation, the amount of gamma radiation from the instrument panel should be reduced or entirely eliminated by developing a nonradioactive luminous paint.

11424
Wallace, R. 1961
BIO-RADIOLOGY IN SPACE AND IN THE LABORATORY. —— In: Lectures in aerospace medicine, 16-20 Jan. 1961, [section] 9. 59 p. Brooks Air Force Base, Texas: School of Aviation Medicine, 1961.

The heavy ions present in cosmic rays are discussed as to their physical characteristics and their effects on living systems. Work being done on the biological effects of heavy ions at the present is outlined as to the location where this work is being done, the type of work, and some of the specific biological problems already encountered. The effect of heavy ions is different from that of X-rays. There is evidence for the occurrence of large effects from a single hit on the tissue, as was found in the case of the mouse hair greying. The need for new heavy-ion accelerators of high energy for biological research is stressed. (52 references)

11425
Wallner, L. E., 1961
and H. R. Kaufman
RADIATION SHIELDING FOR MANNED SPACE FLIGHT. —— National Aeronautics and Space Administration, Washington, D. C. NASA Technical Note no. D-681, July 1961. 45 p.

Possible shielding weights and configurations against radiations from space and from nuclear power plants are considered for manned space flights of up to 1½ years duration. A long-term mission (to Mars, e. g.) would encounter cosmic and solar-flare radiations and would require shielding of the order of 10^5 lb. Space assembly and refueling will probably be necessary for such a mission. It is possible that a partial body shield weighing about 100 lb./man would be adequate for short-term space flights using chemical rocket propulsion. The report includes calculation methods, diagrams, and 56 references.

11426
White, R. K., 1958
and W. Lynn Brown
CONDITIONED FOOD AVOIDANCE ON A T-MAZE IN IRRADIATED RATS.—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-48, March 1958. 4 p.

Two groups of rats, one irradiated (with cobalt-60) and one sham-irradiated, were deprived of food for 21 hours before irradiation and 66 hours after irradiation before training on a T-maze. The irradiated group avoided the food arm of a maze a significantly greater number of times than the sham-irradiated group and also significantly more than by chance. This demonstrates that (1) the avoidance motivation of irradiated rats is sufficient to motivate learning on a T-maze; (2) eating during irradiation is not a necessary condition for avoidance behavior at lethal levels; and (3) the value of food shifts from a plus value to a minus value and not to zero. (Authors' summary)

11427
White, W. J., 1958
D. F. Morris, and M. Weinstein
VISUAL THRESHOLDS AFTER EXPOSURE TO ULTRAVIOLET LIGHT.—In: Symposium on Air Force Human Engineering, Personnel, and Training Research, p. 155-161. National Academy of Sciences—National Research Council, Publication no. 516. 1958.

The effects of ultraviolet light on subsequent dark adaptation were investigated in three adult males once each day for two months. Clearly, the addition of the ultraviolet component of a mercury arc lamp results in a delay in the onset of subsequent rod dark adaptation and in an elevation in the absolute threshold above that obtained when these radiations are excluded.

11428
Williams, C. M., 1958
and G. M. Krise
INHIBITION OF POSTIRRADIATION DIURESIS BY VASOPRESSIN IN RATS (Preliminary report).—University of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-77, Feb. 1958. 2 p.

Results with an experiment involving 54 rats (20 controls, 15 irradiated with cobalt-60 and sham-injected, and 19 irradiated, injected with 500 mU. Pitressin) suggest that postirradiation polydipsia and polyuria may be the result of antidiuretic hormone deficiency during the first 24 hours after irradiation.

11429
Winckler, J. R. 1961
PRIMARY COSMIC RAYS. —— Radiation Research, 14 (5): 521-539. May 1961.

A study is made of the characteristics of galactic and solar cosmic rays observed since 1957. Particle energy distributions from 10^8 to 10^{18} ev. have been observed; however, the predominant radiations are 40 to 500 Mev. protons. Measured high altitude dosage rates and inferred free space dosage rates ranged from 4×10^{-4} r/hr. to 7.6×10^3 r/hr. during periods of high activity.

11430
Winckler, J. R. 1961
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. I. SOLAR INFLUENCES ON THE RADIATION FIELD IN SPACE.—Aerospace Med., 32 (10): 893-900. Oct. 1961.

Energy spectra and composition of the solar cosmic rays and the time variations, with resulting implications, about propagation from Sun to Earth are discussed for a series of 14 solar cosmic ray events, most of the larger events (flares) of the period from 1958 through 1960. The events were selected because direct measurements were made on the primary particles with balloons or rockets.

11431
Zellmer, R. W., 1960
and J. E. Pickering
BIOLOGIC EFFECTS OF NUCLEAR RADIATION IN PRIMATES.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-66, Aug. 1960. 11 p.

Macaca mulatta primates were exposed to the neutron and gamma radiation of nuclear detonations as one phase of an extensive animal program designed to yield a better understanding of the biologic effects of ionizing radiation. A field test utilizing ionizing radiation from nuclear devices was chosen to simulate as closely as possible the conditions of dose, dose rate, and radiation distribution that have occurred in human exposures. In both detonations the radiation dose required to produce death in 30 days for 50% of the animals was determined. All animals were followed for acute radiation effects, and where no mortality occurred, they are being followed for long-term effects such as cataract production, bone marrow change, shortening of life span, and carcinogenesis. (Authors' abstract)

11432
Zellmer, R. W., 1961
and R. G. Allen
SYMPOSIUM ON AEROSPACE RADIOBIOLOGY. VIII. COSMIC RADIATION – LABORATORY OBSERVATIONS.—Aerospace Med., 32 (10): 942-946. Oct. 1961.

Forty-eight Macaca mulatta primates were exposed to a beam of 730 Mev protons or 910 Mev alphas focused on the eyes in varying total dosages, from 500 to 2000 rad. The effects of this exposure were evaluated clinically, and from these data estimations were made of the threshold doses necessary to produce iridocyclitis, erythema, epilation, and desquamation. In general, the effectiveness of the alphas appeared less than that of the protons, and the damage that occurred in a milder degree, occurring somewhat later. (Authors' summary, modified)

o. Magnetic and Electric Fields

11433
Eiselein, J. E., 1961
H. M. Boutell, and M. W. Biggs
BIOLOGICAL EFFECTS OF MAGNETIC FIELDS—NEGATIVE RESULTS.—Aerospace Med., 32 (5): 383-386. May 1961.

Attempts to demonstrate a significant biological effect of a sustained magnetic field (8,800 to 14,400 gauss) on 31 mice were unsuccessful. Under the conditions of the experiments, the magnetic field did not alter the rate of growth of an Ehrlich's ascites tumor; it did not significantly change the rate of young male animal growth; and it did not significantly change the white blood cell count. (Authors' summary)

11434
Stroikova, K. V., 1958
and T. I. Beliaeva
THE INFLUENCE OF A HIGH-TENSION, LOW-FREQUENCY ELECTRICAL FIELD ON THE LEVEL OF HIGH-ENERGY PHOSPHORIC COMPOUNDS IN THE SKELETAL MUSCLE OF WARM-BLOODED ANIMALS.—Sechenov Physiol. Jour. USSR (Permagon Press, New York), 43 (5/6): 440-445. [1958].
English translation of item no. 7635, vol. VI.

p. Posture

11435
Bedford, T. H. B. 1958
THE EFFECT OF TILTING FROM THE HORIZONTAL TO THE TAIL UPWARDS POSITION ON THE PRESSURE OF THE CEREBROSPINAL FLUID OF THE DOG [Abstract].—Jour. Physiol. (London), 141 (1): 3P-4P. April 3, 1958.

A study was made of the effect of tilting at an angle of 45° in the tail-up position on the pressure of the cerebrospinal fluid in anesthetized dogs. Tilting was found to produce an initial transient increase in cerebrospinal fluid pressure, followed by a decline to a nearly normal level in 15-30 minutes. Upon return to the horizontal poistion, fluid pressure fell to a level below normal, and then returned slowly to normal. Tilting frequently produced a rise in mean arterial blood pressure of 5-15 mm. Hg, with rapid recovery after return to the horizontal position. The decline in cerebrospinal fluid pressure after the initial rise during tilting is attributed in part to an increased rate of absorption.

11436
Bouisset, S., 1959
H. Monod, and J. L. Pelosse
[THE STANDING POSTURE: PHYSIOLOGICAL EFFECTS AND DAMAGE] La posture debout: effets physiologiques et nuisances.—Travail humain (Paris), 22 (3-4): 247-266. July-Dec. 1959. In French, with English summary (p. 266).

A review is presented of experimental studies on the physiological effects of various postures. The standing posture has been observed to cause an increase in metabolism, cardiac frequency, and blood pressure. Certain body malfunctions, particularly spinal and circulatory disorders, have been shown to be related to prolonged maintenance of the standing posture.

11437
Brody, A. W., 1960
P. S. O'Halloran, H. J. Wander, J. J. Connolly, E. E. Roley, and E. Kobold
VENTILATORY MECHANICS AND STRENGTH: LONG-TERM RE-EXAMINATIONS AND POSITION CHANGE. — Jour. Applied Physiol., 15 (4): 561-566. July 1960.

Pulmonary function tests were performed in normal subjects in the standing, seated, and supine positions and in normal subjects and poliomyelitis patients at intervals during a period of 2-39 months. Significant changes were observed in normal subjects in tidal volume, expiratory reserve volume, inspiratory capacity, and in k_2 (turbulent factor in resistance) with position change. Tidal volume was increased nearly 20% during the change from a sitting (or supine) to a standing position, expiratory reserve volume was decreased during the change from a supine to a standing position or from a standing to a seated to a supine position, and inspiratory capacity was increased 18% during the change from a sitting to a supine position. No significant changes were observed in maximal flow, maximal pressure, elastance, total re-

sistance, or vital capacity. Significant variations were observed with repetition of the tests at intervals of one week or 9 months; no evidence was seen, however, for any systematic effect of training except for an average increase of 20% in maximal pressures.

11438
Brown, J. R., 1959
G. P. Crowden, and P. F. Taylor
CIRCULATORY RESPONSES TO CHANGE FROM RECUMBENT TO ERECT POSTURE AS AN INDEX OF HEAT STRESS.—Ergonomics (London), 2 (3): 261-273. May 1959.

Experiments are described in which Crampton Index values, derived from measurements of blood pressure and pulse rate following change in posture, are related to conditions of environmental heat and to the thermal sensations of resting and working subjects. Changes in the Crampton Index can be used as a measure of the impaired adaptation of the circulation in individuals exposed to conditions of increasing environmental temperature and humidity over a range of 55-100° F. dry bulb and 48-94° F. wet bulb. The absolute values of the index are not considered to be of use in the assessment of physiological stress since a wide range of values was found for individual subjects at rest. Changes in the Crampton Index values, however, were found to be closely associated with changes in sensations of heat and moisture, and marked decreases, e.g., 40 to 50 in the index, were associated with symptoms of thermal stress, such decreases being aggravated by muscular work. (Authors' summary and conclusions, modified)

11439
Caldwell, L. S. 1959
THE EFFECT OF ELBOW ANGLE AND BACK-SUPPORT HEIGHT ON THE STRENGTH OF HORIZONTAL PUSH BY THE HAND.—Army Medical Research Lab., Fort Knox, Ky. (Project no. 6-95-20-001, Task Psychomotor Studies). Report no. 378, March 16, 1959. ii+11 p. AD 212 244

The effect of the elbow angle on the strenth of horizontal push by the hand with different back-rest heights was determined. The strength of the movement was greatly dependent upon both the joint angle and the back-support height. The optimal elbow angle was about 135° or 160°. Little variation existed among the results for the various heights of back support at elbow angles of 60°, 85°, and 110°, but at the 135° and the 160° angles, a high back-support was most efficient. In general, the back-rest should be as high as possible without subjecting the scapulae to large reactive forces when force is applied to the control. A hand control on which a subject must exert forces in the direction measured here should be placed at a distance of approximately 23" from the center of the shoulder, or at a distance which will produce an elbow angle of 150° to 160°. The back-support should be such as to provide a rigid support for the back just below the level of the lower edges of the scapulae. This would be at a height of about 14". (Author's abstract)

11440
Caldwell, L. S. 1960
THE EFFECT OF FOOT-REST POSITION ON THE STRENGTH OF HORIZONTAL PULL BY THE HAND.—Army Medical Research Lab., Fort Knox, Ky. (Project no. 6X95-25-001). Report no. 423, June 10, 1960. ii+[17] p.

The effect of nine foot-rest positions on the strength of horizontal pull by the hand was determined for four elbow angles. At all elbow angles the strength of hand pull increased as the thigh was elevated above the horizontal or as the leg was straightened. The effect of foot-rest position on output increased as the arm was straightened. The knee angle exerted a greater effect on the strength of the hand movement than did the thigh angle. The results were in agreement with the hypothesis that the strength of hand pull is greater when the legs are in the best position for pushing against the foot rest. (Author's abstract, modified)

11441
Caldwell, L. S. 1961
THE RELATIONSHIP BETWEEN THE MAXIMUM FORCE EXERTABLE BY THE HAND IN A HORIZONTAL PULL AND THE ENDURANCE OF A SUB-MAXIMAL RESPONSE. — Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X95-25-001). Report no. 470, April 25, 1961. ii+13 p.

The relationship between measures of maximum force of horizontal pull by the hand and the duration of a sub-maximal holding response at a variety of body positions was studied in ten subjects. Five elbow-angles (95°, 110°, 125°, 140°, and 155°) were combined factorially with 2 thigh-angles (0° and 20°), and 2 knee-angles (110° and 150°) to produce 20 different body positions. At each position each subject was measured to determine his peak force, and the time he could maintain a given force on a dynamometer handle. The magnitude of output to be maintained by each subject at all positions was his peak-output at the least efficient body positions; that is, with the elbow at 95°, the thigh at 0°, and the knee at 110°. There was a small but statistically significant increase in peak strength and duration of the holding response as the thigh elevation was increased from 0° to 20°. Both peak force and duration increased as the legs were straightened, but, again, this influence was fairly small. The effect of the thigh position on these measures was dependent upon the knee-angle. The thigh position decreased in importance as the knee-angle was increased. As the arm was straightened there was an increase in the strength and duration of the holding response. Within the limits employed in this study, it may be stated that whether a person is required to apply a large force to a control for a short period of time, or whether a lesser force must be maintained over longer periods, performance will be best when the leg and arm are almost straight and the thigh is elevated above the horizontal. (From the author's summary and conclusions)

11442
Camp, J. L., 1958
F. Tate, P. B. Lowrance, and J. E. Wood
EFFECT OF POSTURE ON SALT AND WATER RETENTION. I.—Jour. Lab. and Clinical Med., 52 (2): 193-201. Aug. 1958

Measurements were made of urine volume and urinary sodium, potassium, and chloride concentrations 40 minutes after ingestion of a sodium chloride solution in subjects in the reclining or standing position. A decrease in the excretion of water and electrolytes occurred after 5-10 minutes of quiet standing, and persisted for 25 minutes after resumption of the reclining position. Ingestion

of 90 ml. of 100 proof Bourbon whiskey 10 minutes prior to standing inhibited antidiuresis, but did not affect the excretion of sodium and chloride. Potassium excretion decreased with standing, and continued to be decreased in the reclining position. The decline in water and electrolyte excretion with standing was not significantly affected by cerebral congestion produced by a blood pressure cuff around the neck, and was present in patients with bilateral thigh amputation. It is suggested that the postural decrease in water excretion results from the release of antidiuretic hormone by the neurohypophysis, and that the adrenal cortex and the lower extremities are not significant factors in the postural decrease in electrolyte excretion.

11443
Camp, J. L. 1958
EFFECT OF POSTURE ON SALT AND WATER RETENTION. II. APPEARANCE OF A CIRCULATING VASOCONSTRICTOR SUBSTANCE IN THE BLOOD ON ASSUMING THE ERECT POSITION.—Jour. Lab. and Clinical Med., 52 (2): 202-205. Aug. 1958.

Blood and urine samples were taken from three subjects after successive 40-minute periods of quiet standing or reclining preceded by ingestion of a sodium chloride solution. Standing resulted in the appearance of vasoconstrictor activity in the blood, and produced a decrease in urinary volume and sodium, potassium, and chloride excretion. It is suggested that the vasoconstrictor substance produced by standing may be norepinephrine and that it may cause the decrease in electrolyte excretion by modification of renal blood flow.

11444
Craig, A. B. 1960
EFFECTS OF POSITION ON EXPIRATORY RESERVE VOLUME OF THE LUNGS.—Jour. Applied Physiol., 15 (1): 59-61. Jan. 1960.

The expiratory reserve volume (ERV) reflects the resting position of the lungs and thorax and is the most variable subdivision of the lung volume. It was confirmed that the ERV decreased when the subject changed from the sitting to the supine position. When the subject's elbows were supported on the arms of the chair, the ERV increased 3.1% and a further increase was noted when the subject leaned forward in the sitting position. The maximal ERV was recorded in the hands-knee position. To explain these changes, the effect of the weight of the shoulder girdle and of the abdominal contents must be considered. There may also be other effective elastic forces in the abdomen in addition to those elastic forces contributed by the lungs and thorax. (Author's abstract)

11445
Crawford, W. A. 1960
FALSE PERCEPTION OF THE HORIZONTAL AND VERTICAL PLANES IN A DYNAMIC SETTING.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 150 (h), Oct. 1960. 1+4 p.

Man's inability to locate the horizontal when visual and proprioceptive cues are disparate has been demonstrated by a new method. Subjects vary in their estimations and also show a daily variation in any one subject when lying on a couch on his right or left side, respectively. The extent of the error in locating the horizontal varied from 3° to 22° of arc. The location of the vertical was of comparable error. (Author's summary)

11446
Damey, E., and B. Paramelle 1961
EFFECTS OF ORTHOSTATISM ON SPONTANEOUS AND INDUCED CORTICAL ELECTRICAL ACTIVITY IN ANIMALS.—In: Cerebral anoxia and the electroencephalogram, p. 105-111. Springfield, Illinois: Charles C Thomas, 1961.

The effects of experimental orthostatism on arterial pressure and cortical activity were determined in rabbits and dogs in order to understand their physiological predispositions to strong acceleration as passengers in missiles. The sensibility of the intact and anesthetized rabbits to orthostatism varied from animal to animal. In all experimental animals, when the arterial pressure reached 6 to 7 cm. of mercury, the electroencephalogram (EEG) showed a generalized synchronized rhythm of 4 to 5 cycles per second and 10 microvolts. In those rabbits which could not endure orthostatism the rhythm manifested itself in a transient way at the start of orthostatism, paralleling the drop in arterial pressure. Other rabbits endured the test well. Short orthostatism in the anesthetized dogs, whether intact or after the sinus and pneumogastric nerves has been severed, did not lead to any change in the EEG. The EEG was altered only in the case of ligature of the vertebral arteries and clamping of the carotids. (27 references)

11447
Danileiko, V. I. 1961
[ON THE CAUSAL MECHANISM OF BLOOD CIRCULATION AND THE PRESSURE OF THE ATMOSPHERE] Do pytannia pro prychynnyi mekhanizm krovoobihy i tysk atmosfery. —Fiziologichnyi zhurnal (Kyiv), 7 (5): 608-616. Sept.-Oct. 1961. In Ukrainian, with English summary (p. 616).

Electrocardiographic investigations were carried out on 11 adult snakes (Coluber jugularis and Ptyas mucosus) which were kept for a long time in horizontal and vertical positions at normal atmospheric pressure and at a simulated altitude of 12,000 m. The absence of pronounced deterioration of heart function in most animals in the vertical position at simulated altitude refutes the hypothesis that the circulatory function is a result of mechanical pressure exerted by the ambient atmosphere. (Author's summary, modified)

11448
Ferris, B. G., J. Mead, and N. R. Frank 1959
EFFECT OF BODY POSITION ON ESOPHAGEAL PRESSURE AND MEASUREMENT OF PULMONARY COMPLIANCE.—Jour. Applied Physiol., 14 (4): 521-524. July 1959.

In order to assess the effect of body position on esophageal pressure and pulmonary compliance, esophageal pressures were measured by means of a "long" thin-walled balloon at the same lung volumes in different body positions in human subjects. Pulmonary compliance was measured by relating esophageal pressure change to associated lung-volume change. The data indicate that in the supine position false values of esophageal pressure and pulmonary compliance may be obtained. These

false values appeared to be caused by an altered esophageal pressure as a result of gravity pressing other mediastinal structures against the esophagus. In the upright, lateral and prone positions esophageal pressures were similar to each other but different from those obtained in the supine position. These results suggest that measurements of esophageal pressure and pulmonary compliance in recumbent subjects are most reliable when made in the prone or lateral positions. (Authors' abstract)

11449
Gowenlock, A. H., 1959
J. N. Mills, and S. Thomas
ACUTE POSTURAL CHANGES IN ALDOSTERONE AND ELECTROLYTE EXCRETION IN MAN.—Jour. Physiol. (London), 146 (1): 133-141. April 23, 1959.

Aldosterone was assayed in the pooled urine of groups of 3-8 subjects who either remained recumbent for five hours, or stood up for three hours after two hours recumbency. In those who stood, the aldosterone output rose; in those who remained recumbent, or stood in water, the output fell. Subjects who sat either in air or water showed an aldosterone output intermediate between those of lying and standing subjects. Aldosterone injection into recumbent subjects led to very high outputs of aldosterone. Sodium and potassium outputs were determined separately for each subject. Sodium fell on standing in air, and was unaltered by continued recumbency, with or without aldosterone injection, or by standing in water; sitting subjects showed an intermediate response. Potassium output fell in all groups except those injected with aldosterone. The fall was greatest on standing in air, and least in recumbency. The electrolyte behavior is most simply explained by a drop in glomerular filtration rate on standing in air, and an increased tubular secretion of potassium exchange for sodium under the influence of aldosterone. The changes in aldosterone secretion are discussed in relation to volume receptors in the upper half of the body. (Authors' summary) (27 references)

11450
Hall, F. G., 1959
and J. Salzano
EFFECT OF BODY POSTURE ON MAXIMAL INSPIRATORY AND EXPIRATORY STROKE VOLUME. —Duke Univ. Medical Center, Durham, N. C. (Contract AF 33(616)-3821); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-128, March 1959. iii+8 p. AD 212 319
Also published as: MAXIMAL INSPIRATORY AND EXPIRATORY STROKE VOLUMES IN HUMAN SUBJECTS AS RELATED TO BODY POSTURE. — Jour. Aviation Med., 30 (3): 167-172. March 1959.

Timed maximal expiratory and inspiratory stroke volumes were measured in 18 normal young men ranging in age from 19 to 30 years. During these tests, subjects were placed in four postures: standing, supine, head up and and body axis at 45 degrees from horizontal, and head down and body axis at 45 degrees from horizontal. The percentage of maximal stroke volume recorded in each case was at rates unrelated to body posture. Flow rates were nearly linear during the first one-half second of flow. A method for measurement of both inspiratory and expiratory stroke volumes is described. (Authors' abstract)

11451
Jones, F. P., 1961
F. E. Gray, J. A. Hanson, and J. D. Shoop
NECK-MUSCLE TENSION AND THE POSTURAL IMAGE. — Ergonomics (London), 4 (2): 133-142. April 1961.

The "postural images" of comfort, correctness, and height were studied in seven male subjects aged 16 to 21. The image was recorded photographically and electromyographically as the immediate response to a specific verbal stimulus. The response was quantified by measuring the angular relation of head to trunk and the change in electric potential of the sternocleidomastoid and upper trapezius muscles. Both sitting and standing postures were recorded. In addition, the effect on posture of effort (lifting), anticipation of movement, forced respiration, and standing on tiptoe was studied. The data were treated statistically. (Authors' abstract)

11452
Kidd, B. S. L., 1958
and R. V. McCready
EFFECT OF CHANGE IN POSTURE ON THE BLOOD FLOW THROUGH THE FINGERS AND TOES.— Jour. Applied Physiol., 12 (1): 121-124. Jan. 1958.

Heat elimination from the fingers and toes was measured calorimetrically in subjects (1) lying horizontally with the extremities at heart level; (2) standing erect with the extremities dependent; (3) lying horizontally with the leg supported below heart level; and (4) standing erect with the fingers at heart level. No significant changes were observed in heat flow from the fingers, while toe heat elimination was increased slightly when the leg was lowered. It is concluded that large changes in blood flow during changes in posture are prevented by the opposition of centrally-induced reflexes to the local effects of increased transmural pressure.

11453
Kilburn, K. H., 1960
J. McDonald, and F. P. Piccinni
EFFECTS OF VENTILATORY PATTERN AND BODY POSITION ON LUNG VOLUME IN DOGS.— Jour. Applied Physiol., 15 (5): 801-806. Sept. 1960.

The functional residual capacity (FRC) of paralyzed pump-ventilated dogs was measured by open-circuit helium dilution at various rates and volumes of ventilation, and the FRC's of spontaneously ventilated dogs were compared after changes in body position. When tidal volume was constant, increases in rate and minute volume increased FRC. The FRC tended to increase with larger tidal volumes when minute ventilation was constant. An inclination of 30 degrees increased FRC 23.8% above the FRC measured in the horizontal position, whereas a declination of 30 degrees decreased FRC by 65.8%. It is suggested that larger tidal or minute volumes open pulmonary units which are closed by surface tension forces when the volume or duration of inflation is less. Tilting head-up or head-down changes the position of the diaphragm and the abdominal contents in the thoracic 'cylinder' to accommodate more or less gas volume in the thorax. (Authors' abstract)

11454
Knowles, J. H., 1960
S. K. Hong, and H. Rahn
POSSIBLE ERRORS USING THE ESOPHAGEAL BALLOON IN THE DETERMINATION OF PRESSURE-VOLUME CHARACTERISTICS OF THE LUNG AND THORACIC CAGE IN VARIOUS POSTURES.—In: H. Rahn, Studies in pulmonary physiology ..., p. 10-16. Univ. Buffalo School of Medicine, New York (Contract AF 33(616)-5606); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71819). WADD Technical Report no. 60-1, April 1960. viii+153 p.

The simultaneous pressure-volume relationships of the lung, thoracic cage, and total respiratory apparatus in various postures was determined by the esophageal balloon technique to assess the magnitude of the compression artifact observed with this technique in the supine position at various lung volumes, and to describe the interrelationships of the elastic forces in the chest for the entire range of lung volumes. At lung volumes above 50% of the vital capacity, the slope of the three lung pressure-volume curves (supine, prone, and sitting positions) was essentially identical. Below 50% of the vital capacity, the prone and sitting curves remained parallel, while the supine curve was shifted in the direction of decreased pressure (reduction in compliance). A large discrepancy in thoracic cage pressure at small lung volumes was observed for all postures. It is concluded that the effect of posture on the lung pressure-volume curve is negligible and that the difference recorded in the supine position is due to a compression of the esophagus by the mediastinal content, particularly the heart.

11455
Lewis, B. M., 1960
W. T. McElroy, E. J. Hayford-Welsing, and L. C. Samberg
THE EFFECTS OF BODY POSITION, GANGLIONIC BLOCKADE AND NOREPINEPHRINE ON THE PULMONARY CAPILLARY BED. —Jour. Clinical Investigation, 39 (9): 1345-1352. Sept. 1960.

The pulmonary capillary blood volume (Vc) and the diffusing capacity of the pulmonary membrane (Dm) of normal subjects were calculated from measurements of diffusing capacity of the lungs for carbon monoxide in the recumbent and 45° head-up tilted positions during a control period and during the infusion of trimethapan (a ganglionic blocking agent) or norepinephrine. Head-up tilting was observed to produce a fall in Vc, with no change in Dm. Infusion of trimethapan decreased Vc in the recumbent position and accentuated its decrease during tilting. Norepinephrine had no effect on Vc in the recumbent position, but abolished the decrease in Vc during tilting and increased Dm during recumbency. The changes observed in Vc were in the same direction as changes in calculated capillary transmural pressure. It is suggested that the capillary changes which occur during tilting, exercise, and during trimethapan infusion are passive responses of the capillary bed to changes in transmural pressure. The absence of an increase in capillary volume during norepinephrine infusion, when transmural pressure was probably increased, suggests the presence of an active vasomotion under some circumstances.

11456
Lewis, B. M., 1958
J. Heyford-Welsing, W. T. McElroy, and L. C. Samberg
THE MECHANISM REGULATING PULMONARY CAPILLARY BLOOD VOLUME DURING CHANGE IN POSITION [Abstract].—Jour. Lab. and Clinical Med., 52 (6): 922. Dec. 1958.

The volume of blood in the pulmonary capillaries was calculated by measurement of the diffusing capacity of the lungs for carbon monoxide in 6 subjects in the recumbent position and during a head-up tilt of 45°. Tilting was found to produce a decrease in CO diffusing capacity, chiefly because of a decrease in pulmonary capillary blood volume. The decrease in blood volume was greater during infusion of a ganglionic blocking agent (Arfonad), and did not occur during infusion of norepinephrine. It is suggested that pulmonary capillary blood volume is a function of venous return, or right ventricular output.

11457
Mases, P., 1959
R. Falet, and C. Jacquemin
[RESPIRATORY AND CIRCULATORY CHANGES CAUSED BY CERTAIN WORK POSITIONS OF FLYING PERSONNEL IN FLIGHT] Modifications respiratoires et circulatoires engendrées par certaines positions de travail du personnel navigant au cours du vol.—Médecine aéronautique (Paris), 14 (1): 1-3. 1959. In French, with English summary (p. 3)

Crouching positions adopted in some flight situations interfere with circulatory and respiratory functions. In studies of subjects in crouching and in normal seated positions, the following respiratory change has been observed: (1) a reduction in vital capacity (of the order of 15% in relation to values obtained in the normal seated position) and an increase in tidal volume; (2) a displacement of the thoracic mid-position with an accompanying modification of respiratory exchange; (3) a tendency toward rise in oxygen consumption; and (4) a reduction in respiratory quotient. With the head and shoulders bent forward in a position equivalent to a crouch, it was observed that the cardiac frequency was not appreciably changed, but return blood flow was impaired. The amplitude of the arterial pressure tracing diminished because of elevation of the minima. These findings suggest that crouching positions alter reciprocal effects produced between respiratory and circulatory functions with a concomitant modification of the ventilation-perfusion ratio in the lungs.

11458
Miyahara, M., 1961
and S. Rodbard
EFFECT OF TILTING ON RK TIME IN NORMAL SUBJECTS AND IN PATIENTS WITH HEART DISEASE. —Amer. Heart Jour., 62 (3): 401-405. Sept. 1961.

The time from onset of the R wave of the electrocardiogram to the registration of the arterial compression sound of Korotkoff at diastolic pressure level (RK_D time) was measured before and after passive changes in posture in normal subjects and in patients with heart disease. In normal subjects the RK_D time was significantly prolonged after they assumed the upright position and shortened to control values when they returned to the

horizontal position. These effects were diminished by compression of the calves, thighs, and abdomen of the subject with an antigravity suit. It is suggested that in normal subjects with a relatively constant level of diastolic pressure, RK_D time varies inversely with the stroke volume. (From the authors' summary)

11459
Moreno, F., and H. A. Lyons 1961
EFFECT OF BODY POSTURE ON LUNG VOLUMES. — Jour. Applied Physiol., 16 (1): 27-29. Jan. 1961.

The changes produced by body posture on total lung capacity and its subdivisions have been reported for all positions except the prone position. Twenty normal subjects, twelve males and eight females, had determinations of total lung capacity in the three body positions, sitting, supine and prone. Tidal volume, minute ventilation and O_2 consumption were also measured. The changes found on assumption of the supine position from the sitting position were similar to those previously reported. For the prone position, a smaller inspiratory capacity and a larger expiratory reserve volume were found. The mean values were changed, respectively, -8% and +37%. Associated with these changes was a significant increase of the functional residual capacity by 636 ml. Ventilation did not change significantly from that found during sitting, unlike the findings associated with the supine position, in which position the tidal volume was decreased. Respiratory frequency remained the same for all positions. (Authors' abstract)

11460
Riley, R. L., S. Permutt, S. Said, M. Godfrey, T. O. Cheng, J. B. L. Howell, and R. H. Shepard 1959
EFFECT OF POSTURE ON PULMONARY DEAD SPACE IN MAN.—Jour. Applied Physiol., 14 (3): 339-344. May 1959.

Physiologic dead space was determined in the supine and upright postures by simultaneous sampling and subsequent analysis of arterial blood and expired gas for P_{CO_2}. In seven normal men there was invariably a higher dead space in the upright than in the supine position. The difference averaged 83 ml. and was statistically significant (S.E. 25 ml. and $P < 0.01$). The ratio of dead space to tidal volume also invariably increased on assuming the upright posture. Evidence is presented for believing that most of the change in physiologic dead space resulted from the change in alveolar dead space. Estimated changes in the ratio of alveolar dead space to alveolar tidal volume suggest that approximately one-seventh of the total number of alveoli became nonperfused on changing from the supine to the erect posture. These findings are consistent with bronchospirometric and hemodynamic evidence that the apex of the lung is virtually nonperfused in the resting human subject in the upright posture. (Authors' summary)

11461
Robinson, F. R., and R. L. Hamlin 1961
THE ELECTROCARDIOGRAM AND VECTORCARDIOGRAM OF NORMAL MACACA MULATTA IN DORSAL-SUPINE, RIGHT-LATERAL, LEFT-LATERAL, AND SITTING POSITIONS. — Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723101). ASD Technical Report no. 61-738, Dec. 1961. iii+13 p.

Results are presented of studies designed to elucidate normal electrocardiographic and vectorcardiographic values for monkeys (Macaca mulatta) in the most frequently used positions in biological experimentation as well as in the dorsal supine position. These baselines will be used in the immediate future to detect electrocardiographic and vectorcardiographic changes that may be induced in monkeys involved in lateral-impact studies where they will be subjected to high-g forces in a position which may make the heart vulnerable to trauma.

11462
Solley, C. M. 1960
INFLUENCE OF HEAD TILT, BODY TILT, AND PRACTICE ON REDUCTION OF ERROR IN PERCEPTION OF THE POSTURAL VERTICAL.—Jour. Gen. Psychol., 62 (1): 69-74. Jan. 1960.

It was hypothesized that subjects improve with practice in their accuracy of perception of the postural vertical in complex test conditions. Four groups of six subjects each were used. Two conditions of body tilt—either 30° to the right or 30° to the left—were studied as well as two conditions of head tilt—either 30° to the right or 30° to the left. A given subject was always tilted in one direction with one direction of head tilt. Each subject had to return himself to the point where he perceived himself as aligned with true vertical on each of 30 trials. It was found that there was a significant reduction of error in perception of the postural vertical with practice, that right and left head tilts produced significantly different results, that there was a significant interaction between head tilt and trials, and that there was a significant interaction between head tilt, body tilt, and trials.

11463
Thomas, S. 1959
EFFECTS OF CHANGE OF POSTURE ON THE DIURNAL RENAL EXCRETORY RHYTHM.—Jour. Physiol. (London), 148 (3): 489-506. Oct. 1959.

In experiments performed at different times of day on five subjects, urinary electrolyte outputs were determined for several hours before and after change of posture and compared with outputs in experiments in which initial posture was maintained. In continued recumbency, diurnal rhythmic changes in urine outputs were accompanied by spontaneous rhythmic variations in the Na:K ratio. Renal responses to change of posture at all times of day, but against a background of rhythmic variations in renal electrolyte excretion. At all times of day the sodium retention caused by standing up was associated with an increased hydrion excretion, and the sodium diuresis caused by lying down with a decreased hydrion excretion, particularly on prolonged maintenance of the new posture. The Na:K ratio decreased after standing up and increased after lying down. Prolonged maintenance of the new posture was associated with an increasing tendency to change in potassium excretion in the opposite direction to change in sodium excretion. It is concluded that, in addition to any change in excretion due to alteration in glomerular filtration

rate, the renal response to change of posture involves a specific tubular ion exchange of sodium for hydrion and potassium. (From the author's summary)

11464
Whitney, R. J. 1958
THE STRENGTH OF THE LIFTING ACTION IN MAN.—Ergonomics (London), 1 (2): 101-128. Feb. 1958.

The maximum isometric force exertable on a horizontal bar situated in a frontal plane was found to vary, for eight young male subjects and for the different lifting conditions observed, from 15 to 120 kg. Increase of foot placement distance from 30 cm. to 50 cm. effected the largest reduction in lifting force. The reduction produced by increase of grasp height from 12-1/2 cm. to 50 cm. was very much less, and the effect of type of grasp (overhand or underhand) and type of lifting action (using or not using knee extension) was generally small. It appeared that the magnitude of the lifting force was largely determined by the magnitude of the force moment which the body mass could exert to counter-balance the reaction of the lifting force upon the body. The nature of the muscular activity associated with this stabilization of the body during lifting operations is discussed. (Author's abstract)

11465
Woellner, R. C., 1958
and A. Graybiel
REFLEX OCULAR TORSION IN HEALTHY MALES.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 17 01 11, Subtask 1). Report no. 47, July 30, 1958. ii+12 p.

In five normal subjects ocular torsion was determined using a method of subconjunctival sutures. Torsion was found to average 1.6° for 15° lateral tilt, 2.8° for 30°, 3.2° for 43°, and 4.2° for 66°. Torsion for a corresponding change in direction of force but an increase in magnitude of force on the human centrifuge was 2.9° for 30°, 4.8° for 43°, and 8.4° for 66°. If these results are analyzed in terms of lateral force acting on the body, the torsion is found to be proportional to lateral force rather than to the angle. This is in accord with the current theory of otolith organ function. (Author's summary)

1466
Yamazaki, T. 1960
[STUDY ON THE RESPONSE OF THE OPHTHALMIC ARTERY WAVE TO DYNAMIC ACTION. I. VARIATIONS DURING POSTURAL ALTERATIONS] Rikigakuteki sayō ni taisuru gandōmyaku myakuha no kenkyū. 1. Taii henkan ni yoru henka ni tsuite. — Japanese Defense Forces Med. Jour. (Tokyo), 7 (5): 1-5. May 1960. In Japanese, with English abstract (p. 4-5).

Investigations were made of ophthalmic artery responses to changes in posture in an effort to gain insight into the possible effects that positive and negative accelerations may have upon cerebral blood circulation. With the subject lying on his back in a freely-tilting (up and down) bed, observations were made of variations in the curve of the ophthalmic artery wave during the following three positions: head-high (angle of tilt: +30°), horizontal, and head-low (angle of tilt: -30°). As the postural alterations proceeded from head-high to head-low positions, two types of curves were observed: one in which the first elevation remained as the highest peak, and the other in which the highest peak was maintained by a second elevation. Subjects exhibiting the two-peak type of curve showed a large variation in pulse pressure and some abnormalities in the circulation. (From the author's abstract)

q. Other Agents

11467
Alexander, H. S., 1959
and W. D. Chiles
AN EXPLORATORY STUDY OF PROLONGED INTERMITTENT PHOTIC STIMULATION.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71580). WADC Technical Report no. 59-715, Nov. 1959. iii+6 p.

In order to investigate the resistance of the human operator to effects of intense, flashing lights for prolonged periods of time, four subjects were exposed to very bright intermittent photic stimulation at 5, 10, and 15 cycles per second for a period of 2.5 hours. None of the subjects suffered any adverse subjective or behavioral effects, although all became somewhat drowsy from time to time, presumably as a result of the boring nature of the situation. After about one hour of stimulation, all four subjects showed definite evidences of electroencephalographic responses to the lights. (Authors' abstract)

11468
Anderson, R. S., 1959
F. W. Stemler, R. F. McHugh, and E. B. Rogers
AIR BLAST STUDIES WITH ANIMALS.—Chemical Warfare Labs., Army Chemical Center, Md. CWLR Report no. 2288, July 1959. 23 p. AD 215 403

The damage to be expected in man due to the long duration blasts from bombs is not known at present. As a step in obtaining such information a study of the extent and nature of injuries to large and small animals exposed to air blast in the large shock tube at the Ballistics Research Laboratory, Aberdeen Proving Ground, is under way. The first phase of the study, reported here, has been a pilot study to test the feasibility of getting data useful in field problems from shock-tube experimentation and has been accomplished with a minimum of change in the tube. Single goats, rabbits, or groups of mice were exposed in the tube under a number of conditions which varied, especially the extent of animal translation and the shock-front characteristics. A few of the goats were seriously injured or killed when exposed to the full blast effect of the maximum pressure available in the 4-ft. section of the tube. The most serious injuries probably resulted from translation and occurred even though deceleration, the most damaging phase, was relatively slow across a grassy pasture. Also with the smaller animals, rabbits and mice, translation seemed to be the major factor in producing deaths since when translation was reduced by side chambers but few animals were killed. The velocities given to goats at a fixed blast pressure were fairly consistent and depended on the initial orientation of the animals. (Authors' summary)

11469
Brebner, D. F., 1958
D. M. Kerslake, and J. L. Waddell
THE EFFECT OF ATMOSPHERIC HUMIDITY ON THE SKIN TEMPERATURES AND SWEAT RATES OF RESTING MEN AT TWO AMBIENT TEMPERATURES.—Jour. Physiol. (London), 144 (2): 299-306. Dec. 4, 1958.

Skin temperature, mouth temperature, and sweat rate were measured in three resting subjects after exposure for 40-60 minutes to dry-bulb temperatures of 36° or 40° C. and humidities of 10 to 50 mm. Hg. Humidity was found to have little effect on the values measured below 33 mm. Hg at 40°, and 37 mm. Hg at 36° Above the critical humidity level, small changes in humidity were associated with large changes in body temperature and sweat rate. Equivalence in the effects of various temperatures and humidities could not be predicted by "effective temperature", but was successfully described by the "Four Hour Sweat Rate Index" of McArdle.

11470
Campbell, B. A., 1961
and R. A. Williams
ACTIVITY, WEIGHT LOSS, AND SURVIVAL TIME OF FOOD-DEPRIVED RATS AS A FUNCTION OF AGE. — Jour. Compar. and Physiol. Psychol., 54 (2): 216-219. April 1961.

Rats of four different age groups (23, 38, 54, and 100 days) were placed in rectangular, tilt-operated activity cages two days prior to food deprivation. Daily records were made of activity, as shown by the number of counts (cage tilts), and body weight; recordings were made also for the number of days of survival for each animal. An abrupt and rapid rise in activity from the onset of deprivation was observed in 23-day-old animals, but in succeeding age groups the rise occurred later, until, at 100 days of age, no sizable increase in median activity was found. Rate of weight loss during food deprivation decreased with age. Survival time increased directly with age (the 23-day-old animals lived an average of only four days; 100-day-old ones lived twelve days). Death occurred when weight loss reached 43% regardless of the age of the animals. It is suggested that the severity of food deprivation for rats ranging in age from infancy to maturity is proportional to percent of weight loss.

11471
Campbell, B. A. 1960
EFFECTS OF WATER DEPRIVATION ON RANDOM ACTIVITY. —Jour. Compar. and Physiol. Psychol., 53 (3): 240-241. June 1960.

The activity of rats deprived of water for 96 hours was measured during 17 days in which a water ration was provided once daily following a one-minute dark stimulus. Activity was increased rapidly during the one-minute stimulus period and only slightly over the 24-hour total daily activity period during total water deprivation. Total and one-minute stimulus activity was decreased for several days after daily provision of water was initiated. On the fourth day, one-minute stimulus activity began a sharp seven-fold increase, while total activity declined to control values. The findings support the hypotheses that deprivation lowers response thresholds to external stimulation, and that a heightened motivational state occurs when a consummatory response is elicited by conditioned stimuli in the absence of a consummable stimulus.

11472
Carr, R. M., 1959
J. E. Overall, R. K. White, and W. Lynn Brown
THE EFFECTS OF FOOD DEPRIVATION AND RESTRICTED ACTIVITY UPON EXPLORATORY BEHAVIOR OF THE RAT.—Jour. Genetic Psychol., 95 (2): 321-328. Dec. 1959.

Thirty-six male albino rats were divided into two groups, with one group being maintained on a 23-hour food deprivation schedule throughout the experiment. Each subject was "confined" preceding one experimental period, and "not confined" preceding the other. The subjects were placed in the Y-maze at the choice point and allowed to explore for 10 min. on two consecutive days. Records were made of the number of 12-inch units explored per minute and of the orderliness of exploration. The experimental results support these hypotheses: (a) a reduction in exploration over time, (b) a decrement in exploration due to an internal drive arising from restricted activity, (c) no difference in orderliness of exploration between either the deprived and undeprived or confined and not confined animals; and (d) a suggestion of a decrement in exploration due to the internal drive aroused by food deprivation. (Authors' summary, modified)

11473
Chernomordikov, V. V. 1961
[AIR HUMIDITY AS AN ECOLOGIC-PHYSIOLOGICAL FACTOR] Vlazhnost' vozdukha kak ekologo-fiziologicheskii faktor. — Dokiady Akademii nauk SSSR (Moskva), 140 (4): 935-937. Oct. 1961. In Russian.

The effect of humidity during moderate environmental temperatures was investigated with groups of black rats and Norwegian rats, as well as selected species of birds. The air temperature was maintained between 15-21° C. Relative humidity was varied on different days from 40% to 80%. Total caloric value of the food consumed in a 24-hour period was used as an index of the metabolic requirements. In both species of rats the daily food requirement varied inversely with the relative humidity in the room; in Norwegian rats the maximum variance was 13.5%, in the black rats this difference was 60.9% partly due to the younger age level. The food requirement for birds increased at first with the increase in relative humidity, stayed at a plateau, and then increased once more.

11474
Chiles, W. D., 1960
J. M. Cleveland, and R. E. Fox
A STUDY OF THE EFFECTS OF IONIZED AIR ON BEHAVIOR. — Wright Air Development Division. Aerospace Medical Division, Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 71620); and Physics, Engineering and Chemistry Corp., Boulder, Colo. (Contract AF 33(616)-5839). WADD Technical Report no. 60-598, Nov. 1960. iii+20 p.

The effect on human behavior of an atmosphere containing excesses of unipolar ions was investigated. Fifteen subjects were tested on a complex mental task, an additional fifteen performed a vigi-

lance task, and twenty subjects indicated their attitudes through marking an adjective check list while exposed to five levels of air ionization. The ion conditions for each study were varied from a high excess of positive ions through a medium excess of positive ions, low ion (neutral), medium negative, and low negative. None of the differences found among the ion conditions for these tests were statistically significant. (Authors' abstract) (38 references)

11475
Davis, T. R. A., and A. D. Matzger 1960
THE COOLING EFFECT OF WIND ON THE LITTLE FINGER. — Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001). Report no. 440, Dec. 28, 1960. i+13 p.

A study of the cooling effect of combinations of wind velocity and temperature upon the little finger of man indicates that, in humans as in animals, the rate of cooling is highly variable and that only mean patterns of cooling can be established. The cooling rate of tissues bears no predictable relationship to the occurrence of actual freezing. In increasing the rate of cooling from 25° C. to 5° C., the influence of wind is greatest at velocities under 10 miles per hour. The cooling effect of wind can be expressed on a log to log relationship at least for wind velocities up to 25 miles per hour and for temperatures between -5° C. and -35° C. (Authors' abstract)

11476
Eichmeier, J., J. Rheinstein, and H. Schmeer 1959
INVESTIGATION OF THE POSSIBLE INFLUENCE OF ATMOSPHERIC IONS ON HUMAN REACTION TIME.—Technische Hochschule. Institut für Technische Elektronik, Müchen, Germany (Contract DA-91-508-EUC-268). Final Technical Report for 1958, [1959]. 42 p. AD 210 761

The effects of artificially generated atmospheric ions on human reaction time were investigated by the push-button method and by encephalographic reaction time measurement. By the push-button method, an effect due to ions was obtained but neither its magnitude nor its direction was reproducible for the same individual. The effects on latency, or visual reaction time, as measured by an encephalographic method, may be hidden by statistical variations. No conclusive results were obtained of the influence of oxygen deficiency in the presence of ions in a low-pressure chamber. The small ion counter equipment is described, and its sensitivity is presented.

11477
Frey, A. H. 1961
HUMAN BEHAVIOR AND ATMOSPHERIC IONS. — Psychol. Review, 68 (3): 225-228. May 1961.

Research on behavioral effects of atmospheric ions is reviewed. Negative ionization has been shown to affect critical flicker fusion, restoration of visual purple, tinnitus, perception of thermal pain, electroencephalogram, muscle chronaxia, and reaction time. Positive ionization increased reaction time. Negative ion environment reportedly increased activity of rats, raised work capacity of athletes, increased duration of grip on the dynamometer, and endurance on treadmill. Positive ionization increased variability of individuals on the Minnesota Formboard. Results from experiments on learning are ambiguous. A possible explanation for the differential effect of positive and negative ions on behavior may lie in promotion of release of free serotonin or acceleration of its oxidation.

11478
Frey, A. H. 1961
A RATIONAL FRAMEWORK FOR INTERPRETING THE BEHAVIORAL EFFECTS OF ATMOSPHERIC IONS. — IRE Trans. Bio-Med. Electronics, BME-8 (1): 12-16. Jan. 1961.

It is suggested that men in space vehicles will be subjected to substantial doses of atmospheric ions produced by the action of cosmic radiation, solar flares, and Van Allen radiations on the air supply of the space cabin. These atmospheric ions apparently have a significant effect upon man' s performance. Behavioral observations in past studies indicate that negative ions normalize subjects under various stresses and that positive ions have debilitating effects. A brief review of the behavioral effects and of the nature of atmospheric ions is given, and a framework for interpreting previous experiments is offered. It is hypothesized that negative ions stimulate the secretion of gluco-corticoids, and positive ions either stimulate the secretion of the mineralo-corticoids or inhibit the gluco-corticoid secretion. The literature on the differential secretion of corticoids and on the similarities between corticoid and ion effects during various stressful conditions is reviewed.

11479
Hamburger, R. J. 1958
[THE METEOROLOGIC INFLUENCE UPON THE PHYSICAL EFFICIENCY INDEX] Meteorologische invloeden op de physical efficiency index. — Aeromedica acta (Soesterberg, Netherlands), 6: 191-194. 1958. In Dutch.

A group of 704 pilot candidates were observed in their reactions to a variety of meteorological conditions (hot and humid, sunny and humid, low air pressure, fluctuating air pressures, cold and hot front passages, etc.). The following correlations between meteorological conditions and Physical Efficiency Index (P.E.I.) were observed: (1) Cold-front passages brought about significant deviations of the P.E.I. These deviations could be positive or negative, which is in agreement with the theory that biotropic factors exert their influence upon the vegetative lability in general rather than in any specific direction. (2) The distribution of the P.E.I. values on days with varying meteorological characteristics did not differ significantly from the expected one. (3) The number of electromagnetic impulses in the atmosphere (wavelengths 6-100 km., frequency 3000-50,000 kc.p.s.) showed no clear correlation with the P.E.I. However, on days with high indices the impulses were lower than expected and vice versa.

11480
Hamlin, R. L., F. R. Robinson, and C. R. Smith 1961
ELECTROCARDIOGRAM AND VECTORCARDIOGRAM OF MACACA MULATTA IN VARIOUS POSTURES. — Amer. Jour. Physiol., 201 (6): 1083-1089. Dec. 1961.

Electrocardiograms and vectorcardiograms of 11 normal monkeys placed in dorsal-supine, right lateral, left lateral, and sitting positions were analyzed. Initial forces were directed cephalad, dextrad, and ventrad. Intermediate forces were directed caudad and slightly sinistrad, and either dorsad or ventrad. Terminal forces were directed cephalad, dextrad, and dorsad. (Authors' abstract)

11481
Holečková, E., and P. Fabry 1959
HYPERPHAGIA AND GASTRIC HYPERTROPHY IN RATS ADAPTED TO INTERMITTENT STARVATION. —Brit. Jour. Nutrition (London), 13 (3): 260-266. 1959.

Adult female rats adapted to intermittent starvation for 17 weeks demonstrated, with gradually increasing periods of fasting, a gradually increasing intake on the days of free access to food. In the last week of the experiment, the adapted animals ate on the average of 112 g. of food in two 1-day portions, whereas non-starved rats ate on the average 133 g. of food in seven daily portions. The increased quantity of food eaten in one portion led to gastric hypertrophy. This condition was first apparent after 6 weeks of intermittent starvation but gradually disappeared after refeeding. Gastric hypertrophy developed even though there was loss of body weight. No pathological changes in the gastric mucosa were found. (From the authors' summary)

11482
Johnson, B. C., V. Fiorica, M. S. Mameesh, and G. S. Smith 1961
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION. — Univ. of Illinois, Urbana; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-12). Technical Report no. 60-32, Oct. 1961. 17 p.

Young swine were subjected to repeated episodes of starvation and refeeding in which the starvation phases were terminated by short periods of pure nutrient feeding. Cardiovascular responses to the various dietary manipulations were followed daily throughout the 18-month study. Tachycardia and apparent impairment in the blood pressure control mechanisms, as evidenced by extreme daily fluctuations upon refeeding, were immediately evident when the animals were refed with pure glucose, high-glucose diets, or a complete, natural diet. Similar effects of lesser severity accompanied the refeeding with pure protein, but were not observed in conjunction with pure starch or corn oil refeeding. Extreme hypertension and ventricular strain, as well as aortic placques and histological evidence of myocardial degeneration were observed, apparently as a consequence of the repeated refeeding stresses. (From the authors' abstract)

11483
Knoll, M., J. Rheinstein, G. F. Leonard, and P. F. Highberg 1961
INFLUENCE OF LIGHT AIR IONS ON HUMAN VISUAL REACTION TIME. — IRE Trans. Bio-Med. Electronics, BME-8 (4): 239-245. Oct. 1961.

An automatic electronic visual-reaction-time meter has been developed which includes a random-pulse generator controlled by nuclear radiation for starting the subject's light pulse. With this instrument (using radioactive ion generators) several hundred subjects have been investigated in over 12,900 tests. An influence of light atmospheric ions on the human reaction time has been found for ion currents between 10^6 and 10^9 inhaled ions per second or ion densities of about 10^3 to 10^6 ions/cm^3. Inhaling positive or negative ions may increase or decrease the reaction time of different people or even of the same person after several hours. In this respect the influence of ions resembles the effect of many drugs on the human system. The effect disappears when the subject is breathing through the nose instead of the mouth. (Authors' summary)

11484
Masoro, E. J. 1961
METABOLISM OF FATTY ACIDS AND RELATED SUBSTANCES IN ANIMALS EXPOSED TO COLD. — Tufts Univ. School of Medicine, Boston, Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska Technical Note no. AAL-TN-61-9, Oct. 1961. 15 p.

In vitro studies of the effects of starvation and feeding on lipogenesis in the rat liver, kidney, and other tissues were carried out. The data obtained indicate that: (1) a loss of lipogenic enzymes is not the primary defect in the reduction of lipogenesis during fasting; (2) the role of coenzyme-A during fasting should be further studied; (3) the intercapsular brown adipose tissue exhibits high lipogenic activity; (4) the liver and gastrointestinal tract contains less than 10% of newly-synthetized fat; (5) there is a marked heterogeneity in the ability of white adipose tissue to synthesize fatty acids; and (6) the brain contains little newly-synthesized fatty acids at early time intervals but a considerable amount after 24 hours. A quantitative re-evaluation of the importance of adipose tissue in the biosynthesis of fatty acids appears necessary, since the data indicate that extra-adipose tissues of the rat are major contributing sites in the biosynthesis of fatty acids.

11485
Morin-Jomain, M., J. Trémolières, J. Abraham, O. Champigny, and R. Jacquot 1961
[EFFECT OF PERIODIC DIETARY RESTRICTIONS ON THE NUTRITIONAL BEHAVIOR OF THE WHITE RAT: LIVING WEIGHT, NITROGEN BALANCE, ENERGY EXPENDITURE] Influence de restrictions alimentaires périodiques sur le comportement nutritionnel du rat blanc: poids vif, bilan azoté, dépense énergétique. — Comptes rendus de l'Académie des sciences (Paris), 252 (20): 3142-3144. May 15, 1961. In French.

During the periods of rehabilitation following periods of dietary restriction, rats showed a gain in weight and nitrogen retention greater than that of animals eating ad libitum. Inanition produced immediate and more severe effects in animals fed ad libitum than in animals subjected to discontinuous feeding.

11486
Quay, W. B. 1961
REDUCTION OF MAMMALIAN PINEAL WEIGHT AND LIPID DURING CONTINUOUS LIGHT. — Gen. and Compar. Endocrinol., 1 (3): 211-217. Sept. 1961.

Continuous artificial illumination for four weeks in comparison with 14 hours of light per day leads to significant reductions in lipid content and lesser reductions in wet and dry weights of pineals in subadult and adult rats and in adult hamsters. This pineal response is not affected by increased consumption of NaCl or KCl nor by adrenalectomy, but is blocked by bilateral intraorbital transection of the optic tracts. It is suggested that continuous light in these experiments may be a type of chronic stress and may affect the pineal by way of a neural route including the lateral eyes, brain stem and nervi conarii. (Author's abstract)

11487
Smith, G. S., 1961
and B. C. Johnson
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION. X. AD LIBITUM REFEEDING OF GLUCOSE OR STARCH.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-60-29, Feb. 1961. 15 p.

Four young swine were subjected to an initial starvation-refeeding episode to determine the effects of refeeding diets high in either glucose or starch content. The results indicate that carbohydrate is a primary factor which contributes to cardiovascular stresses in refeeding following starvation.

11488
Smith, G. S., 1961
and B. C. Johnson
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION. XI.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-61-1, Sept. 1961. 10 p.

Four young adult swine were subjected to a second long-term starvation episode and refeeding, initially with either pure glucose or pure corn oil and subsequently with diets high in content of either glucose or corn oil. The observations confirm earlier findings; they suggest that starvation-refeeding stresses result in irreversible changes in heart rate and blood pressure. Although both glucose and corn oil are considered stressful, the stress which accompanied refeeding with the corn oil diet was less severe; this may have been due to other components of the diet.

11489
Swearingen, J. J., 1960
and E. B. McFadden
STUDIES OF AIR LOADS ON MAN. — Human Factors, 2 (2): 84-91. May 1960.

Data obtained in three different studies related to measurement of forces on the body due to air movement are summarized. The effects of short duration blast forces on personnel seated or standing at various distances from openings during pressure loss, blast forces necessary to disorient the body from numerous positions, effects of clothing on the drag forces, and measurements of forces and moments on the body during wind tunnel tests are discussed and compared. (Authors' abstract)

11490
Teghtsoonian, R., 1960
and B. A. Campbell
RANDOM ACTIVITY OF THE RAT DURING FOOD DEPRIVATION AS A FUNCTION OF ENVIRONMENTAL CONDITIONS. — Jour. Compar. and Physiol. Psychol., 53 (3): 242-244. June 1960.

An experiment was conducted to determine the relation between activity level and duration of food deprivation under moderately noisy (laboratory) or sound-isolated, stimulus-controlled environmental conditions. Laboratory-housed rats showed a consistently higher activity level during an adaptation period prior to food deprivation. Under terminal food deprivation, laboratory-housed rats showed on the second day a typical increment in daily activity to a maximum level of 400% of the predeprivation level, while sound-isolated rats showed a slight initial decrement followed by a gradual rise to a maximum only 70% above the predeprivation level. The average survival time for the latter group was ten days, while that for laboratory-housed animals was eight days. The results support the hypotheses that activity represents a response to environmental stimulus change and that food deprivation reduces the response threshold. The low level of activity during the early phases of deprivation is attributed to the interaction of lowered response thresholds with the cessation of eating and food-seeking behavior.

11491
Vaughan, D. A., 1961
H. F. Drury, L. N. Vaughan, A. M. Larson, and D. W. Young
ARCTIC SURVIVAL RATIONS. VIII. FURTHER EXPERIMENTS ON PERSISTENCE OF ADAPTATION TO CALORIC RESTRICTION.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-1). Technical Report no. 60-30, May 1961. 7 p.

Twelve adult men were divided into two equal groups and for 5 days were fed a daily 1000-Calorie diet consisting either of 168 grams of pemmican, or 140 grams of pemmican with 40 grams of sugar. Following a "recovery" period of 7 days (ad libitum food intake), all men were fed 168 grams of pemmican for another 5-day period. Various blood and urine metabolites were measured during both experimental periods. It was found that, contrary to a previous report, these subjects did not exhibit a "carry-over" effect from one period of semistarvation to the next. Differences in caloric expenditure between this experiment and the one cited above are given as a possible explanation of this discrepancy. Comparisons made on the basis of body weight indicated that "overweight" subjects maintained higher blood sugar levels and excreted less ketones than did "normal" subjects. (Authors' abstract)

11492
Young, D. R. 1959
EFFECT OF FOOD DEPRIVATION ON TREADMILL RUNNING IN DOGS.—Jour. Applied Physiol., 14 (6): 1018-1022. Nov. 1959.

Effect of food deprivation on endurance capacity was studied in dogs under the following conditions: (a) 3 and 5 days of fasting with daily high levels of energy expenditure, and (b) 15 days of fasting with low daily levels of energy expenditure. Relative maximum performance, i.e., endurance capacity under conditions wherein work dehydration is a limit-

ing factor, is unaffected by 10-15% body-weight loss and hypoglycemia induced by acute food deprivation. Even with weight loss up to 22%, capacity for daily moderate levels of work is well maintained. Absolute maximum performance (water-provided exhaustive treadmill running) improves with 5 days of fasting. Associated with 74% increase in endurance capacity, there is an increased mobilization of body tissue for fuel for the working muscles and a large increase in the post-exercise blood glucose concentration. The dog is resistant to starvation ketosis. In animals tested for absolute performance capacity, the average cumulative calorie deficit, including the exhaustive running trial, was 7500 calories; yet there was no significant change in the level of blood acetone. It is concluded that absolute performance in the dog increases with 5 days of food deprivation; this response is mediated by a unique permissive effect of such treatment particularly on ability to mobilize body energy reserves. (Author's abstract)

7. PERSONNEL

[General psychological aspects under 5]

a. General

11493
Brokaw, L. D., 1960
and F. E. Holdrege
QUALIFYING APTITUDE MINIMUMS AS A FUNCTION OF RECRUITING AND TRAINING OBJECTIVES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Texas, (Project no. 7717, Task no. 87006). WADD Technical Note no. 60-134, May 1960. ii+5 p.

This paper discusses the interrelationships between desired performance of technical training graduates, the length, content, and training standards of the course, and the aptitude qualification of the entrants into the training. The impact of shifting the cutting score upon the characteristics of the other factors in the production of airmen trained to the requisite level is examined. The relationships between scores on selection or classification instruments and measures of proficiency, such as a final school grade, are described. (Authors' abstract)

11494
Folley, J. D., 1960
J. B. Fairman, and Edna M. Jones
A SURVEY OF THE LITERATURE ON PREDICTION OF AIR FORCE PERSONNEL REQUIREMENTS. — Amer. Inst. for Research, Pittsburgh, Pa. (Contract AF 33(616)-6427); issued by Wright Air Development Division. Aerospace Medical Division, Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7190). WADD Technical Report no. 60-493, July 1960. iv+384 p. 7190).

A review and 121 abstracts of the professional, unclassified literature concerning methods of personnel requirements for future Air Force weapon systems are presented. The emphasis of the survey is placed on methods and procedures for the derivation of personnel requirements information and on supporting methodological rationales. It is concluded that fairly thorough procedures are available for the description of tasks and positions and for the combination of tasks into positions. Little attention has been given to the evaluation of techniques or to the determination of criticality of tasks, and only one report discovered describes a procedure for the estimation of manpower requirements. Most attention has been directed toward the rating of skill levels rather than toward an objective determination of skill requirements.

11495
Gentry, T. G. 1958
THE RELEVANCY OF CURRENT PHYSICAL CERTIFICATION REQUIREMENTS TO PILOTS' HEALTH AND SAFETY.—Skyways, 17 (11): 14-16, 44-46, 54, 62, 68. Nov. 1958.
Reprinted in: Jour. Aviation Med., 30 (1): 38-48. Jan. 1959.

A forum discussion was held during an annual meeting of the Flying Physicians Association (at Montonk Manor, Long Island, N. Y.) on current standards of physical examinations for civil aviation pilots. The wide range, from a thorough executive-type physical examination offered to pilots by some companies to a screening-type examination given by CAA examiners, was contrasted with the strict physical requirements in military aviation. The feasibility of requiring ophthalmological examinations and yearly electrocardiograms for pilots reaching a certain age was discussed. Dr. Leet emphasized the necessity of psychological tests to reject individuals with undesirable personality traits, behavior disorders, accident proneness, or emotional disturbances, thus preventing possible future accidents. Eighty to ninety percent of all accidents in industry and civilian life occur to approximately 3-5% of such persons. For the purpose of detecting undesirable tendencies, a person's automobile driving habits could be correlated with flying habits. Also, his medical history furnished by him or his family doctor may offer valuable clues. The reliability of physical certificates issued by family physicians was questioned, however, because of the possibility of unduly favorable interpretation of physical requirements for flying as well as unfamiliarity with stresses of flying. The role of visual field, ocular tension level, and ocular fatigue has increased in importance. A tightening of requirements concerning Class-III certificates was recommended to screen out border-line personality deviates. In general, a limited flying status based on health factors, is to be discouraged, because the person would still be subject to identical stresses and emergencies. It was the consensus among the participants that piloting an airplane calls for a stable, competent, mature individual, and that these personality traits are of equal if not greater importance than physical perfection.

11496
Gerd, M., 1961
and H. Gurovskii
[TRAINING OF THE COURAGEOUS: DIFFICULT ON EARTH—EASIER IN SPACE] Trenirovka otvazhnykh: trudnee na zemle—legche v kosmos. — Znanie—Sila (Moskva), 36 (9): 12-14. Sept. 1961. In Russian.
English translation by U. S. Joint Pub. Research Service (Washington), no. 11431, p. 13-28, Dec. 7, 1961.

The unique experience in space of being cut off from the usual auditory, visual, etc. stimulus background on earth is depicted for the lay reader. Much of the feeling of isolation in space may be relieved by playing tape recordings of accustomed background noises, programs, television communication, movies, etc. Selection procedures are illustrated in a description of an astronaut as he goes through testing and recording routines while enclosed for several days in a space-craft simulator. Adherence to the task schedule and timing in a normal fashion characterizes the successful candidate.

11497
Gifford, E. C. 1960
COMPILATION OF ANTHROPOMETRIC MEASURES ON U. S. NAVY PILOTS. — Naval Air Material

Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-437, July 28, 1960. v+[19]p. (Project no. TED NAM AE-1404, Part 1).

Standard anthropometric techniques were utilized to measure 25 different morphological features of 1190 Navy pilots. The accumulated data are presented in tables and graphs and show cross correlation coefficients, percentiles, and frequency distributions of the 25 anthropometric variables. By comparing the percentiles obtained on these variables with other sources of anthropometric data, the author concluded that with respect to some of the more important dimensions, such as functional arm reach and overall height, a significant difference existed between Navy pilots and pilots in the other services. The results of this study are being adapted to the establishment of criteria for the sizing of personnel clothing and equipment and to the determination of aircrew station dimensional requirements.

11498
Graham, A. E. 1959
MEDICAL CERTIFICATION.—Skyways, 18 (11): 15, 61. Nov. 1959.

A general discussion is presented on the physical standards for airmen (U. S. Federal Agency, Civil Air Regulations, Part 29) which were revised without the anticipated public hearing and which are strongly opposed by civil pilots.

11499
Pitts, G. C. 1960
A STUDY OF GROSS BODY COMPOSITION OF SMALL ALASKAN MAMMALS AS COMPARED WITH THOSE FROM THE TEMPERATE ZONE. I.—Univ. of Virginia. School of Medicine, Charlottesville; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 57-46, Sept. 1960. 13 p.

A collection was made of 63 mammals from Alaska and 62 from Virginia. This collection was made under natural conditions and represented 13 families, 25 genera, and 30 species. These mammals were dissected into 11 components (heart, liver, kidneys, spleen, gut, CNS, skin, muscle, bone, adipose tissue, and remainder), and the following values were determined: fresh weight, percentage of fat, percentage of water, and fat-free weight. The distribution of fat and the fractional composition of the fat-free body with respect to the 11 gross components were expressed in tabular form. An indiscriminate plot of data from all specimens reveals that fatness and body size are statistically related, inversely in animals with fat-free body weights below 300 grams, and directly in animals with fat-free body weights above 300 grams. Body fatness and percentage of fat in separable adipose tissue are directly related. No interpretation of these results has been attempted as yet. Statistical and graphical analyses, which will undoubtedly reveal other relationships, are still in the initial stage.

11500
Strollo, M. 1961
[A TYPE OF PROFESSIONAL MONOGRAPH FOR THE AIRPLANE PILOT] Un tipo di monografia professionale per il pilota di aviazione.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 61-68. Roma, 1961. In Italian.

The development and description of a professional questionnaire for pilots is reviewed. The questionnaire emphasizes technology and psychophysiology. It endeavors to analyze the work of airplane piloting as based on professional techniques from written information supplied by the pilot. This information is integrated with that given orally. The questionnaire may be of value in exploring attitudes and personality in the area of psychology applied to work analysis, and in determining characteristics of candidates during selection procedures and occupational orientation.

b. Selection, Classification, and Rating

[*Physical fitness tests under 8-f*]

11501
Ambler, R. K., J. T. Bair, and R. J. Wherry 1960
FACTORIAL STRUCTURE AND VALIDITY OF NAVAL AVIATION SELECTOR VARIABLES.—Aerospace Med., 31 (6): 456-461. June 1960.

The present study was designed to assess the effectiveness of the Aviation Score sheet as an aid in selecting Naval aviation officers. From the 790 subjects selected, the following conclusions are drawn: (1) The selection tests are the best predictors of the pre-flight performance and the attrition criteria. (2) The mathematics and physics credit hours have some validity. (3) There is no evidence to support the qualitative appraisal variables, but it is recommended that these variables be further validated against flight proficiency and fleet proficiency before final judgment is made concerning their utility as refined predictors. (4) The identification of Factor V, with positive loading on voluntary withdrawal and a negative loading on flight failure and with other loadings which are indicative of a non-ability attribute, suggests a point of departure for future motivational research.

11502
Ambler, R. K., J. R. Berkshire, and W. F. O'Connor 1961
THE IDENTIFICATION OF POTENTIAL ASTRONAUTS. —Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3003, Subtask 1). Report no. 33, June 5, 1961. ii+8 p.

It appears that the men from naval air training who indicated an interest in participating in space flights were superior in aptitude, performance, and motivation to those who indicated no interest in the space program. Further, these Navy volunteers compared favorably to the candidates for Project Mercury on measures of intelligence and mechanical ability. In general this report aims to demonstrate that the beginnings of a high-level selection program can be implemented within the framework of an existing training program with little effort and expense. It is anticipated that programs of this type will make the final screening of space personnel more precise and economical. Whenever they are needed, the data available on these volunteers will eliminate much of the redundancy of effort that hindsight tells us was evidenced in the Mercury selection program. (Authors' conclusions)

11503
Ambler, R. K. 1959
THE OFFICER SELECTION BATTERY AS AN

ADJUNCT TO THE NAVAL AVIATION SELECTION BATTERY.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3003, Subtask 1). Report no. 31, Oct. 15, 1959. iii+14 p.

The eight-test Officer Selection Battery was assessed against ground grades and flight attrition criteria. The Mathematics and Arithmetic Reasoning tests in combination with the current Flight Aptitude Rating produced maximum ground grade validity. The FAR flight attrition validity was augmented only slightly by OSB variables. History and Social Studies was negatively related to pass versus flight failure. Mechanical Comprehension was related slightly to pass versus voluntary withdrawal in a positive direction. There was slight evidence that Verbal Analogies was related to all criteria. Naval Knowledge, English, and Science were eliminated from consideration. Recommendations for implementation of findings are made. (Author's abstract)

11504
Ambler, R. K., 1958
J. T. Bair, and R. J. Wherry
A STUDY OF THE VARIABLES FROM THE BUREAU OF NAVAL PERSONNEL'S AVIATION SCORE SHEET.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 16 01 11, Subtask 15). Report no. 1, Sept. 1, 1958. iii+[26] p.

Factor analysis was used to define the different areas covered by the Bureau of Naval Personnel's Aviation Score Sheet and to determine the validity of its component parts. Subjects were a prescreened group of 790 trainees. Aviation selection battery tests were the most valid components for predicting preflight performance and flight attrition. Credit hours in mathematics and physics demonstrated some validity against the same criteria. The scores derived from interviews and references showed no validity. Five factors were identified: flight ability, appearance of maturity, military conduct, motivation to take risks, and academic interest. Flight ability accounted for most of the explained attrition variance, but the positive loading of voluntary attrition on academic interest indicated future motivational research possibilities. (Authors' abstract)

11505
[Armour, M.] 1959
PART 29 CONTROVERSY ON THE REVISED PHYSICAL STANDARDS FOR AIRMEN: THE MEANING AND EFFECT OF THE REVISED PART 29.—Skyways, 18 (11): 54; 56-57. Nov. 1959.

A brief discussion is presented on the revised physical standards for airmen (U. S. Federal Aviation Agency, Civil Air Regulations, Part 29) from the standpoint of their terminology, interpretation, and the reasons for revision. In addition, the effect of these revisions on civil aviation are noted.

11506
Atroshkin, N. T. 1961
[METHOD OF SELECTING RADAR STATION OPERATORS BY SENSORIMOTOR REACTIONS] K metodike otbora operatorov radiolokatsionnykh stantsii po sensomotornym reaktsiiam. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (11): 66-69. Nov. 1961. In Russian.

Sensorimotor reactions of 240 radar-station operators were examined by means of the NIIIAM apparatus (complex visual display apparatus developed by the Scientific Research Testing Institute of Aviation Medicine) and the results compared with their work-performance ratings. Three sensorimotor tests were included: (1) simple reaction time to a light signal, (2) visual motor reaction to a complex of stimuli combined with the appearance of a sudden extraneous stimulus (bell sound), and (3) visual motor switching reaction, where the interrelationship of keys changed upon a certain signal. The results of laboratory examination were in agreement with performance ratings in 59% of cases. However, these tests showed some promise as predictors of performance under stress, e.g., under combat conditions.

11507
Barron, F., 1958
J. Block, D. W. MacKinnon, and D. G. Woodworth
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. III. ASSESSMENT CORRELATES OF CRITERIA OF OFFICER EFFECTIVENESS.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Report no. 58-9 (III), Dec. 1958. viii + 48 p. AD 210 218

Data were collected on 61 variables in order to provide criteria of officer performance against which the prediction devices of the assessment research could be evaluated. The data were gathered from Promotion Boards, Officer Effectiveness Reports, and superior officers. By means of factor and cluster analyses, the variables were consolidated into eight less redundant criterion measures. The eight criterion measures were in turn submitted to a factor analysis which revealed three basic factorial dimensions. The Officer Effectiveness Report Over-all Rating was averaged for each officer for the past five years; this average rating was correlated with the officer's psychological assessment scores and ratings. The 14 Superior Officers' Ratings were factor analyzed, and these factors were identified: general effectiveness, interpersonal relations, and conscientiousness. (Authors' summary, modified)

11508
Berest, N., 1958
J. Curveillé, and G. Perdriel
[VISUAL APTITUDE STANDARDS FOR RADAR SCOPE READERS] Les normes d'aptitude visuelle des lecteurs de scope.—Médecine aéronautique (Paris), 13 (3): 265-270. 1958. In French, with English summary (p. 270)

The selection of radar scope readers has not been made the object of much comment, though their visual acuity is a matter of greatest importance. For this reason it is essential to subject them to the most rigorous aptitude test. The author, therefore, sets forth minimum qualifications which appear to him obligatory for the admission to this specialization. He deals first with the various forms of ametropia, namely short-sightedness, far-sightedness, and astigmatism; then with accommodation and convergence, binocular vision, the visual field, color vision, and night vision. The stated minimum requirements must be very strict considering the extremely high demand of visual acuity in reading the radar scope. A good optical apparatus will not only discern much better fine differences but also be less subject to visual fatigue.

11509
Berry, C. A. 1958
THE ROLE OF PHYSICAL STANDARDS IN JET AND ROCKET AIRCRAFT FLIGHT.—Jour. Aviation Med., 29 (9): 631-640. Sept. 1958.

Physical standards in the selection of military pilots should be based on a reasonable assurance, commensurate with the highest possible yield, that qualified candidates will have no defects which might interfere with their safety and proficiency as pilots of high performance combat aircraft serving for a certain minimum period. The development of physical standards requires a detailed job analysis to aid in the selection of measuring instruments or tests, establishment of the reliability of measurements, and validation of standards against appropriate performance measures. Standards must insure some resistance against stresses such as reduced barometric pressure, temperature alterations, acceleration, disorientation, fear, loneliness, hypoglycemia, fatigue, and hyperventilation. Changes of standards and instruments which have been suggested for the selection and maintenance of jet and rocket pilots include cardiovascular stress tests, electrocardiograms under normal conditions and during respiratory maneuvers, pulmonary function tests, extended psychiatric interviews, electroencephalograms, more stringent weight standards, motion parallax tests of depth perception, and raising of visual acuity standards. Selection of space pilots should be based on similar but more intensive studies, with testing under actual conditions of stress.

11510
Boiceff, T., 1961
L. Caputo, and R. Virgili
[ELECTROENCEPHALOGRAPHY IN FLYING PERSONNEL: CRITERIA AND ORIENTATIONS IN SELECTION] L'elettroencefalografia nel personale aeronavigante: criteri ed orientamenti nella selezione.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 231-235. Roma, 1961. In Italian.

Electroencephalographic tracings (EEG) were made on 198 civilian pilots, 261 military pilots, and 513 pilot candidates. The electroencephalograms were differentiated into three groups: normal or with slight and insignificant disturbances (Group I), normal or with limited abnormal changes (Group II), and pathological (Group III). The percentage of Group I tracings for both military and civilian pilots was much higher than in personnel only partially selected, i.e., 94.4% (civilian pilots), 93.2% (military pilots), and 90.8% (pilot candidates). The percentages for subjects in Group II were: civilian pilots, 3.6%, military pilots, 4.6%; and pilot candidates, 5.1%. In Group III they were: 2% (civilian pilots), 2.2% (military pilots), and 4.1% (pilot candidates). Since military pilots are subjected to violent flight stresses, it is recommended that EEG be used at an early stage to screen persons predisposed to epilepsy. Civilian pilots, although subjected to less severe stresses, must also undergo EEG tests during the selection process. The medico-legal aspects of using EEG during control medical examinations are noted.

11511
Brokaw, L. D. 1959
PREDICTION OF AIR FORCE TRAINING AND PROFICIENCY CRITERIA FROM AIRMAN CLASSIFICATION BATTERY AC-2A.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87006), WADC Technical Note 59-196, Oct. 1959. vi+14 p. AD 228 445

This Note reports the validity of the Airman Classification Battery AC-2A during the first 14 months of its administration. Data are presented for 46 specialties for which both technical training and job proficiency criteria were available, in the form of Final School Grades and Airman Proficiency Test scores. Technical training validities are given for an additional 20 technical schools. The expectation of some reduction of general validity as a function of maximizing differentiating power was realized. Slightly greater drops in general validity than had been anticipated were found in the mechanical and administrative aptitude clusters, while the remainder of the battery showed validity comparing favorably with the preceding Battery AC-1B. The AC-2A Battery demonstrated itself to be an effective instrument for differential classification; interpretation of its validities are made in this frame of reference. Current Air Force policies require a different kind of instrument for most effective recruitment and placement of new airmen. (Author's abstract)

11512
Brokaw, L. D. 1959
PREDICTION OF CRITERIA FOR MEDICAL AND DENTAL SPECIALTIES FROM AIRMAN CLASSIFICATION BATTERY AC-2A.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Texas, (Project no. 7717, Task no. 87006). WADC Technical Note no. TN-59-202, Dec. 1959. iii + 8 p. AD 231 257

Validation of Airman Classification Battery AC-2A for training grades in five medical and one dental specialty, and for Airman Proficiency Test scores in two medical career fields, Pharmacy Specialist, and Medical Administrative Specialist, reveals a satisfactory predictive efficiency for the General Aptitude Index. Although the Electronics Aptitude Index seems of comparable validity, there is no basis for recommending a change in the selective aptitude index. (Author's abstract)

11513
Brokaw, L. D. 1960
SUGGESTED COMPOSITION OF AIRMAN CLASSIFICATION INSTRUMENTS.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). WADD Technical Note no. 60-214, Aug. 1960. iv+48 p.

Each test of Airman Classification Battery AC-2A was evaluated for its contribution to Air Force classification procedures. Criteria were success in Air Force technical training and scores achieved on job proficiency tests. By a multiple regression technique standard beta weights and a squared multiple correlation coefficient were derived for 16 predictors against both criteria for 36 criterion groups. Components for four aptitude indexes were selected by reviewing the frequency with which tests appeared among the best four predictors within each of four job clusters. (Author's abstract)

11514
Burwell, R. T., 1958
and S. B. Sells
MILITARY PILOT SELECTION: A SURVEY OF

PROGRAMS IN UNITED STATES, CANADA, GREAT BRITAIN AND FRANCE.—Jour. Aviation Med., 29 (11): 832-841. Nov. 1958.

A survey was made of psychological pilot selection programs in the U. S. Air Force and Navy, the Royal Canadian Air Force, the Royal Air Force, and the French Air Force to assess the effect of the introduction of high-performance aircraft on selection criteria and methods. A minimum age of 18 was found to be required for application for pilot training in all air services surveyed. The lowest maximum age of 22 is required by the F.A.F., and the highest of 26 and 1/2 by the U.S.A.F. High school graduation or the equivalent is required by all services except the U.S.N., which requires a minimum of 2 years of college. Psychological selection of pilots is the responsibility of the medical department only in the U.S.N. Assessments of personality and adjustment are made by interviews with line officers and medical officers in the U.S.A.F., U.S.N., and F.A.F., and by "syndicate tasks" (problem situations) and interviews in the R.C.A.F. and R.A.F. All air services assess officer quality aptitude in pilot selection, primarily by measurements of general intelligence. For assessment of military flying aptitude, interests and verbal skills are tested by the U.S.A.F., U.S.N., and F.A.F., numerical and perceptual skills by all services, abstract reasoning by the U.S.N. and R.A.F., special abilities and knowledge pertinent to aviation by the U.S.A.F., U.S.N., R.A.F., and F.A.F., and motor skills by the R.C.A.F., R.A.F., and F.A.F. Programs of research in pilot selection currently being conducted are adaptability screening by the U.S.A.F., validation of the "syndicate tasks" with the criterion of officer effectiveness by the R.C.A.F., development of new aptitude tests by the R.A.F., and study of fluctuations in motivation at various stages of training by the F.A.F. It is concluded that no drastic changes in pilot selection methods have been introduced since the end of World War II.

11515
Caporale, R. 1959
[FITNESS FOR FLYING AND VESTIBULAR FUNCTION] Idoneità al pilotaggio e funzionalità vestibolare.—Rivista di medicina aeronautica e spaziale (Roma), 22 (2): 31-52. April-June 1959. In Italian, with English summary (p. 49).

Vestibular function was tested by electronystagmography during selection and control of flight personnel. Functional changes of the vestibular apparatus considered as rendering the pilot unfit for flight are labyrinthine hyper- and hypoexcitability. Symmetrical labyrinthine hyporeflexia is not a condition causing pilot inefficiency, but vestibular hyperexcitability is a cause for judging a pilot unfit for flight. Cases of bilateral labyrinthine hyperreflexia due to transitory reasons (improper rest, excessive smoking, or disease) are presented, where the subjects were deemed unfit for flight following vestibular function tests. The author concludes that candidates report to the medical examination in a satisfactory physical condition in order to prevent errors in judgment due to transitory reasons.

11516
Carp, F. M. 1958
RELATIONSHIPS BETWEEN AIRMAN INTERESTS AND CAREER SATISFACTION.—Trinity Univ., San Antonio, Tex. (Contract AF 41(657)-60); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17008). WADC Technical Report no. 58-90, March 1958. iv+23 p. AD 151 038

This study is an attempt to validate a 264-item interest inventory for inclusion in the basic airman battery to improve prediction of general competence in the U. S. Air Force situation and in particular Air Force jobs. Assuming that satisfaction is related to effectiveness in a work situation, it was taken as the criterion for this study. Responses of the 842 airmen were validated against their answers to Sample Survey questions selected as indices of satisfaction with the general Air Force situation and with particular duty. Predictive validity was not demonstrated for existing keys with general U. S. Air Force personnel or selected job specialty groups; item analysis did not result in new scales. (Author's abstract)

11517
Chandessais, C. 1960
[THE SELECTION OF MILITARY OFFICERS] La sélection des cadres militaires.—Travail humain (Paris), 23 (1-2): 113-136. Jan.-June 1960. In French, with English summary (p. 136).

Changing principles governing the selection of military officers are indicated in a discussion of the methods of selection in the French, German, British, and American armies, and in an analysis of the criteria of occupational efficiency in several job situations. The recent trend towards a more global personality investigation and towards study of interpersonal relations is critically discussed.

11518
Cobb, B. B. 1960
CONVERSION OF APTITUDE INDEXES BETWEEN FORMS AC-1B AND AC-2A OF THE AIRMAN CLASSIFICATION BATTERY.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no 17106). WADD Technical Note no. 60-39, Feb. 1960. iii+6 p.

The study represents an empirical approach by which scales have been developed to facilitate conversion of aptitude indexes derived from the Airman Classification Battery AC-1B to equivalents of corresponding aptitude indexes for the Airman Classification Battery AC-2A. There has been a continuing need, both in test development and in operational situations, for a reliable means of converting the stanine-type aptitude indexes to the modified percentile-type indexes of Battery AC-2A. The Armed Forces Qualification Test score was used as a reference variable to select and equate an AC-1B sample with an AC-2A sample. Frequency distributions were obtained for each of four sets of corresponding indexes and conversion tables were derived by the equipercentile technique. These tables are appropriate for use when comparing qualifications of individuals tested by different forms of the Airman Classification Battery. (Author's abstract)

11519
Cook, E. B. 1961
A FACTOR ANALYSIS OF PERSONNEL SELECTION DATA: INTRA- AND INTER-AREA RELATIONSHIPS OF BIOCHEMICAL, PHYSIOLOGICAL, PSYCHOLOGICAL, AND ANTHROPOMETRIC MEAS-

URES. — Naval Medical Field Research Lab., Camp Lejeune, N. C. (Task no. MR005.14-2101). Vol. 11, no. 26, Dec. 1961. xi+398 p.

Tests used in routine screening, together with special additional measures, were administered to 120 randomly selected enlisted submarine candidates under carefully controlled conditions. The 362 variables were divided into a number of sub-studies and factors analyzed by the Thurstone Group Centroid method. Selected factors from each sub-study were then combined to determine inter-area relationships. As the end product of the elaborate statistical analysis, seven factors were extracted which explained more than 90% of the total variance. Two of these were related to the reaction of 17-ketosteroids during stressful situations, and another was designated as a size-strength factor with masculinity overtones. The cluster of loadings on one extracted factor was suggestive of the type of individual who thinks with his heart while loadings on another factor were considered characteristic of the person who thinks with his head. Another factor was designated as orientation in environment. There was a poorly defined factor suggestive of hormonal response. Appended data include material on the biochemistry of nervous stability; correlational relationships of the various white blood cells in healthy male adults; physical fitness, anthropometric and somatotyping measures; two independent scorings of the Rorschach ink-blot test; personal interviews given each subject separately by two interviewers; and several psychological tests employed in selection. (From the author's abstract) (60 references)

11520
Dobie, T. G. 1961
AIRCREW SELECTION PROBLEMS.—In: IInd World — IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 7-11. Roma, 1961.

The initial screening of flying personnel can, at best, only attempt to select those who appear to be most suitable for training. This suitability is based on an assessment of the individual from three points of view: medical, aptitude, and personal quality. Much work needs to be done in the field of aircrew selection from the standpoint of attempting to define requirements of the best operational aircrew. Tests of physical efficiency and psychological reaction to stress should be sought to this end. Aircrew selection must be looked upon as a continual process in depth. Whatever changes may occur in personal and aptitude qualities desired, selection is likely to be more successful if the candidate is of the highest medical standard.

11521
Elliott, L. L. 1960
FACTORIAL STRUCTURE OF AIRMAN SELF-RATINGS AND THEIR RELATIONSHIP TO PEER NOMINATIONS.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17155). Technical Report no. WADD-TN-60-141, July 1960. iii+13 p.

Over 600 airmen rated themselves on the same traits for which they later made peer nominations. Self-ratings showed a highly differentiated factor structure, with eight factors defined as compared with four for peer nominations. There was no direct correspondence between the two sets of factors. In combination with the Armed Forces Qualifying Test category and amount of education, the self-ratings were moderately predictive of peer ratings of positive traits. Since peer ratings have been shown to have greater validity for prediction of future performance, the author concludes that further research on self-ratings for selection purposes may not be justified. (Author's abstract, modified)

11522
England, G. W., and D. G. Patterson 1958
RELATIONSHIP BETWEEN MEASURED INTEREST PATTERNS AND SATISFACTORY VOCATIONAL ADJUSTMENT FOR AIR FORCE OFFICERS IN THE COMPTROLLER AND PERSONNEL FIELDS.—Jour. Applied Psychol., 42 (2): 85-92. April 1958.

The purpose of the study was to determine the degree to which the Strong Vocational Interest Blank (SVIB) reflects satisfactory vocational adjustment of Air Force officers in the comptroller and personnel fields. Of 1,853 questionnaires sent to officers employed in these fields, 1,398 were analyzed. The officers were asked to fill out answer sheets for the SVIB and a personal history form. Profiles from the SVIB for both comptroller and personnel groups were classified with respect to interest in their work, and were compared with profile standards of their civilian counterparts. It is concluded that the degree of satisfactory vocational adjustment for Air Force personnel in these occupations may be measured with the aid of the Strong Vocational Interest Blank, and, "that measured interests should receive increased emphasis as a factor in military selection and classification procedures for Air Force officer specialists".

11523
Evrard, E. 1960
[USE AND VALUE OF THE STEP TEST FOR SELECTING AIRMEN AND EVALUATING THEIR CARDIAC TOLERANCE TO STRESS] Emploi et valeur du step-test dans la sélection des aviateurs et le contrôle de leur tolérance cardiaque à l'effort.—In: Selected papers from symposium held 16-17 June, 1958, Paris, France, p. 3-5. Supplement to AGARDograph 2. Paris, July 1960. In French, with English summary (p. 5).

A study of the relation between the step-test index and the psycho-physiological selection of Air Force pilots has resulted in the following conclusions: (a) The step-test as a screening test is justified. It enables us to ascertain the minimum threshold of cardiac tolerance to stress, an important factor of the physiological condition to be required of the candidates, so that flight training may be conducted without excessive risks. According to our data, this minimum threshold is 'index 70'. (b) The step-test is not justified as a classification test in order to predict the successful or unsuccessful results of training. (c) The step-test provides objective information for the medical examination of airmen and the medical care of young airmen during the training period, so that its use is justified. (Author's summary)

11524
Ewart, E. S. 1960
FACTORIAL STRUCTURE OF AIRMAN PEER NOMINATIONS.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex.

(Project no. 7719, Task no. 17155). Technical Report no. WADD-TN-60-140, June 1960. 12 p.

A bipolar rating scale was constructed describing twenty traits representing adaptive or maladaptive behavior during basic training and five global behavioral characterizations. The peer nominations were collected from 11 flights of airmen in basic training. A factor analysis yielded four interpretable factors, thought to represent dimensions of a "general" rating factor, "good naturedness", "sociability", and "motivation for military life". (Author's abstract, modified)

11525
[EXPEDITION INTO SPACE: HIGHEST REQUIREMENTS OF FUTURE ASTRONAUTS] Expedition in den Weltraum: Höchste Anforderungen an künftige Astronauten.—Luftwaffenring (Bremen), 1959 (July): 79-80. In German.

The article describes the strict intellectual, physical, and psychological standards which must be met by the astronauts who have been selected for Project Mercury of the National Aeronautics and Space Agency and discusses the training program the astronauts will have to undergo.

11526
Fichtbauer, S. 1961
[INVESTIGATIONS OF THE BOURDON-TEST WITHIN THE FRAMEWORK OF PILOT SELECTION] Untersuchungen zum Bourdon Test im Rahmen der Fliegerauslese. — Psychologische Rundschau (Göttingen), 12 (3): 201-216. July 1961. In German.

The diagnostic value of the Bourdon Test (crossing out of certain letters in a random sequence of letters) in the psychological test battery for pilot selection was re-examined in respect to its validity. The test was restandardized and rescored according to a stanine scale. As subjects were used a group of 400 pilot candidates and 98 flight students at the Lufthansa Flight School in Bremen. Of the former group 177 candidates had been rated positively and 233 negatively with regard to their aptitude. A comparison of these ratings with the test results was essentially negative as to the discriminatory value of the Bourdon Test for flight aptitude. Only the variable R (number of correctly scored) seemed to have a positive relation to flight aptitude.

11527
Flickinger, D. [D.] 1960
PERSONNEL SELECTION AND TRAINING FOR SPACE FLIGHT.—In: International Astronautics Congress, Xth (London, 1959), Proceedings, vol. 2, p. 639-649. Wien: Springer, 1960.

The problems of organizing and implementing a program for the selection and indoctrination of astronauts are briefly discussed. An outline of procedures is presented which reflects the US Air Force and to a limited degree the National Aeronautics and Space Administration experiences in this field to date, being considered under the three general headings of medical evaluation, stress tolerance testing, and indoctrination. It is pointed out that the sole selection process contained in the entire procedure is the one which specifies that all candidate-volunteers be recruited from those pilots who have graduated from experimental test pilot schools. Medical and psychophysiological examinations are considered more as qualifying than as selective procedures. (Author's summary and conclusions, modified)

11528
Flinn, D. E. 1961
PSYCHIATRIC FACTORS IN ASTRONAUT SELECTION. — In: Psychophysiological aspects of space flight, p. 87-95. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

Factors underlying astronaut selection procedures and experimental data obtained from the Project Mercury candidate evaluation program are surveyed. The astronaut assessment program must differentiate between high levels of adaptability to the stresses of military flight, consider psychological requirements unique to space flight, and assess basic personality stability in an attempt to predict maladaptive behavior.

11529
Flyer, E. S. 1959
FACTORS RELATING TO DISCHARGE FOR UNSUITABILITY AMONG 1956 AIRMAN ACCESSIONS TO THE AIR FORCE.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17155). WADC Technical Note no. 59-201, Dec. 1959. iv+15 p.

This report provides major findings from a large-scale research investigation in which suitable and unsuitable airmen were compared for a large number of personal attributes. Educational level was found to be the best single predictor of unsuitability discharge, although aptitude and age considered in conjunction with educational level significantly increased the accuracy of prediction. The implications of the findings for current selection procedures are discussed. (Author's abstract)

11530
Frantsen, B. S. 1959
[SHORTCOMINGS OF MEDICAL SELECTION IN THE AVIATION SCHOOLS] O nedostatkakh meditskinskogo otbora v aviatsionnye uchilishcha.—Voenno-meditsinskii zhurnal (Moskva), 1959 (2): 67-69. Feb. 1959. In Russian.
English translation in: Military Medical Journal, 1959 (2): 106-109. New York: U.S. Joint Pub. Research Serv., No. 1634-N, June 4, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

The integration function of the cerebral cortex and the level of internal inhibitory processes were investigated in 49 students, eliminated for failure from the primary flight training school. Diagnostic methods used were F. P. Maiorov's conditioned blinking reflex and the speech-motor test of A. G. Ivanov-Smolenskii. In addition, questionnaires filled out by supervisors and individual interviews were used to obtained information about personality characteristics. Three diagnostic groups emerged. The first (29 subjects) was characterized by an inertia of the fundamental neural processes as manifested by difficulties in establishing the conditioned blinking and speech-motor reflexes in spite of the large number of combinations used; the case histories characterized them as below average in general development and scholastically, slow in action, incapable of complex reactions (small attention span), and shifts of attention (rigidity). The second group was characterized by

hyperreactivity of excitatory processes and a relative weakness of internal inhibitory processes; they are hypermobile, irritable, tense, and exhibit lack of coordination and rashness of movements, and instability of attention in flight. The third group was composed of students who failed to master proper landing procedures due to inadequate depth perception.

11531
Friedberg, E. S. 1959
REVISED VISUAL REQUIREMENTS FOR ADMISSION TO SERVICE ACADEMIES.—Optical Jour. and Rev. Optometry, 96 (5): 33-36. March 1, 1959.

General visual requirements for admission to the Military, Naval, and Air Force Academies are listed. Causes for rejection are compared to some extent and discussed. For instance, errors of refraction are causes for rejection from the Military and Air Force Academies (even though the visual acuity falls within acceptable limits), but refraction tests are not required for entrance into the Naval Academy unless medically indicated. This paper predates the publication of newly-revised Air Force visual requirements and is intended to serve as a quick guide for practicing optometrists in advising applicants to the service academies concerning the ocular requirements for admittance.

11532
Galubińska, K. 1960
[CONCERNING CERTAIN PSYCHOLOGICAL EXAMINATIONS CONDUCTED AT THE MILITARY INSTITUTE OF AVIATION MEDICINE] O niektórych badaniach psychologicznych prowadzonych w Wojskowym Instytucie Medycyny Lotniczej.—Lekarz wojskowy (Warszawa), 36 (8): 804-810. 1960. In Polish, with French summary (p. 810).

Results are presented of psychological tests used in the selection of aviation cadets and of other flight personnel. The tests are also applied in controlling pilot performance. The following methods are used: recording of case histories, direct observation, and administration of aptitude tests.

11533
Gastaut, H., 1960
M. C. Lee, and P. Laboureur
COMPARATIVE EEG AND PSYCHOMETRIC DATA FOR 825 FRENCH NAVAL PILOTS AND 511 CONTROL SUBJECTS OF THE SAME AGE.—Aerospace Med., 31 (7): 547-552. July 1960.

An investigation of the validity of slow electroencephalographic (EEG) activity as a basis for aviator elimination was carried out on 511 twenty-year-old male military recruits and over 1,000 pilots of the same age. Slow rhythms in the waking EEG records of young male adults are not necessarily a sign of pathology or abnormality, and extreme caution should be exercised in using such criteria for the screening of flight personnel. It appears that the EEG idiosyncrasies observed in pilots are not peculiar to the group, but are characteristic of the general population of young adult males. The results from the group of military recruits do not agree with those for pilots as regards the existence of significant relationships between EEG characteristics and personality traits, but a meaningful interpretation of the discrepancies cannot be given at the present time.

11534
Gordon, M. A. 1960
ARITHMETIC REASONING ITEMS WITH FORMULA RESPONSES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). WADD Technical Note no. 60-210, July 1960. iii+9 p.

This is a study of the effect of practice on item statistics. Some specific practice effects were found. These were not large enough to be troublesome in selecting items for a new test from a pool of experimental items. If experimental items are protected by initial practice items and final time-filling items, most of the practice effects can be controlled. Arithmetic reasoning items with formula responses as used in this study were found to be suitable for moderate to difficult tests of airman aptitude. (Author's abstract)

11535
Gough, H. G. 1958
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. IV. PREDICTABILITY OF A COMPOSITE CRITERION OF OFFICER EFFECTIVENESS.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Report 58-91(IV), Dec. 1958. viii+72 p. AD 210 219

This is the fourth in a five-part report of a project to develop methods for identifying Air Force officers with high potential for effective military leadership. Data for 11 criteria are reduced to a practical composite criterion and the 631 test and assessment variables for prediction of the composite criterion are organized. Evaluation of the criteria led to selection of three for combination in a Criterion Index. From correlations of the predictor variables with this criterion, 41 were identified which maintained significant relationships. By cluster analyses, these were reduced to homogeneous composite predictors which could be identified as psychological dimensions of officer effectiveness. By item analysis, lists of adjectives differentiating high-scoring from low-scoring officers on the Criterion Index were made, and extensive personality questionnaire data were reduced to two brief scales keyed to predict the Criterion Index. The results identify both the group-testing instruments and individual assessment devices that hold promise for identification, early in an officer's career, of those capable of becoming outstanding commanders. (Author's abstract, modified) (27 references)

11536
Groen, J. A. 1960
[REPORT ON A VISIT TO THE AEROMEDICAL INSTITUTE AT DÜBENDORF, SWITZERLAND] Verslag van het bezoek aan het Fliegerärztliches Institut te Dübendorf, Zwitserland.—Nederlands militair geneeskundig tijdschrift (s'-Gravenhage), 13 (2): 39-41. Feb. 1960. In Dutch.

The Swiss procedures for selection and training of pilots are described. There is extensive preselection of applicants by tests of visual acuity, color vision, intelligence and general ability. Applicants who pass this phase (50%) undergo extensive psychiatric interviews aimed at uncovering neurotic trends and bases for motivation to flight. In addition, Rorschach and draw-a-tree tests are administered. Approximately 25% of the appli-

cants are accepted for a preselective flight training course for an actual test of flight aptitude. The successful candidates go through regular military training, another psychiatric and medical examination, and finally are accepted by the school of aviation. Approximately 70% of the aviation students are certified by the school. There is no attempt made at any point in selection to predict success of flight training. The author discusses the merits and limitations inherent in such procedures.

11537
Himelstein, P., and T. L. Blaskovics 1960
PREDICTION OF AN INTERMEDIATE CRITERION OF COMBAT EFFECTIVENESS WITH A BIOGRAPHICAL INVENTORY. — Jour. Applied Psychol., 44 (3): 166-168. June 1960.

The Torrance-Ziller Risk Scale, a biographical inventory, was administered to a sample of senior ROTC students. After this procedure, the cadets made choices for branch of service for active duty, and the peer-nomination technique was utilized to obtain ratings in combat effectiveness and in leadership. Scores on the Risk Scale correlated at the .01 level with the two ratings and a significant difference in the expected direction was obtained between the mean scores of those selecting combat and noncombat assignments. (Authors' summary)

11538
Hoffman, A. A. 1958
CARDIOVASCULAR PROBLEMS IN THE UNITED STATES AIR FORCE.—Amer. Jour. Cardiol., 1 (3): 388-391. March 1958.

Four cardiovascular problems associated with high-altitude flying and stresses produced in supersonic aircraft are considered: (1) Coronary disease; the Air Force is now controlling the fat intake of its personnel, and since 1953 has been carrying on blood lipid studies in an attempt to determine the etiology of arteriosclerotic heart disease. (2) Rheumatic fever; the problem of this and of streptococcal throat is now being met by the administration by benzathine penicillin G at the reception center and by better bacteriological identification of beta hemolytic streptococcus from cultures of the nasopharynx. (3) Cardiographic screening; three types of defects presented complications in the cardiovascular examination program, the complete right bundle branch block, the Wolff-Parkinson-White pattern, and T-wave changes. As a result in 1956 detailed electrocardiographic deviations were defined which would preclude candidates from acceptance to flight training and remove personnel from flying status. (4) Unexplained syncope; research is currently under way at the U. S. Air Force School of Aviation Medicine, using the tilt table and simultaneous recording of the electroencephalogram and electrocardiogram; preliminary investigation discloses evidence of a central neurocirculatory instability in some of the cases.

11539
Holdrege, F. E. 1961
FACTORIAL STRUCTURE OF BASIC TRAINING PERFORMANCE VARIABLES.—Aeronautical Systems Div. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17155). Technical Note no. 61-50, July 1961. iii+12 p.

Peer nominations of basic airmen on 25 traits had been previously factor analyzed into six factors, only four of which were interpretable. A new analysis was made with six added variables based on tactical instructor ratings and objective measures of aptitude, education, and age. The new analysis duplicates the first four factors of the previous analysis (General Rating Factor, Agreeableness, Surgency, Motivation for Military Life). By the addition of age and the aptitude measure to the analysis, the remaining two factors of the new analysis can be interpreted as Maturity and Intelligence. (Author's abstract)

11540
Hori, H., A. Nagasawa, Y. Kurihara, Y. Oshima, and H. Tugane 1960
(THE ANALYSIS OF THE RESULTS ON QUALIFYING TEST FOR AIR CADETS AND CANDIDATES). — Koku igaku jikkentai hokoku [Report of the Aero Medical Experimental Group] (Japan), no. 29, March 1, 1960. 16 p. In Japanese, with English summary.

The validity and reliability of two intelligence tests and two psychomotor tests are examined. Improvement was found to be necessary in the scoring method for the intelligence tests and in the problems and apparatus for the psychomotor tests. Some of the tests lack standardization.

11541
Imus, H. A., and J. L. Fuelling 1959
DISQUALIFICATION FOR FLIGHT TRAINING DUE TO OCULAR DEFECTS.—Naval School of Aviation Medicine, Pensacola, Fla. Special Report no. 59-3, May 29, 1959. 3 p.

A review of physical disqualifications for flight training revealed that 56 out of 224 cases during the period February 14, 1957, to October 27, 1958, were due to ocular defects. This amounts to 25% of the rejections. For this reason it was decided to analyze the complete record of the eye examination of each case disqualified on this basis. The following information was found: In one half of the cases two or more ocular defects considered to be disqualifying for flying were found. Of those disqualified on the basis of a single ocular defect, one third were due to defective vision, one half were due to motor anomalies, one twelfth failed tests of depth perception, and on twelfth showed frank ocular disease. Only one case was rejected for failure on the Verhoef Test of depth perception alone. (Authors' summary)

11542
Imus, H. A. 1961
PSYCHOLOGIC FACTORS IN SPACE TRAVEL. — Naval Research Reviews (Washington), p. 20-24. Aug. 1961.

As a result of scientific data and first-hand observations from balloon and simulated space-cabin flights, it is possible to predict the qualities of human performance necessary for successful manned vehicle missile and orbital flights. The control of motivation, morale, boredom, and fatigue, the reduction of feelings of isolation, and the minimization of anxiety are all important factors and should be given the utmost consideration. But the selection of men who have demonstrated consistent and reliable performance in a variety of hazardous missions over a period of years still provides the

best guarantee of a successful mission into outer space. (Author's conclusions)

11543
Janiszewski, S. 1961
[CRITICAL EVALUATION OF THE OPHTHALMOLOGICAL METHODS OF QUALIFYING FLYING PERSONNEL FOR FLIGHT ON MODERN AIRCRAFT] Krytyczna ocena metod okulistycznych kwalifikowania personelu latającego do lotów na współczesnych samolotach. —— Lekarz wojskowy (Warszawa), 36 (5): 406-409. 1961. In Polish, with French summary (p. 409).

In order to avoid the possibility of dissimulation by aviators during examination of visual acuity, the use of Landolt's ring is advocated. Flying modern aircraft does not necessitate rigid pilot-selection criteria. It is suggested that only those pilots be admitted to jet flight who have had adequate flight experience, a good medical record, and whose slight visual defects may be corrected by eyeglasses.

11544
Judy, C. J. 1959
AN ANALYSIS OF QUALIFICATIONS DATA ON A GROUP OF AIR FORCE MECHANICS.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17018). WADC Technical Note 59-40, June 1959. iii+10 p. AD 216 454

The problem of this investigation was to determine whether selected qualification variables will predict a measure of job proficiency. The subjects were 415 Air Force mechanics specializing in the maintenance of a heavy bomber aircraft. By intercorrelation and multiple regression techniques, three groups of variables were identified and evaluated for their power in predicting scores on a written test of job proficiency. The group composed of specific high school courses showed no relationship to the criterion. A second group (education level, time in the Air Force, and Air Force training courses not specific to the equipment maintained) were individually predictive of the criterion, but added nothing to prediction from a composite of the other variables. The third group (Mechanical Aptitude Index, Air Force training courses specific to the equipment maintained, and Air Force maintenance experience) were individually predictive, and, in combination with the other qualification variables, added significantly to the composite prediction. (Author's abstract)

11545
Judy, C. J. 1960
APPRAISAL OF EDUCATIONAL REQUIREMENTS FOR AIRMAN SPECIALTIES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17018). WADD Technical Note no. 60-264, Dec. 1960. ii+14 p.

Educational requirements for airman specialties are given in Air Force Manual 35-1. This study examines the role of some of these gross indicators of academic achievement in predicting technical school grades. Attention was restricted to the educational information shown on testing and assignment record cards completed for a sample of airmen in 13 Air Force specialties. By linear regression techniques it was found that the joint contribution of this limited amount of information permits the prediction of a large part of the variance in technical school grades. High school graduation was the best single predictor among the educational variables. Completion or noncompletion of particular high-school-level courses, although individually and generally predictive of the criterion measures, consistently did not reach a level of practical significance for any specialty when the effects of other information were controlled. Further validation of educational requirements for Air Force specialties should start with better basic information on academic achievement. (Author's abstract)

11546
Judy, C. J. 1959
RELATIONSHIP BETWEEN AVAILABLE QUALIFICATIONS DATA AND INITIAL ASSIGNMENT.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17018). Report no. WADC-TN-59-200, Dec. 1959. iii+11 p.

Initial assignments in the Air Force are made on the basis of those qualifications identifiable at the time of enlistment which presumably are related to success in the various position types which make up Air Force specialties. The problem of this investigation was to determine how accurately initial assignment can be predicted from a knowledge of aptitudes, education, physical condition, and other supposedly relevant data routinely assembled on entering airmen. Multiple-regression analysis, using data on two 1000-man groups who entered the Air Force in 1956, was used as the principal statistical procedure. Under the set of conditions prevailing at the time, it was found that variables of the kind examined, altogether, can be used to explain from 30 to 47% of the variance in job family assignment, depending upon the particular job family considered. Aptitudes and counselor recommendations were found to play major roles in the prediction, but physical-profile data were of little value. Education variables, taken by themselves, were found to predict assignment, but they did not add significantly to the prediction from other available information. (Author's abstract)

11547
Kameda, N., H. Sugiyama, and K. Shiozawa 1958
[A STUDY OF THE MENTAL APTITUDE OF THE PILOT] Kōku seishin tekisei ni kansuru kenkyū.—Japanese Safety Forces Medical Journal (Tokyo), 5 (6): 755-760. June 1958. In Japanese, with English summary (p. 760).

A study was carried out, from November 1953 to July 1955, on four groups of pilot candidates for the Japanese ground self-defense force, to aid in the development of criteria on which pilot-candidate aptitude tests should be based. The study consisted of a neuro-psychological aptitude test, an analysis of the students' ratings at graduation from the candidate school, and a questionnaire investigation of the students' personality traits. The cooperation was enlisted of home unit commandants and instructors. The results were as follows: (1) Excellent students had high I. Q.'s. (2) On the Rorschach test, the S reaction was frequently shown by students who excelled in tactical flying; the Dd reaction prevailed among students who were unsuccessful in basic flying; and the CF and C reactions were rather common among superior students. (3) Low marks on the psychomotor test could be used to predict failure of a student. (4) Successful students were attentive and emotionally stable, and manifested good insight, whereas unsuccessful candidates revealed themselves to be careless, confused, self-willed, unattentive, slovenly, hasty, and overstrained.

11548
Kapor, G. 1959
[THE INVESTIGATION OF PSYCHOMOTOR ACTIVITY IN THE FRAME OF GROUP SITUATIONAL TASKS] Ocenjivanje psihomotorike u okviru grupnih situacionih zadataka.—Neuropsihijatrija (Zagreb), 7 (1-2): 111-115. 1959. In Serbo-Croatian, with English summary (p. 115).

Various methods of investigating psychomotor activity are reviewed. Group situational tasks are described in particular as a method for the investigation of the total personality. A rating scale was constructed for the assessment of psychomotor activity within the frame of group situational tasks. These tests are of paramount importance in the personality evaluation for pilot selection. (From the author's summary)

11549
Kelley, H. P. 1958
A STUDY OF PREFERENCES FOR TYPE OF NAVAL AIR ADVANCED TRAINING.—U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 16 01 11, Subtask 8). Report no. 1, Jan. 6, 1958. iii+[40] p.

At the end of a "common core" of flight training, students indicate their choices for type of specialized training. The results of this study indicate that stated preferences should be weighted fairly heavily in making assignments to training in seaplanes. There is also the implication that a great deal could be done to influence preferences, which should make it possible to bring the stated choices of the students more nearly in line with the necessary training quotas.

11550
Kirsch, H. 1961
[RESULTS OF A VALIDITY CHECK OF QUANTITATIVE METHODS FOR THE PREDICTION OF FLIGHT APTITUDE] Ergebnisse einer Bewährungskontrolle von quantitativen Verfahren für die Vorhersage der Fliegereignung. — Diagnostica (Göttingen), 7 (4): 117-123. 1961. In German.

Validity coefficients of different test methods used for selection of pilot candidates are presented for comparative evaluation. Instructor evaluations during flight training, Link-simulator training, and theory (navigation, meteorology, air traffic control, and technology) were used as final criteria. Only a few tests in the psychological test battery were shown to have useful prognostic value (spatial orientation tests, short-term concentration tests). (From the author's summary)

11551
Knapp, R. R., and J. A. Most 1960
PERSONALITY CORRELATES OF MARINE CORPS HELICOPTER PILOT PERFORMANCE. — Naval Med. Field Research Lab., Camp Lejeune, N. C. Research Project no. MR005.15-1001.1.3 (vol. 10, p. 111-178). Aug. 1960.

Personality test and questionnaire scores obtained from the Minnesota Multiphasic Personality Inventory, the Guilford-Zimmerman Temperament Survey, and the Objective-Analytic Personality Test Battery were related to indices of success as a pilot in an operational setting. Several test and questionnaire scores were found to correlate with the criteria of peer nominations of pilot proficiency and social acceptability, and with frequency of sick-bay visits. Pilots more often nominated as the most proficient tended to be the least competitively assertive, the least inhibited or timid, and the least mentally exuberant. Those more often nominated as the most socially acceptable tended to be less anxious, to have greater self-sentiment control, to be more paranoid, and to display greater psychological defensiveness. Those attending sick call more frequently tended to be more competitively assertive, more nervous and alert, bolder and more uncritical in their reactions, higher in cognitive fluency, and less self-controlled and careful. Differences in group means were not sufficiently great for practical use in the selection of individual pilot candidates. (Quoted in part).

11552
Kubala, A. L. 1958
ADAPTABILITY SCREENING OF FLYING PERSONNEL: PRELIMINARY ANALYSIS AND VALIDATION OF CRITERIA OF ADAPTABILITY TO MILITARY FLYING.—School of Aviation Medicine, Randolph Field, Tex. Nov. 1958. 25 p. Report no. 58-121.
Also published in: U.S. Armed Forces Med. Jour., 10 (7): 815-842. July 1959.

The criteria of adaptability employed in preliminary test development and validation by the School of Aviation Medicine were evaluated in terms of the following four questions: (1) What personal characteristics are reflected in the early criterion measures? (2) Which of the characteristics reflected in the early criteria are predictive of success in later career stages? (3) Are tests developed with the aid of the early criteria able to predict a later criterion successfully? (4) What differences in the relative importance of various personal characteristics are found at different stages in the career sequence? The following personal characteristics were reflected in the early criterion measures: military aptitude, ability, personal adjustment, flying performance, age, military conformity, and education. Of these, all except age and military aptitude were related to eventual success in an Air Force career, although the military conformity factor was related to the Form 66 score at only the .10 level of significance. Although a low magnitude of relationship was found between early adaptability tests and post-training success, it was concluded that the continued use of the training-level criteria in preliminary test development was justified. The comparison of adaptability and aptitude measures provided evidence that aptitudes were of much greater importance in determining outcome in pilot training, but that post-training success was about equally dependent upon aptitudes and adaptability characteristics. Practical utility of the training-level adaptability criteria was demonstrated by the significant relationships found between the experimental adaptability screening tests and the post-training criterion.

11553
Lecznar, W. B., and B. F. Davydiuk 1960
AIRMAN CLASSIFICATION TEST BATTERIES: A SUMMARY.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). Technical Report no. WADD-TN-60-135, May 1960. vi+17 p.

Assignment to training and jobs has been effectively accomplished by the U.S. Air Force through the use of test batteries. Two basic testing instru-

ments have been used: the Airman Classification Battery and the Airman Qualifying Examination. These two tests have been revised periodically to counteract item obsolescence incurred by technology changes, to protect test security, and to use new test theory. Revisions in test content, format, and administration also have been prompted by validation studies. This report compiles a review of each form of these tests, together with development information, and citation of published reports. (Authors' abstract)

11554
Lecznar, W. B. 1961
DEVELOPMENT OF THE AIRMAN CLASSIFICATION TEST 1961.—Aeronautical Systems Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). Technical Note no. ASD-TN-61-42, April 1961. v+11 p.

Airman Classification Test—1961 was developed for use in Air Force personnel classification programs other than selective enlistment. It is a four-hour test composed of ten subtests from which four aptitude scores can be derived. The battery is adapted for either hand or machine processing of results. (Author's abstract)

11555
Lecznar, W. B. 1960
EQUIVALENCE OF SCORES FROM THREE AIRMAN CLASSIFICATION DEVICES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87006). WADD Technical Note no. 60-211, July 1960. iii+12 p.

Airman Classification Battery, AC-2A, and Airman Qualifying Examination, Forms D and E, were administered in various combinations to groups of examinees. Aptitude composite scores from the several samples were compared for normative purposes and to verify certain differences found in the data obtained during the development of Airman Qualifying Examination, Form E. The results indicate a general comparability of scores from one test to the others, but some isolated variations appeared and some of the deviations found during the Form E development were not replicated. The data did not suggest that AQE-E norms should be revised. (Author's abstract)

11556
Lecznar, W. B. 1959
PREPARATION OF THE AIRMAN CLASSIFICATION TEST—1960.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). Report no. WADC-TN-59-197, 1959. 5 p. AD 228 453

The Airman Classification Battery was used for classification of basic airmen from 1948 to 1959. Introduction by the Air Force of selective enlistment required the development of a new instrument, the Airman Classification Test, for use by the Recruiting Service in pre-enlistment aptitude testing. A preliminary form, for use in 1960, was developed by abbreviating and simplifying administration of Airman Classification Battery AC-2A. The reduced battery requires only four hours for administration. It retains elements that provide aptitude indexes equivalent to four of the five indexes of Battery AC-2A. A table gives the content of each subtest, the time limits, and the composition of the four aptitude indexes. (Author's abstract)

11557
Levine, A. S. 1960
PSYCHOMETRIC CONSIDERATIONS IN SELECTING PERSONNEL FOR UNUSUAL ENVIRONMENTS. — Personnel Psychol., 13 (3): 233-243. Autumn, 1960.

A discussion is presented of the methodological considerations which underlie the selection of men for unusual environments such as may be encountered in high-altitude and space vehicles, long-submergence submarines, and polar regions. Selecting men for space travel involves a rigid physiologic screening for high acceleration tolerance, for cardio-vascular efficiency, for tolerance to extreme variations of temperature and pressure, and for ability to adjust to weightlessness, as well as a completely exacting aptitude, psychiatric, and neurologic assessment. Subsequent training procedures represent a continuing program of supplementary selection, in that attrition may be high because of inability to qualify on any of the physiologic or psychologic types of conditioning or on flight checks. On-the-job selection criteria can be developed through the use of the clinical interview, peer and supervisory ratings, and by defining motivation, the best measurement of which is volunteering. Aside from the problems which lie within the area of methodology, certain substantive problems such as sensory deprivation and the "break-off" effect must be considered in programs of selection research.

11558
Lomonaco, T., and A. Scano 1961
[ORIENTATION FOR THE FUTURE SELECTION OF SPACE PILOTS] Orientamenti per la futura selezione dei piloti spaziali. — In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 55-63, Roma, 1961. In Italian, with English summary (p. 62).

Laboratory physiological studies preliminary to the selection of space pilots center primarily around the testing of human tolerance to acute hypoxia, aeroembolism, explosive decompression, accelerations, weightlessness, and transition from acceleration to zero gravity. Observations of neurovegetative phenomena, heart rate, and individual behavior during the tests provide reliable material for appraisal.

11559
Lomonaco, T. 1960
[EXPERIMENTAL RESEARCH ON THE CALIBRATION OF SOME RESPIRATORY AND CARDIO-CIRCULATORY FUNCTIONAL TESTS] Recherches expérimentales sur l'évaluation de quelques épreuves fonctionnelles respiratoires et cardio-circulatories.—In: Selected papers from symposium held 16-17 June, 1958, Paris, France, p. 61-65. Supplement to AGARDograph 2. Paris, July 1960. In French, with English summary (p. 65).

Muscular exercise results in increases of pulmonary ventilation, cardiac output, and arterial blood pressure. These values can be used as calibration data of respiratory and cardio-circulatory functions of the candidates belonging to a homogeneous group (age, trained or untrained, etc.). The author intends to integrate them in the conventional physical examination of the candidates to aeronautics, in order to get a classification of the

psycho-physiological fitness of each candidate. (Author's summary)

11560
Lossberg, V. von 1960
[INSTRUMENT FLIGHT IN THE SINGLE-SEAT AIRPLANE] Instrumentenflug im Einsitzer.—Truppenpraxis (Darmstadt), 1960 (4): 305-307. April 1960. In German.

The medical and psychological selection, the training, and the experience required of pilots of single-seat jet aircraft are briefly discussed. Characteristic situations arising during instrument flight are described in view of the demands placed on the pilot.

11561
Lowry, R. H. 1960
SELECTION OF PERSONNEL FOR MANNED SPACE STATIONS.—Aero Space Eng., 19 (5): 32-33. May 1960.

The qualifications and abilities to be considered in selecting crew members for manned space stations are discussed. The selection procedure should satisfy the following fundamental criteria: (1) selected personnel must meet acceptable medical standards; (2) selected crews must be highly motivated and have a recognized leader who will be the ship commander; (3) selected personnel must be capable of further intensive training in their own and related specialties associated with the crew duties involved in the program; (4) selected personnel must be capable of living and functioning under the conditions and environment to be provided in the space station. A biphasic program for training crewmen is proposed to familiarize the individual crewman with the space program and the vehicle, and to coordinate members as a composite crew, including specific crew orientation with all aspects of the vehicle and its emergency systems.

11562
Luehrs, R. E. 1959
ELECTROENCEPHALOGRAPHIC EVALUATION OF NAVAL AVIATION CADETS.—In: Medical aspects of flight safety, p. 258-289. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The methods currently employed by the Research Laboratory of the U. S. School of Aviation Medicine in Pensacola, Florida, to obtain, evaluate and correlate data concerning the electroencephalographic variations among candidates for flight training are depicted and commented on. At this time no means have been established to provide valid selection criteria. (Author's summary)

11563
MacKinnon, D. W., 1958
R. S. Crutchfield, F. Barron, J. Block, H. G. Gough, and R. E. Harris
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. I. DESIGN OF THE STUDY AND DESCRIPTION OF THE VARIABLES.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Report 58-91 (I), April 1958. x+153 p. AD 151 040

This is the first of a five-part report covering an extensive psychological assessment of a group of Air Force captains eligible for promotion. The 343 captains participating in the field-testing phase of the assessment were given 27 paper-and-pencil tests. From the field-testing sample, 100 officers were assigned, in groups of 10, to a 3-day living-in phase. During this period, a staff of psychologists rated each officer on a wide variety of personality variables considered relevant for effectiveness in senior command and staff assignments. Effectiveness measures were obtained from Officer Effectiveness Reports, promotion board ratings, and superiors' ratings. A total of 648 variables were derived from the data collected. This report presents the over-all design of the assessment study and defines each of the 648 variables. Norms are listed in an appendix. (Authors' abstract, modified) (74 references)

11564
MacKinnon, D. W. 1958
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. V. SUMMARY AND APPLICATIONS.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Report 58-91(V), Dec. 1958. v+53 p. AD 210 220

A total of 631 variables obtained from living-in assessment and field-testing of 100 captains were evaluated for the development of methods of identifying Air Force officers with high potential for effective military leadership. A summary of significant relationships between predictor and criterion variables is given. Inferences from these relationships provide a comparative evaluation of the criteria of officer effectiveness and lead to selection from the experimental devices of instruments proposed for inclusion in a program of officer assessment. (Author's abstract, modified)

11565
McReynolds, J. 1958
APTITUDE LEVELS IN THE ENLISTED MANPOWER POOL OF THE AIR FORCE. I.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17106). WADC Technical Note 58-63(I), Sept. 1958. v+30 p. AD 151 047

This is the first in a series of reports designed to provide estimates of the aptitude levels of enlisted personnel in the Air Force. From data collected in the May 1957 Sample Survey, distributions of aptitudes were obtained by career fields, by reenlistment plans, by term of enlistment, by skill level, and by grade. Distributions are presented in terms of the total Air Force enlisted population so that estimates can be made not only of the numbers of airmen of each aptitude level in any one group, but of the numbers in any other group who have aptitude levels high enough to permit efficient retraining into shortage areas. For airmen in their first term of enlistment, aptitude distributions were typically the normal bell shape with little difference in level between career fields. Airmen in later enlistments were typically higher in aptitude; methods of screening for re-enlistment and for promotion build up of the quality of career personnel so that the majority of noncommissioned officers, and especially

those in the highly technical career fields, have high aptitude qualifications and are capable of supporting modern technological advances. (From the author's abstract)

11566
Madden, J. M. 1960
A COMPARISON OF THREE METHODS OF RATING-SCALE CONSTRUCTION.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17015). WADD Technical Note no. 60-262, Nov. 1960. iii+15 p.

Four job evaluation factors were used as the basis of rating 10 Air Force specialties. For each factor three different methods were used in constructing the scale: (I) each scale division was defined and illustrated; (II) neither scale division definitions nor examples were used; and (III) definitions were used but the examples were omitted. Ratings by samples of aviation cadets were analyzed for effects of method on mean ratings. For three of the four factors, the mean ratings obtained were not different as a function of the method of scale construction. Methods I and III were about equally reliable, both yielding more reliable means than Method II. Method III is suggested as being the most effective because the task of the rater is somewhat simpler than for method I and the reliability is higher than for Method II. (Author's abstract)

11567
Madden, J. M. 1961
A FURTHER NOTE ON THE FAMILIARITY EFFECT IN JOB EVALUATION.—Aeronautical Systems Div. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17015). Technical Note no. 61-47, June 1961. iii+4 p.

Job evaluations were found to vary as a function of the extent to which raters were familiar with them. In addition, there was an interaction between the job rated and the familiarity level of the rater. It is suggested that an adequate control of the familiarity effect would be maintained by maximizing the familiarity level of the raters. However, this should be done by using job descriptions and other materials rather than obtaining raters with a high degree of familiarity gained through personal work experience. A personal relationship with the job rated may reduce the validity of the ratings if affective factors are operating. (Author's abstract)

11568
Madden, J. M. 1960
A NOTE ON THE RATING OF MULTIDIMENSIONAL FACTORS.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17015). WADD Technical Note no. 60-258, Oct. 1960. ii+7 p.

To determine how the reliability of ratings is affected by fractionating a multidimensional rating factor, the complex job-evaluation factor, Knowledge, was split into four simpler factors: Formal Education, Special Education, On-the-Job Training, and Work Experience. Aviation cadets' ratings of 42 Air Force specialties on these four factors were somewhat more reliable than ratings on the original multidimensional Knowledge factor. Maximum reliability of rater judgments is suggested as one criterion for the most desirable level of fractionation of a complex factor. (Author's abstract)

11569
Miller, C. P. 1959
THE NEW MEDICAL CODE FOR PILOTS.—AOPA Pilot, 2 (10): 23-24; 57-60. Oct. 1959.

The revised medical standards for airmen (U. S. Federal Aviation Agency, Civil Air Regulations, Part 29) are appraised from the standpoint of their possible effects on civil aviation. In addition the controversial amendments dealing with (1) disqualification of applicants having heart, diabetic, nervous, and other conditions from certification, and (2) the placement of unprecedented statutory power for certification in the hands of the civil air surgeon are discussed. The objectionable terminology of the original draft is noted, along with reasons why the regulations were enacted without granting the requested public hearing.

11570
Miller, Earl F. 1958
EVALUATION OF CERTAIN VISUAL AND RELATED TESTS. I. AUDITORY AND VISUAL DIGIT SPAN.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 14 01 11, Subtask 6). Report no. 1, March 7, 1958. ii+13 p.

One hundred and fifteen naval aivation cadets were given a test of auditory and visual digit span as part of an evaluation of a battery of tests recommended by Renshaw for screening pilots for visual difficulties that cannot be detected by the usual clinical methods. The test-retest reliability of both tests in this study was .72. The auditory span for digits was more variable and on the average greater than the visual span. Correlation between performance on these two tests was not significant from zero. The mean visual digit span fell below the level considered by Renshaw to be minimal for visual efficiency.

11571
Miller, Earl F. 1958
EVALUATION OF CERTAIN VISUAL AND RELATED TESTS. II. PHORIA.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 14 01 11, Subtask 6). Report no. 2, April 17, 1958. ii+20 p.

In order to determine if large, near heterophorias exist among pilots screened by the required visual tests, 110 naval aviation cadets were tested by four methods: von Graefe, Maddox rod, Keystone Db9 target, and Monocular Projections (Renshaw). The phoria values obtained by these tests differed considerably and correlated moderately in most cases. Heterophoria at near ranged from 16$^{\Delta}$eso to 19$^{\Delta}$exo. The test-retest reliability of most of these tests was found to be satisfactory. (Author's summary)

11572
Miller, Robert E. 1960
PREDICTION OF TECHNICAL TRAINING CRITERIA FROM AFOQT COMPOSITES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87003). WADD Technical Note no. 60-215, Sept. 1960. ii+5 p.

The Air Force Officer Qualifying Test (AFOQT) is used in various officer procurement and selection programs. Scores on this test are of significance in selecting officers for attendance at basic technical courses. A study of 975 reserve officers in seven different technical courses was therefore conducted to provide data on the predictive validities of AFOQT composite scores for final technical course grades. Satisfactory validity coefficients were obtained for

the AFOQT aptitude composites against the course criteria. Most of the composites were valid for each separate criterion, and coefficients as high as .58 were obtained. Evidence was found that these validities persist in different samples of officers enrolled in the same course at different times. Validities of the AFOQT interest composites, however, were markedly lower and frequently negative. The highest in terms of absolute value was .32. (Author's abstract)

11573
Moritz, H. C., and N. C. Nicholas 1961
ROUTINE PARTIAL PRESSURE SUIT INDOCTRINATION: RESULTS OF A TWO AND ONE-HALF YEAR PROGRAM IN STRATEGIC AIR COMMAND.—Aerospace Med., 32 (10): 953-957. Oct. 1961.

Of the series of 378 partial-pressure suit indoctrinations, only 20 runs were considered failures. Of these, 10 were due to equipment failure, while 10 were due to physical problems, four of which were successfully re-run. A majority of the six failures that could not be re-run were due to the physiological concomitants of anxiety; from this it is concluded that a lack of motivation is a definite factor contributing to the absolute failure rate. The absolute failure rate noted here (15.8 per 1000 candidates) is not considered excessive for this type of program. The value of the amplified partial-pressure suit physical examination, as well as the value of the partial-pressure suit indoctrination as a preselection factor would seem to be justified in view of the fact that using agencies in the Strategic Air Command have to date had no single instance of a human failure. (Authors' summary, modified)

11574
Morton, A. S. 1960
AVIATORS AND ENVIRONMENTAL CONTROLS.—Naval School of Aviation Med., Pensacola, Fla. Special Report no. 60-3, May 16, 1960. iv+[12] p.

An experimental multiple-choice examination was administered to 214 Naval squadron members to test knowledge of equipment and procedures for environmental control in flight (recognition and control of disorientation, procedures for maximally effective vision, effects of acceleration, need for and optimum use of oxygen, and of pressurization). A mean score of 74% was obtained on the questions analyzed. No correlation was found between scores and the Naval procurement source of the examinees, years of flying experience, age, or number of flight hours. Higher scores were obtained by regular officers, by men who requested that their score be returned to them, and by certain individual squadrons. Significant differences were found among groups, indicating that differences in training and in motivation to learn affect knowledge of environmental controls. Recommendations for the inclusion of items on temperature control and of bailout and ejection are appended.

11575
PART 29 CONTROVERSY ON THE REVISED PHYSICAL STANDARDS FOR AIRMEN: THE BACKGROUND OF THE DECISION.—Skyways, 18 (11): 57; 66. Nov. 1959.

The original and current concepts of the medical standards for airmen are briefly reviewed. In addition, controversial aspects of the newly revised regulations (U. S. Federal Aviation Agency, Civil Air Regulations, Part 29) are noted.

11576
Perdriel, G. 1958
[CICATRICIAL CHORIORETINITIS CASES AND THE SELECTION OF FLIGHT PERSONNEL] Chorioretinites cicatricielles et sélection du personnel navigant.—Médecine aéronautique (Paris), 13 (1): 59-64. 1958. In French, with English summary (p. 64).

For the purpose of determining adequacy of visual performance in pilot candidates during selection procedures, the extent of scar formation after chorioretinal lesions has to be ascertained. It is usually revealed by the aspect of the scar; but for greater safety the etiology of chorioretinitis should be established, which is very difficult. Proliferating scars should be a reason for rejection of the candidate, since barometric depression may induce a hemorrhage into the vitreous body. Goldmann's apparatus for the detection of scotoma is recommended for complete campimetric examination; but to be of decisive value, the scotoma has to be searched from the "seen" to the "not-seen" point and backward. Pilot candidates who present a minimal perimacular lesion, extended nasal chorioretinitis, or proliferating retinitis should be rejected. In 980 check-up examinations, minimal chorioretinal lesions were found in seven certified pilots who had experienced no significant flight accidents. For adequate follow-up studies of such cases, the use of retinal photography is suggested in all instances of cicatricial retinitis. This will permit evaluation of the stability of the scar and thus safeguard aerial security.

11577
Platonov, K. K. 1961
[DISPUTABLE AND SOLVED PROBLEMS OF THE THEORY OF FLIGHT APTITUDES] Spornye i reshennye voprosy teorii letnykh sposobnostei. —Voenno-meditsinskii zhurnal (Moskva), 1961 (1): 24-29. Jan. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (1): 29-36. Washington: U. S. Joint Pub. Research Serv., no. 9169 (1374-N/38), April 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Controversy about innateness versus acquisition of flight aptitudes has been resolved slowly in favor of the Marxist concept of aptitude, which recognizes the existence and invariability of aptitudes. The study of flight aptitudes either in their specific aspects or as a dynamic configuration of psychological characteristics of the personality is aimed at (1) deliberate development of inadequately developed abilities in training, (2) use of them as a baseline in flight medical evaluation, and (3) selection or rejection of applicants to air force schools. Psychological selection as practiced in the United States is recognized as unsuitable and unsatisfactory since it is directed primarily at evaluation of preparedness of the candidate rather than his aptitudes. Some of the tests and testing methods may be adapted for use in Soviet air force selection.

11578
Puister, G. J. 1960
THE ELECTROENCEPHALOGRAM IN SELECTION OF FLYING PERSONNEL. —Aeromedica acta (Soesterberg, Netherlands), 7: 123-128. 1959-1960. In English.

Electroencephalographic data from 360 applicants to the Netherlands National Aviation School for

Civil Pilots were classified on the basis of the alpha rhythm patterns and used to predict the success or failure of the applicant to gain admission. The electroencephalograms with a monorhythmic alpha pattern were placed in Class I; those without manifest alpha activity, with a flat, low voltage record, or with a polyrhythmic pattern were included in Class II. Only three of the 71 candidates admitted to the school had Class II EEG's. A survey of the electroencephalograms of 700 licensed pilots revealed that only 4.6 per cent of these were in Class II. The author concludes that it may be justifiable to use the EEG in the selection of pilot candidates, keeping in mind that a good alpha pattern alone is no guarantee that the subject will become a successful pilot.

11579
Quero R., 1959
P. Laboureur, C. Grousset, and R. Clignet
[PSYCHOLOGICAL SELECTION OF NAVAL AVIATION STUDENT PILOTS: THEIR SCORES] La sélection psychologique des élèves pilotes de l'aéronautique naval. Ses resultats.—Médecine aéronautique (Paris), 14 (1): 77-85. 1959. In French, with English summary (p. 85).

The selection of student-pilots by the Medical Examination Center for Flying Personnel, Toulon, includes a historical method for the appraisal of personal history data; a psychometric method (depending on standardized use of mental tests); a clinical method (depending on standardized use of mental tests); a clinical method consisting of a qualitative exploration of the personality (interview, projective technique, questionnaire); and a psychotechnical method which allows for an evaluation of several psychophysiological aptitudes, sensory data, manual aptitudes, etc. All scores are compared with each other and with those yielded by the medical examination. Their synthesis enables the psychiatrist to make decisions relating to the candidate's aptitude and predictions about his success. These predictions are formulated only at the end of a seven-months preparatory course mandatory before the admission of the candidate to the Pilot Training Station.

11580
Ritter, R. M. 1958
ADAPTABILITY SCREENING OF FLYING PERSONNEL: RESEARCH ON THE INDIVIDUAL TEST BATTERY.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-52, April 1958. 12 p.

As a part of a continuing project to develop methods and devices for the adaptability screening of military aircrew personnel, this study examined the relationships of 41 experimental variables, derived from five psychologic tests, with appropriate specific and pooled criteria in 412 aviation cadets. The tests, which were administered individually, involved habit interference in printing symbols, mirror vision drawing, color naming, and different aspects of complex perceptual-motor behavior. The findings indicate that the Controls Orientation Test (CP 638A), an apparatus designed to elicit "controls confusion", warrants further investigation as a potentially useful device for adaptability screening. (Author's abstract, modified)

11581
Rossanigo, F. 1958
[A FURTHER CONTRIBUTION TO THE DEMONSTRATION OF THE VALIDITY OF FUNCTIONAL RESPIRATORY AND CARDIOVASCULAR TESTS FOR MEDICAL SELECTION OF AVIATION PERSONNEL] Ulteriore contributo alla dimostrazione della validità delle prove funzionali respiratorie e cardiocircolatorie in sede di selezione medica del personale navigante. — Rivista di medicina aeronautica (Roma), 21 (4): 757-763, Oct.-Dec. 1958. In Italian.

A modification of conventional clinical respiratory and cardiovascular tests was carried out to demonstrate their value as criteria in aviation personnel selection procedures. The tests included measurements of vital capacity and of maximum expiratory volume, both at rest and after performing muscular work on the ergometer to the point of exhaustion. The three subjects selected for the tests had case histories of preceding incidents of respiratory illnesses, which might have precluded their acceptance for flight duty. The results attested the fact that all three individuals demonstrated sufficiently satisfactory respiratory and cardiovascular performance data to warrant their acceptability for pilot duty.

11582
Rossanigo, F. 1959
[ADDITIONAL DATA ON THE DEMONSTRATION OF THE VALIDITY OF THE RESPIRATORY AND CARDIOVASCULAR FUNCTION TESTS FOR THE MEDICAL SELECTION OF FLIGHT PERSONNEL] Ulteriore contributo alla dimostrazione della validità delle prove funzionali respiratorie e cardiocircolatorie in sede di selezione medica del personale navigante. — Rivista di medicina aeronautica e spaziale (Roma), 22 (1): 163-168. Jan.-Mar. 1959. In Italian.

Respiratory and cardiovascular function tests were conducted on three subjects with basal pleuritis and the results compared with a previous study on a similar group of subjects. Spirometric values for the vital capacity, and the maximum expired value as affected by exercise were evaluated. Pulmonary ventilation appeared to increase greatly following exercise (+21%) in comparison to the average value for the subjects in the previous study. The value for O_2 volume was slightly less (-3.07%) than the average standard value in both series of patients. Cardiac frequency and arterial pressure at the end of exercise were also determined. The author concludes that anatomo-clinical tests demonstrating a diminished functional efficiency of the respiratory tract may be a valuable guide for pilot selection.

11583
Ruff, G. E., 1959
and E. Z. Levy
PSYCHIATRIC EVALUATION OF CANDIDATES FOR SPACE FLIGHT.—Amer. Jour. Psychiatry, 116 (5): 385-391. Nov. 1959.
Also published in: U.S. Congress, Senate, 86, 2nd Session. Committee Print, July 15, 1960. p. 243-249.

Procedures for selection and psychological evaluation of the pilots for Project Mercury are described. Eligibility for the mission was restricted to a select group of test pilots, thirty-two of whom were chosen for the final phase of the selection program. In this phase the final medical and psychological evaluation was made and the capacity for tolerating stress conditions expected in space flight was determined. The psychiatric evaluation included 30 hours of psychiatric interviews; 25 psychological tests assessing motivation, personality, intellectual functions, and special aptitudes; and observations of behavior in the

following stress experiments: (1) pressure suit test in low-pressure chamber at 65,000 m. altitude, (2) three hours in the isolation room, (3) a complex behavior test, (4) acceleration at different g loads, (5) noise and vibration stresses, and (6) exposure to heat of 130° F. for 2 hours. No evidence of psychosis, clinically significant neurosis, or personality disorders was observed in any of the 31 candidates who passed through the complete series. They can be described as mature, well-integrated, highly adaptable, action-oriented individuals with a high level of intellectual functioning, who had been successful in demanding missions in the past. Their stress tolerance levels were among the highest. Motives for volunteering varied, but all seemed to be attracted by the constructive rather than the destructive aspects of the mission.

11584
Ruff, S. 1961
THE HUMAN CENTRIFUGE AND ITS APPLICATION TO PILOT SELECTION.—In: Bio-assay techniques for human centrifuges and physiological effects of acceleration, p. 1-13. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

The development and characteristics of the human centrifuge constructed for the Institut für Flugmedizin der Deutschen Versuchsanstalt für Lufthart are presented in the first part of the paper. The second part of the paper deals with the centrifuge as an instrument for pilot selection. A choice reaction time test with six visual and two auditory stimuli was used to study efficiency impairment under acceleration. The rate of acceleration was 0.01 to 0.1 g/sec. The run at 4 or 4.5 g lasted for 5 minutes maximum. Blackout level/time was predicted by means of reaction time increase, and the results were compared with studies in the low-pressure chamber (at 23,000 feet simulated altitude). The findings under acceleration were mostly negative. Most of the subjects showed no sign of disorder compared with their response in a non-stress situation; only a few of the subjects showed greater decrement shortly before they experienced blackout or collapse. Blackout time seems to be a valid criterion for g tolerance.

11585
Schwichtenberg, A. H., 1959
D. D. Flickinger, and W. R. Lovelace
DEVELOPMENT AND USE OF MEDICAL MACHINE RECORD CARDS IN ASTRONAUT SELECTION.—U. S. Armed Forces Med. Jour., 10 (11): 1324-1351. Nov. 1959.

The development and use of IBM machine record cards for the recent "Man in Space" medical selection program is described in detail. Two systems of machine card recording were considered for use in the program: coded work sheets, and mark sense type cards. The former consist of information sheets completed by the examiner according to a code, which is transmitted to punch cards by a trained operator. The mark sense cards are punched automatically from electrographic pencil markings filled in by the examiner in answer to "yes" or "no" questions. In the latter system, work sheet and punch card are combined so that one card is suitable for both machine and individual use. The mark sense card system was adopted for use in the program for the following reasons: the card is easy to use and read; it does not require a skilled card punch operator; and additional comments may be written on the back of the card. It is felt that the system facilitated selection of candidates considerably, and could be profitably adapted to use in other medical record systems.

11586
Schwichtenberg, A. H. 1960
SPACE MEDICINE AND ASTRONAUT SELECTION.—Minnesota Med., 43 (12): 797-812. Dec. 1960.

The interdependence of the fields of medicine, design engineering, and human engineering in the support of manned space flight is demonstrated in a discussion of the external stresses and hazards of space flight, including acceleration, heat, vibration, meteorites, hypoxia, decompression, radiation, weightlessness, noise, glare, and problems of the cabin environment and atmosphere. The various physical tests developed on the basis of the knowledge and experience gained from aviation medicine for the selection of astronauts are described. It is suggested that the research techniques employed in the space program, such as the data-processing technique for the handling of information on applicants for the astronaut program, may be usefully applied to general medical practice.

11587
Seifert, R. 1960
THE PSYCHOLOGICAL SELECTION PROGRAM OF THE GERMAN "INSTITUT FÜR FLUGMEDIZIN" (AEROMEDICINE).—Deutsche Versuchsanstalt für Luftfahrt (Mülheim, Germany), Report no. 125, p. 53-63. June 1960. In English and German.

Preliminary data on the validity of the program of the German Institut für Flugmedizin for the selection of air-crews of the Deutsche Lufthansa indicate a test error rate of 6 to 12%. Aptitude tests in use in the selection program include the complex coordination and link trainer tests of psychomotor performance, the Institut's own bend direction test of spatial relations, in which applicants are required to count bends in a square as quickly as possible, and the Institut's concentration-stress test, involving attention, memory span, visual alertness, and arithmetic.

11588
Sells, S. B., 1958
D. K. Trites, R. C. Templeton, and M. R. Seaquist
ADAPTABILITY SCREENING OF FLYING PERSONNEL: CROSS-VALIDATION OF THE PERSONAL HISTORY BLANK UNDER FIELD CONDITIONS.—Jour. Aviation Med., 29 (9): 683-689. Sept. 1958.

An experimental battery of personality and motivational tests for adaptability screening was administered to 9500 students entering pre-flight school. Results of the tests were validated against attrition data available for 1707 student officers and 363 aviation cadets completing primary pilot or basic training. The most promising test was found to be an aviation interest key, which had a pass-fail correlation of 0.23. Correlation of the key with attrition resulting from flying or academic failure, non-adaptability, or choice of withdrawal rather than extension of service from 3 to 5 years revealed a lower correlation with failure due to lack of ability. Analysis showed that screening of students on the basis of the test would have reduced the attrition rate 1% with cutting at the rate of 5%, and 4% with 20% cutting.

11589
Sells, S. B., 1958
and C. A. Berry
HUMAN REQUIREMENTS FOR SPACE TRAVEL.—

School of Aviation Medicine, Randolph Air Force Base, Texas. Feb. 9, 1958. [31] p.

Also published in: Air Univ. Quart. Rev., 10 (2): 108-120. Summer 1958.

Also published in: Man in space, p. 161-177. New York: Duell, Sloan and Pearce, 1959.

Essentially the same as published in: Human factors in jet and space travel, p. 166-186. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

The requirements for selection, indoctrination, and training of space pilots are reviewed. They include: (1) aptitude and skill requirements; (2) biological, medical, and physical requirements; and (3) required tolerances of anticipated psychological stresses.

11590
Shandrin, G. V. 1959
[CERTAIN DATA IN THE STUDY OF DISTURBANCES OF THE VASCULAR TONUS IN AVIATION SCHOOL STUDENTS] Nekotorye dannye izucheniia narushenii sosudistogo tonusa u kursantov aviatsionnogo uchilishcha.—Voenno-meditsinskii zhurnal (Moskva), 1959 (3): 31-32. March 1959. In Russian.

English translation in: Military Medical Journal, 1959 (3): 49-51. New York: U. S. Joint Pub. Research Serv., No. 1702-N, June 26, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

A study was performed to investigate the influence of flight training on the arterial pressure, the tolerance of flight by students with increased arterial pressure, and the factors responsible for the increase in blood pressure. Second- and third-year aviation school students with blood pressures of 130/80 and above were examined periodically along with a control group of students with blood pressures below 130/80. A table of blood pressures taken during training flights is included. In the control group the blood pressure never rose above 130/68 mm. in any of the flight conditions. The experimental group exhibited a tendency towards increase in arterial pressure during flight training. Of the total number of students under observation 18.7% were dropped from flight training in 1956 and 16.6% in 1957 with the following diagnoses: hypertension, neurocirculatory asthenia, vegetative vascular asthenia, and myocardial fibrosis. It is concluded that the change in living conditions and activity at the time of admission to the aviation school against a background of neuropsychic stress, apparently contributes to the manifestation and stabilization of disturbances of the vascular tone. Part of this attrition can be eliminated by more stringent evaluations in the early stages of medical selection and training.

11591
Silverman, A. J., 1959
S. I. Cohen, and B. M Shmavonian
SYMPOSIUM ON SPACE PSYCHIATRY: SELECTION TECHNIQUES FOR SPACE CREWS.—Amer. Jour. Psychiatry, 115 (12): 1110-1112. June 1959.

Space crew selection involves such problems as: (a) determination of personality types most suited to the mission in general and to the jobs to be carried out; (b) motivations and other psychological characteristics such as judgment which may be expected to lead to high performance capability of the individuals; (c) conscious and unconscious attitudes detrimental to individual and group functioning and methods to avoid these attitudes from occurring or interfering with the person's functional capacity; and (d) delineation of specific psychophysiological responsivity to various aspects of the mission. It is suggested that by using standard dynamic interviews and psychological testing, persons with judgmental defects or other major defects in ego integration may be screened.

11592
Slayton, D. K. 1961
PILOT TRAINING AND PREFLIGHT PREPARATION.—In: Conference on Medical Results of the First Manned Suborbital Space Flight, p. 87-96. [1961?].

All phases of the astronaut training program including the generalized areas pointed toward rocket flights and the specialized aspects pointed directly toward the MR-3 flight. Each astronaut is a jet fighter pilot who graduated from one of the service test-pilot schools and has experience as an experimental test pilot. Each has a bachelor's degree in engineering or one of the basic sciences, is physiologically and psychologically sound, and in good physical condition. The training program is broken down into five major categories as a function of training devices. These categories are: academics (aerodynamics, astronomy, meteorology, astrophysics, physiology, astronautics, etc.); static training devices; dynamic training devices (weightless or zero-g trainers, centrifuge training, multiaxis spin test inertia facility, revolving room, carbon dioxide chamber, flying high-performance aircraft, athletics); egress and survival training; and specific mission preparation.

11593
Smith, H. P. Ruffel 1961
MEDICAL SELECTION OF AIRLINE TRANSPORT PILOTS FOR JET OPERATION. — Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 10 (2): 6-8. 1961. In English.

The problem of pilot selection is divided into two categories: (1) selection of pilots for initial training and (2) selection of pilots for conversion from piston to jet operation. The basic qualities needed for initial trainees are long-term reliability, ability to learn rapidly, and qualities of leadership. Medical qualifications of importance are discussed and these include eyes, hearing, cardio-vascular system, respiratory system, nervous system, skin, and the medical history of the candidate. To convert pilots to jets, qualifications to be considered are previous history of reliability under stress, absence of psychosomatic diseases, and a healthy cardiovascular, respiratory, and digestive system. Economic considerations of cost of conversion and return of time on the investment are discussed. It is suggested that with fully automatic operations likely in the future, qualifications based on multiple-choice reaction times validated against performance should be included.

11594
Stewart, W. K. 1961
PHYSIOLOGICAL PSYCHOLOGY AS A BASIS FOR FUTURE SELECTION METHODS.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 39-42. Roma, 1961.

Elucidation of the objective signs of impaired

efficiency due to stress using various physiological techniques has not withstood the test of time in relation to efficient selection of candidates for flying. Although much is known about the effects of ideation on psychological performance and on physiological analogues, more remains to be learned before objective methods can be applied for scoring the stability and capabilities of candidates for any specific task which may possibly involve conditions of neurogenic stress. To solve this, integration of the disciplines of physiological psychology, neurophysiology, neurochemistry, and biochemistry to study various problems is recommended. Two projects are mentioned. The first deals with investigating in detail how selected individuals learn to learn, and the second uses synthetic tasks to study the possible induction of controlled but suddenly applied neurogenic stress.

11595
Strollo, M. 1959
[LEARNING TO FLY WITH REGARD TO MODERN PSYCHOLOGICAL SELECTION METHODS] L'apprendimento del pilotaggio aereo nella moderna psicologia ai fini della selezione.—Rivista di medicina aeronautica e spaziale (Roma), 22 (2): 53-72. April-June 1959. In Italian, with English summary (p. 71).

The meaning, limits, and possibilities of occupational psychology as applied to employee selection are presented, following a comparative review of modern and classical psychology. Learning, and especially learning to fly, is evaluated in order to establish a better approach to the psychological testing of aptitude, rationality, and objectivity of pilot candidates prior to selection.

11596
Strollo, M. 1958
[INTERESTS AS A CRITERION IN PILOT SELECTION] Interessi nella scelta professionale del pilotaggio aereo.—Rivista di medicina aeronautica (Roma), 21 (2): 255-263, April-June 1958. In Italian, with English summary (p. 262).

Individual interests and motivations are important factors in the selection of pilot candidates. Consistency, scope, and intensity of interests merit particular consideration. A survey of applications of pilot candidates conducted by the Italian Aero Medical Center of Study and Research revealed the following facts: (1) 32% of the applicants manifested primarily literary, 44% scientific, 14% both literary and scientific, and 9% miscellaneous interests; (2) 50% declared to have many, 40% few, and 9% no friends; and (3) 90% gave sports as their chief recreational interest while the remaining 10% indicated art and general culture as their primary source of recreation. Most candidates appeared to look upon flying as a sport and as an opportunity to test their courage; in their personality make-up they were extroverts. In conclusion, it is suggested that professional standards for pilots be defined more precisely, and that interests and motivational factors be given greater consideration.

11597
Strollo, M. 1961
[PSYCHOLOGICAL SELECTION OF FLYING PERSONNEL] Selezione psicologica del personale aeronavigante. — In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 64-88. Roma, 1961. In Italian, with English summary (p. 85-86).

The development of the psychological selection of flying personnel is related to the various stages in the development of aviation. In the first period (World War I) emphasis was placed on emotional factors. In the subsequent stage (interval between World Wars I and II), owing to technological advances in the industry, the accent shifted to psychometric technique, while not completely excluding personality. The third stage began with World War II and is still in progress. Selection is based upon psychometric, aptitude, intelligence, and personality tests. In view of new flight requirements, especially under the conditions of subgravity, confinement, and acceleration, it is suggested that the psychological selection criteria be revised. Greater stress must be placed on intelligence and personality rather than on perceptive and motor skills. It is postulated that introverts will be more adapted to space flight than extroverts.

11598
Tabusse, L., and R. Flandrois 1960
[THE 'STOOL' TEST] Test de l'escabeau.—In: Selected papers from symposium held 16-17 June, 1958, Paris, France, p. 7-14. Supplement to AGARDograph 2. Paris, July 1960. In French, with English summary (p. 11).

In order to improve the results of the current step-test, the authors have developed a new device with the following features: (a) two lateral handles which the candidate grips with both hands, resulting in a better distribution of the strain in the many muscular groups of the body; (b) oxygen consumption and lung ventilation are steadily registered. Data are evaluated: from the duration of the test and subsequent heart rate (coeff. A); from the lung ventilation (coeff. B); from the oxygen consumption (coeff. C). The total score (A + B + C) varies from 5 (bad) to 25 (excellent). Further research and correlations are still needed. (Authors' summary)

11599
Taylor, E. K., and J. W. Parker 1959
SPATIAL TESTS AS PREDICTORS OF SUCCESS IN AIR FORCE TRAINING.—Personnel Research and Development Corporation, Cleveland, Ohio (Contract AF 41(657)-125); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Texas (Project no. 7719, Task no. 17104). WADC Technical Report no. 59-361, Dec. 1959. vi+38 p.

The Airman Classification Battery includes two measures of spatial ability. In a search for possible improvement of coverage, 20 spatial tests were investigated to determine their validity for predicting success in Air Force training courses in five career fields representing the five aptitude indexes used in airman classification and assignment. Factor analysis indicated that a heterogeneous test was a better measure of spatial ability than were tests composed of homogeneous items. Of the final school grades as criteria, those for Aircraft Mechanic were most predictable both from Airman Classification Battery tests and from the spatial tests. Those for Organizational Supply Specialist were least predictable. Of the spatial battery tests, the most promising for a place in a differential classification battery is the heterogeneous subtest, Space Survey I. This had high individual validity for mechanical training

but generally lower validity for other training. The authors suggest, as a general predictor of success in technical school, a composite which would include measures of academic ability, verbal facility, and ability to handle abstractions. (Authors' abstract)

11600
[Thomas, S. A.] 1959
PART 29 CONTROVERSY ON THE REVISED PHYSICAL STANDARDS FOR AIRMEN: THE PHYSICAL STANDARDS OF AIRMEN.—Skyways, 18 (11): 16-17. Nov. 1959.

Generalized remarks concerning the revised physical standards for airmen (U. S. Federal Aviation Agency, Civil Air Regulations, Part 29) are presented, and the following additional changes are proposed: (1) relaxation of the visual acuity requirements; (2) omission of the ocular muscle balance tests, and (3) omission of the depth perception test. In addition, methods for enforcing the physical standards are considered.

11601
Thorndike, R. L., and E. P. Hagen 1958
LONG-TERM PREDICTION OF SOME OFFICER-EFFECTIVENESS MEASURES FROM APTITUDE TESTS.—Columbia Univ., New York, N. Y. (Contract AF 41(657)-10); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17109). WADC Technical Report 58-489, Oct. 1958. iv+33 p. AD 204 531

Aptitude tests administered to applicants for flying training in 1943 were correlated with selected indicators of achievement during the following 12 years for 873 Air Force officers. Criterion components identified were: (1) effectiveness as perceived by superiors; (2) quality and quantity of flying duty; (3) importance of duty assignments; and (4) continuity of service. The first component was predicted, but only to a slight degree, by tests of intellectual and academic ability. Tests of mechanical ability and of motor coordination were slightly predictive of the second and third components. The fourth component was largely unpredicted. Any success in identifying men who would receive high officer effectiveness ratings came from measures of quantitative and intellectual abilities and not from the tests that predict success in flying training. (Authors' Abstract)

11602
Timofeev, N. N., and IU. A. Petrov 1961
[THE PROBLEM OF EVALUATION OF FLIGHT APTITUDE] K voprosu ob otsenke letnykh sposobnostei. — Voenno-meditsinskii zhurnal (Moskva), 1961 (1): 30-34. Jan. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (1): 37-42. Washington: U. S. Joint Pub. Research Serv., no. 9169 (1374-N/38), April 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Psychological selection of candidates for flight schools is reviewed, contrasting the Western selection methods with the Soviet approach.

11603
Tompkins, V. H. 1959
THE SIGNIFICANCE OF THE ABNORMAL ELECTROENCEPHALOGRAM IN AIRCREW.—In: Medical aspects of flight safety, p. 277-294. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The abnormal electroencephalogram (EEG) may have some connection with accident liability and with failure in military flying. There is insufficient statistical evidence at the moment to show what proportion of failures the EEG will select, or what proportion of these would be picked out by other methods already in use. A highly abnormal record of the paroxysmal type at rest is so closely linked with physical or psychological breakdown that candidates with such records should not be accepted for training. However, a follow-up of experienced pilots with such abnormal records suggests that any related symptoms are likely to have been revealed before completion of training. An analysis of subjects with head injuries indicated a relationship between accident proneness and the abnormal EEG. A relationship was also found between an abnormal EEG and episodes of unconsciousness in the aircrew. Certain factors in an EEG clinically within normal limits may be related to anxiety reactions of the type which interefere with efficient performance of flying duties. The EEG may prove an effecting method of grading reaction to anxiety-provoking situations. (Author's conclusions, modified)

11604
Trankell, A. 1959
THE PSYCHOLOGIST AS AN INSTRUMENT OF PREDICTION.—Jour. Applied Psychol., 43 (3): 170-175. June 1959.

Since 1951 the applicants for copilot courses in the Scandinavian Airlines System have been given a psychological examination combining standardized testing procedures with a clinical approach, whereby each applicant is assessed on specific variables in independent individual examinations by two or three psychologists. The assessment variables are based on a job analysis of the airline pilots. The final decision on the aptitude score to be assigned to each applicant was reached in a meeting between the psychologists who examined the applicant. During the span from 1951-1956 out of a total of 780 applicants examined, 363 were assigned to copilot courses. During or subsequent to their training period twenty-nine were dismissed because of their inability to come up to SAS requirements. The validity of the selection system was investigated through a comparison between the remaining and the dismissed pilots. It is felt that the synthesis of a statistical and a clinical approach was worked out to the advantage of SAS, as exemplified by the fact that the attrition rate amounted to 8%. The dismissal rates in various categories of suitability for employment were as follows: particularly suitable—0%, suitable—3.7%, doubtful—6.8%, unsuitable—45.9%.

11605
Trites, D. K. 1961
PROBLEMS IN AIR TRAFFIC MANAGEMENT. I. LONGITUDINAL PREDICTION OF EFFECTIVENESS OF AIR TRAFFIC CONTROLLERS. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 61-1, Dec. 1961. 11 p.
Also published in: Aerospace Med., 32 (7): 630-633. July 1961.

Current (1961) job performance evaluations and medical history data were obtained for 149 of 197

men who were trained in air traffic control work in 1956. Evaluations of psychological test and biographical data collected at the time they went through training indicate that: (1) psychological tests can make a useful contribution to screening applicants for air traffic control work, (2) instructors in the air traffic control school can make exceptionally valid predictions of job performance evaluations some years later, (3) older trainees tended to receive poorer job performance ratings some years later than did their younger classmates, and (4) medical history information of the kind collected in this study is not predictable by the psychological tests which were used. (Author's abstract)

11606
Tupes, E. C., 1960
L. D. Brokaw, and M. N. Kaplan
AN APPLICATION OF THE HIERARCHICAL FACTOR MODEL TO THE CRITERION GROUPING PROBLEM.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87002). WADD Technical Note no. 60-219, Sept. 1960. iii+19 p.

A hierarchical factor analysis was applied to intercorrelations of the validity coefficients of 14 aptitude tests for 66 technical school criteria. Seven factors emerged: a general, two second-order, and four first-order factors. From the implications of these results for airman classification, it was concluded that the present five aptitude indexes could probably be reduced to four with little loss in prediction; however, if the number of aptitude indexes were reduced below four, appreciable loss in prediction would occur. The present aptitude indexes could be reduced to four by combining the General and Electronics Aptitude Indexes. Some shifting in courses from one aptitude index to another is suggested. (Authors' abstract)

11607
Tupes, E. C., 1961
and M. N. Kaplan
RELATIONSHIPS BETWEEN PERSONALITY TRAITS, PHYSICAL PROFICIENCY, AND CADET EFFECTIVENESS REPORTS OF AIR FORCE ACADEMY CADETS. — Aeronautical Systems Division. Personnel Laboratory, Lackland Air Force Base, Tex. (Project no. 7717, Task no. 17110). Report no. ASD-TN-61-53, Sept. 1961. iv+40 p.

Cadets in 3 Air Force Academy classes rated each other on 20 personality traits as well as on physical ability and officer potential. Intercorrelation matrices within each class were analyzed to determine relationships between personality trait ratings and Cadet Effectiveness Ratings (CER) and to determine the factor structure underlying the ratings. Traits such as responsibility, perseverance, good adjustment, poise, social polish, and social intelligence were most highly related to CERs, while traits of surgency or extroversion such as talkativeness, frankness, adventurousness, and sociability bore little or no relationships. When compared with Officer Candidate School candidates and majors attending Command and Staff School, the Academy cadets were found to differ little from these groups in the pattern of the personality trait versus CER relationships. Five personality trait ratings were identified which correspond closely to the five (surgency, agreeableness, conscientiousness, emotional stability, and culture) found in other analyses. A sixth factor was identified as physical ability. (From the authors' abstract)

11608
Tupes, E. C., 1958
and R. C. Christal
STABILITY OF PERSONALITY TRAIT RATING FACTORS OBTAINED UNDER DIVERSE CONDITIONS. —Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17109). WADC Technical Note 58-61, May 1958. [20] p. AD 151 041

Peer ratings by officer candidates on specific personality traits have been shown to be predictive of later officer performance. The present study investigated personality trait ratings to determine their factorial structure and the extent to which the factors remained constant in spite of differences in samples, raters, lengths of acquaintenceship, and rating situation. Six intercorrelation matrices were factored and the resulting factors rotated orthogonal simple structure. Five clearly defined personality factors were found in each analysis which remained relatively invariant through all analyses: surgency, agreeableness, dependability, emotional stability, and culture. It is concluded that the factor structure of personality trait ratings is sufficiently invariant that such trait ratings may be regarded as adequate to criteria for the study of personality differences and for test development purposes. (Authors' abstract)

11609
Valentine, L. D. 1961
DEVELOPMENT OF THE AIR FORCE PRECOMMISSION SCREENING TEST-62.—Aeronautical Systems Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 771706). Technical Note no. ASD-TN-61-146, Oct. 1961. iii+5 p.

The 1962 revision of the Air Force Precommission Screening Test replaces an earlier form for screening of applicants for navigator training and selection of airmen for the Air Force Academy Preparatory School. Sections of the test were constructed as short equivalent forms of five parts of the Air Force Officer Qualifying Test: verbal, quantitative, general science, mechanical, and scale reading. Results of a tryout of the new test with a high-aptitude sample of basic airmen demonstrated a suitable distribution of scores and high correlations between corresponding parts of the new test and AFOQT. (Author's abstract)

11610
Valentine, L. D. 1958
VALIDITY OF THE AFOQT (FORM A) FOR PREDICTION OF STUDENT-OFFICER SUCCESS IN OBSERVER TRAINING.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87006). WADC technical note 58-69, Dec. 1958. iii+5 p. AD 207 334

The Air Force Officer Qualifying Test (AFOQT) is part of the screening and selection procedure for several Air Force officer procurement programs. It is administered to college sophomores applying for advanced AFROTC training. Aptitude composites and subtests of the AFOQT (Form A) from the 1957 group of participants were validated against three criteria

of success in Observer Training using the scores derived from the rescoring at Personnel Laboratory. It was found that the Observer-Technical composite is a valid predictor of success in Observer Training for this population.

11611
[Vickers, H. D.] 1959
PART 29 CONTROVERSY ON THE REVISED PHYSICAL STANDARDS FOR AIRMEN: THE PSYCHIATRIC ASPECTS.—Skyways, 18 (11): 17, 54. Nov. 1959.

The relationship between aircraft accidents and personality defects, episodes of poor judgment, and neurotic behavior attributable to the stress of making decisions in flight are discussed. Since little is known of these factors, it is recommended that the subject be given more study by accident investigation boards, and that simple tests for screening the unstable personality be included in physical examinations.

11612
Voas, R. B. 1959
VOCATIONAL INTERESTS OF NAVAL AVIATION CADETS: FINAL RESULTS.—Jour. Applied Psychol., 43 (1): 70-73. Feb. 1959.

The Kuder Preference Record (a standard vocational-interest test) was administered to 605 naval aviation cadets on entrance into flight training. Test scores of the successful cadets were compared with scores of cadets who withdrew or failed in the training program. The Kuder Preference Record demonstrated small but statistically significant validity for prediction of all categories of attrition. However, when differences in mechanical ability were controlled, this inventory did not show a significant relationship to the pass-fail criterion. It is concluded, therefore, that the vocational interests measured by this inventory do not have an important relationship to success in flight training except as they reflect the presence or absence of the special mechanical skills required in flying. (Author's abstract, modified)

11613
Waldmann, E. B., 1959
and J. H. Tillisch
IMPORTANCE OF THE FAMILY HISTORY IN PRE-EMPLOYMENT SELECTION OF PILOTS.—Aerospace Med., 30 (8): 561-566. Aug. 1959.

As a result of the high cost of training the aircrew, and especially the pilot, of jet aircraft, numerous examinations have been introduced to predict years of useful service. Significant data in the family history often determine the feasibility of proceeding with the training program. The data comprise: metabolic diseases (e.g., diabetes and hyperthyroidism), cardiovascular diseases (such as arteriosclerosis and myocardial infarction), psychiatric problems (e.g., paranoid tendencies), migraine, epilepsy, and hematologic disorders (such as pernicious anemia).

11614
Warrington, W. G., 1958
and J. L. Saupe
SPATIAL ABILITIES AND SELECTED ELEMENTS OF AIR FORCE TECHNICAL JOBS.—Michigan State Univ., East Lansing (Contract AF 41(657)-132); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17108). WADC Technical Report 58-491, Dec. 1958. viii+44 p. AD 207 336

An attempt was made to validate an Air Force spatial survey test and to determine whether the test can contribute additional spatial factors to the Airman Classification Battery. A three-dimensional performance-type criterion was developed that simulated perceptual elements identified in 20 selected Air Force technical specialities. The criterion measure, the Space Survey Test, a measure of general mental ability, and a measure of mechanical experience and interest were administered to 273 junior boys. Analyses of these data indicate that the Space Survey Test has considerable power for predicting the criterion. The predictive power is independent of the measures of mental ability and mechanical experience and further research concerning the advisability of including the Space Survey Test in the Airman Classification Battery is warranted. The data suggest that the Space Survey Test is only slightly more effective in predicting the criterion than one of the sub-scores, Spatial Manipulation-A. Special attention should be given to this subtest in future validation. (Authors' abstract)

11615
Watanabe, H., 1960
G. Fushimi, and A. Nagasawa
(PRELIMINARY INVESTIGATION OF ADAPTABILITY RATING FOR MILITARY AERONAUTICS IN JASDF. I.) — Koku igaku jikkentai hokoku [Report of the Aero Medical Experimental Group] (Japan), no. 34, March 1, 1960. 15 p. In Japanese, with English summary.

The "Adaptability Rating for Military Aeronautics" was tested on 151 pilot candidates consisting of 49 Defense Academy, 52 college, and 50 high school graduates. The interviewer judged the candidates as satisfactory or unsatisfactory on the basis of family history, personal history, status, and motivation. The following were rated unsatisfactory: 14% of the Defense Academy graduates, 17% of the college graduates, and 12% of the high school graduates. Status and motivation each accounted for 35% of the unsatisfactory ratings. There was little difference between Defense Academy and college graduates concerning their motivation for flying.

11616
Watanabe, H., 1960
G. Fushimi, and A. Nagasawa
(PRELIMINARY INVESTIGATION OF ADAPTABILITY RATING FOR MILITARY AERONAUTICS IN JASDF. II). — Koku igaku jikkentai hokoku [Report of the Aero Medical Experimental Group] (Japan), no. 35, March 1, 1960. 7 p. In Japanese, with English summary.

Eighty-seven high school graduate pilot candidates were interviewed. The following were found unsatisfactory: 1 on the basis of family history, 1 because of status, 2 because of personal history, 5 because of poor motivation, and 2 because of maladjustment.

11617
Watanabe, H., 1960
G. Fushimi, and A. Nagasawa
(PRELIMINARY INVESTIGATION OF ADAPTABILITY RATING FOR MILITARY AERONAUTICS. III. CORRELATION BETWEEN THE RESULTS OF THE

FIRST ARMA INTERVIEW AND OF THE APTITUDES FLIGHT TEST). —— Koku igaku jikkentai hokoku [Report of the Aero Medical Experimental Group] (Japan), no. 36, March 1, 1960. 11 p. In Japanese, with English summary.

In 70% of 140 cases the Adaptability Rating for Military Aeronautics (ARMA) and the Aptitude Test Flight gave the same verdict. They differed in the remaining 30%. In general, the unsatisfactory ARMA ratings tended to correspond with the unsatisfactory Test Flight ratings. ARMA, when applied to this group, would have eliminated 8% leaving 19% of the total to be eliminated by the Test Flight.

11618
Waters, L. K., and R. J. Wherry 1959
A FACTOR ANALYSIS OF APTITUDE AND ACHIEVEMENT TESTS AND PERFORMANCE IN THE NAVAL AIR TRAINING PROGRAM.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3003, Subtask 10). Report no. 3, Oct. 16, 1959. ii+11 p.

A 21-variable matrix representing the interrelations among selection tests currently used to screen applicants for the Naval Air Training Program, individual tests of the Officer Selection Battery, several performance measures from U. S. Naval School, Pre-Flight, and an index of completion or failure in the basic phase of flight training was factor analyzed by a full centroid method. Seven factors were extracted and identified as verbal facility, mathematical skills, figure manipulation, academic motivation, program motivation, spatial orientation, and aviation information. (From the authors' summary)

11619
Waters, L. K. 1960
FACTOR ANALYSIS OF CADET PEER RATINGS. —— Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3003, Subtask 10). Report no. 5, Oct. 19, 1960. ii+9 p.

Peer nominations on 15 bi-polar traits, three phases of pre-flight training, potential as a pilot and officer, and selection test scores were obtained on 110 cadets undergoing training in the U.S. Naval School, Pre-Flight. These variables were intercorrelated and the resulting matrix was factored by a full centroid method. A general and six group factors were interpreted as general acceptance or rejection of a cadet by his peers, personal and social adjustment, sociability, program motivation, adjustment to military life, self-confidence in physical pursuits, and general intelligence. These factors are discussed and compared to factors obtained from the analysis of airman peer nominations. (Author's abstract)

11620
Webb, W. B. 1959
TRAINING PERFORMANCE AS A SELECTION DEVICE.—In: Medical aspects of flight safety, p. 273-276. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Secondary screening is becoming a vital part of the selection procedure of the Naval Air Training Program at Pensacola, Florida. Secondary screening involves the use of measurements of individual differences as predictors of proficiency throughout the total span of training. By combining pre-flight selection grades with measures obtained from training performance it is possible to furnish training personnel with highly predictive scores in progressive stages of training. These are utilized in a "tagging" procedure which permits the individual candidate to validate the predictions concerning him. This does not increase attrition by eliminating men on whom predictions may be incorrect as a pure secondary screening procedure would operate. It further furnishes decision-making boards with the wisdom of a larger number of cumulated previous experiences. Speculation is made on the potentiality of such a tagging procedure at the initial screening level in view of the problems of increasing restriction in personnel procurement.

11621
Wherry, R. J., N. E. Stander, and J. J. Hopkins 1959
BEHAVIOR TRAIT RATINGS BY PEERS AND REFERENCES. —— Ohio State Univ. Research Foundation, Columbus (Contract AF 41(657-222)); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17109). WADC Technical Report no. 59-360, Dec. 1959. vi+50 p.

An investigation was conducted to test the hypothesis that ratings of reliability and validity equal to those of peer ratings can be secured from individuals listed as references by applicants for officer training. Four rating forms containing items representing factors of surgency and energy, agreeableness, culture, and dependability were developed from factorial analysis of a preliminary applicability form. From results of peer ratings made by college students, a check-list form and a modified forced-choice form were selected for mailing to references listed by ratees. Analysis of a 71% return of reference ratings showed that (1) reliability was consistently lower for reference ratings than for peer ratings; (2) only educators gave satisfactorily valid (comparable to peers) ratings; and (3) the check-list form brought a higher proportion of returns and yielded a higher validity than the forced-choice form. (Quoted in part)

11622
Wherry, R. J. 1960
A TEST OF NEW RATIONALE AND METHODOLOGY FOR THE FORCED-CHOICE TECHNIQUE. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-5001, Subtask 1). Report no. 21, March 1, 1960. iv+[50] p.

A new set of rationale to underlie the forced-choice technique was found to give accurate prediction of results when administered to first-week naval aviation cadets. The various postulates and theorems which comprise the rationale are discussed. A method of estimating the validity of a forced-choice item under no-bias, selection set, and maximum bias conditions is suggested. (Author's abstract, modified)

11623
Willingham, W. W. 1958
ESTIMATING THE RELIABILITY OF MUTUAL PEER NOMINATIONS.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project No.

NM 16 01 11, Subtask 1). Report no. 19, Oct. 14, 1958. ii+6 p. AD 201 877

In the mutual peer nomination technique, subjects are typically instructed not to choose themselves. This results in a blank diagonal in the nomination matrix and presents a technical difficulty in estimating the reliability (internal consistency) of the nominations. It is concluded that a correction for degrees of freedom is the most satisfactory method of handling this diagonal problem. Computational formulas for intraclass reliability coefficients are presented. (Author's summary)

11624
Willingham, W. W. 1958
A NOTE ON PEER NOMINATIONS AS A PREDICTOR OF SUCCESS IN NAVAL FLIGHT TRAINING.—U.S. Naval School of Aviation Medicine, Pensacola, Fla. (Research Project NM 16 01 11, Subtask 1). Report no. 14, May 23, 1958. ii+5 p.

Previous research has indicated that peer nominations can add unique variance to the prediction of success in the Naval Air Training Program. The purpose of this study was to determine the validity of several different peer nominations and to evaluate the effectiveness of summing several ratings. Two peer nominations were found to predict success equally well. One of these, leadership, is currently included in the grading system of the U. S. Naval School, Pre-Flight. The data indicate that additional peer nominations would not improve prediction of success in the training program. (Author's summary)

11625
Wilson, C. L. (Editor) 1959
PROJECT MERCURY CANDIDATE EVALUATION PROGRAM.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959. viii+133 p.

A battery of physiological, psychological, and biochemical tests was performed by the Aerospace Medical Laboratory on the candidates for the National Aeronautics and Space Administration's Project Mercury. These tests yielded new information on the physiological limitations of high transverse g, methods of recording anthropomorphic measurements, effects of noise and vibration on humans, body responses to heat stress, frequency of heart murmurs during heat stress, physiological and biochemical responses occurring during 1-hour MC-1 tests, physiological responses during vigorous exercise, and interpretation of psychological and psychiatric testing. Data on candidate performance are presented. The final candidate recommendation meeting is described. This report describes the methods which were used to correlate biomedical data statistically. A list of possibly significant correlations between various tests is included. In the final candidate recommendation, psychological attributes outweigh physiological attributes. Potentially fruitful areas for future experimentation are discussed. (Author's abstract) For the individual papers see entries no. 9825, 10125, 10735, 10935, 10952, 11046, 11730, 11760.

11626
Woodworth, D. G., 1958
and D. W. MacKinnon
THE USE OF TRAIT RATINGS IN AN ASSESSMENT OF 100 AIR FORCE CAPTAINS.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Note 58-64, vi+38 p. AD 202 845

As part of a project for developing officer assessment techniques, 30 rating dimensions were used by 10 raters to record their psychological evaluations of 100 captains. A cluster analysis of these ratings yielded three reliable cluster scores which could be defined as measuring general effective intelligence, personal soundness, and effective leadership. The three cluster scores did not correlate significantly with available Air Force criterion evaluations of the subjects. When the subject officers were differentiated on the basis of being rated or nonrated, it was found that the correlations between cluster scores and two of the criteria rose to levels which were significant within the rated group. This was interpreted as an indication that differentiation on the criterion side of the relationship is needed for significant advancement toward an understanding of the Air Force officer personnel evaluation variables, or the relating of psychologically meaningful measures to these criteria. (Authors' abstract)

11627
Zav'ialov, E. S., 1961
N. L. Maizel, and B. L. Pokrovskii
[EXPERIENCE IN PSYCHOLOGICAL EXAMINATION OF FLIGHT STUDENTS FOR SELECTION FOR AIR FORCE SCHOOLS] Opyt psikhologicheskogo obsledovaniia kursantov pri otbore v aviatsionnye uchilishcha. — Voenno-meditsinskii zhurnal (Moskva), 1961 (1): 34-37. Jan. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (1): 43-47. Washington: U. S. Joint Pub. Research Serv., no. 9169 (1374-N/38), April 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

A group of flight students were examined in 1958 using group tests of attention, visual-motor coordination, and characteristics of reorganization of habits as well as individual examination of sensorimotor reaction on the NIIIAM apparatus (Scientific Research Institute of Aviation Medicine) and psychological interview. On the basis of the total test picture a tentative flight prognosis was made for each candidate ranging from good to indefinite or poor. The decision to accept the student was made without knowledge of prognosis. A follow-up of flight progress of 89 students showed that rejection of the 20 students with poor flight prognoses would have reduced the number of poor and average students by more than a third.

c. Training

[*Flight simulators under 11-d*]

11628
Ackermann, J. 1959
[SELECTION AND TRAINING OF PILOTS] Selección y formación de pilotos.—Ciencia aeronáutica (Caracas), 2 (12): 62. 1959. In Spanish.

Preparation of personnel for flight by Iberia Airlines is based on strict observation of the following points: (1) rigorous selection; (2) instruction and constant training; (3) continuous survey of per-

formance; and (4) observation of real discipline, which has radically reduced outbreaks of exhibitionism and individualism during the execution of commercial flights.

11629
Barker, C. C. 1959
SOME PRACTICAL MEDICAL ASPECTS OF ACCIDENT PREVENTION.—In: Medical aspects of flight safety, p. 52-57. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The physical standards for aircrew selection are largely standardized in all the NATO nations. The psychological approach to selections appears to be inadequate since it cannot provide accurate data on a pilot's flight aptitude or his behavior during times of war. The necessity is stressed for indoctrination in aviation medicine and physiology of all aircrews at all stages of their flying careers as a fully authorized integral part of their ground training program. The responsibility for the program should be the air staff's and not the doctors'. This training requirement plays a vital part in the reduction of the accident rate. Since the Aeromedical Panel of AGARD is a research organization, it is recommended that they advise the NATO nations on various matters such as: (1) the value of the ejection seat test rig, its dangers, and how they may be prevented; (2) the use of the decompression chamber; and (3) an evaluation of physical standards and requirements. Current military aircraft are limited in their performance by the human factor. Therefore it is suggested that the Aeromedical Panel direct improvements and developments directly related to the personal equipment, cockpit arrangements and conditions, etc. to improve the pilot's comfort and efficiency while flying.

11630
Barron, C. I. 1959
HIGH ALTITUDE INDOCTRINATION TRAINING FOR COMMERCIAL AIR CREWMEN.—Canad. Air Line Pilot (Montreal), 15 (2): 33-37. April 1959.

The performance capabilities of jet airliners, with ceiling capabilities in excess of 40,000 ft., raise a number of considerations in connection with possible emergency situations, and emphasize the need for a formalized and controlled physiological or high-altitude indoctrination program for commercial air crewmen. Among the considerations related to flight at high altitude are the following: possible exposure to hypoxia after rapid decompression, visual limitations occurring as a result of marked reversal of the brightness-illumination ratio, individual problems centered around an accurate and realistic appraisal of closing speeds, sensory organ limitations and psychological behavior of pilots, and the problems associated with the mechanical characteristics of jet aircraft such as noise, vibration, and the toxicity of fuels. Presentation of pertinent material for the instruction of commercial air crewmen may be accomplished in various ways: through academic lectures supplemented by audio-visual aids; by demonstrations of hypoxia and decompressions performed on military personnel or volunteers; by exposing the trainees to various stresses in a training aircraft; or by actually subjecting them to hypoxia and rapid decompression in low-pressure chambers. A proper understanding of visual problems at altitude and of the need for mechanical assistance in enhancing vision should be included in a training program. Intensive orientation and indoctrination (didactically presented with the aid of teaching devices) should make the pilot aware of the need for mental alertness, constant observation, predetermination of action in the event of emergency situations, and the ability to respond rapidly.—The crew indoctrination program used by the Lockheed Aircraft Corporation of California is briefly reviewed and its purposes are summarized as follows: to alert the employees to the stresses associated with aircraft flight, to insure the proper use of protective equipment whenever necessary, and to minimize potential hazards that might exist under stress conditions. The hazards and limitations attendant to pressure chamber exercises, the precautions to be supplied in their use, and the medical ramifications of such training are also mentioned.

11631
Boisbourdin, C., and A. de Brisson de Laroche 1959
[LIMITS OF PROGNOSIS BASED ON PSYCHOMOTOR TESTS] Limites des pronostics fondés sur les test psychomoteurs.—In: Medical aspects of flight safety, p. 253-261. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

The validities of psychomotor tests (Aircrew Classification Battery) are presented for flight training schools in the United States, Canada, and France in which French students were trained. The most pronounced differences in requirements between these schools concern the French advanced fighter training school which puts more emphasis on intellectual capacities. Psychological interpretations of the tests were made through factor analysis, biographical inventories, study of test performance, and the effect of learning at a second testing. Psychomotor tests are predictive in the selection-training system when measuring previous learning and the social environment. The tests do not aid in discriminating between aptitude, motivation, and environmental condition in past activities. The psychological problems of selection arise primary from criteria of the school rather than from the tests.

11632
Busyrev, A. 1959
["NOW WE SHALL PROCEED WITH THE TEST..."] "Seichas pristupim k opytu..."—Sovetskaia aviatsiia (Moskva), 142 (3312): 4. June 19, 1959. In Russian.

This is a short note describing the training and the work of flight surgeons in the Soviet armed forces.

11633
Day, R. E. 1961
TRAINING ASPECTS OF THE X-15 PROGRAM.—In: The training of astronauts, p. 5-14. National Academy of Sciences-National Research Council, Publ. no. 873. 1961.

The aims of the mission and the pilot tasks and qualifications are briefly reviewed. Various training aids are described such as a motion simulator, and an analog computer-simulator for flight control from launching to landing. A centrifuge for study-

ing the effects of acceleration is shown, and a variable-stability T-33 airplane for matching the characteristics of the X-15 is discussed. The landing phase of the X-15 is critical, and for training the pilot both an oscilloscope presenting approach attitudes and a F-104A airplane with devices to simulate the approaches of the X-15 were used. The two phases of the training program are discussed briefly, and the various aspects of a typical flight are described.

11634
Demaree, R. G. 1961
DEVELOPMENT OF TRAINING EQUIPMENT PLANNING INFORMATION. —— Psychological Research Associates, Arlington, Va. (Contract AF 33(616)-7464); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7190, Task no. 71608). ASD Technical Report no. 61-533, Oct. 1961. vii+101 p.

Data are presented on the nature, purpose, time phasing, technical considerations, developmental procedures, and documentation associated with Training Equipment Planning Information (TEPI). Accounts are given of engineering and human factors considerations (with special emphasis upon the latter) because both approaches enter into the determination of what items of training equipment will best serve the purposes of a particular system. The first two sections contain general information of interest to those Air Force and contractor personnel who are associated with the training; the remaining sections describe technical considerations and developmental procedures of interest to those with specific responsibilities in the planning and development of training equipment. A bibliography of 65 references is included.

11635
Diringshofen, H. von 1961
[THE SIGNIFICANCE OF THE SO-CALLED HUMAN FACTOR IN THE RELIABILITY OF COLLISION PREVENTION IN HIGH-DENSITY AIR TRAFFIC AREAS] Die Bedeutung des sogenannten Faktor-Mensch für die Zuverlässigkeit der Kollisionsverhütung im Nahverkehrsbereich. —— Flugleiter (Frankfurt), 8 (3): 20-22. July 1961. In German.

In view of the importance of the human factor in the air traffic control, particularly for prevention of mid-air collisions, the author suggests (1) flight training of ground air traffic controllers to acquaint them with the pilot's problems, (2) relief from some air traffic control duties by technological substitutes and automatization, and (3) a program of aeromedical control of the working conditions, selection, and prophylactic care of the air traffic controllers.

11636
Diringshofen, H. von 1961
CONSIDERATIONS FOR SPECIAL INSTRUMENT FLIGHT TRAINING TO MINIMIZE SPA[T]IAL DISORIENTATION.——Aerospace Med., 32 (5): 442-443. May 1961.

Statistics of the U. S. Air Research and Development Command show that probably 14% of fatal aircraft accidents can be attributed to spatial disoreintation and vertigo. Disturbances of spatial orientation appear frequently during the transition from visual flight to instrument flight. A catastrophe during this transition can almost always be traced to pilot error. In order to avoid such mishaps, special instrument training should become standard procedure during flight training, and if the cadet is forced into flying situations where he suffers from spatial disorientation and dizziness, it is probable that the number of accidents could be reduced. For a special instrument flight training program to embrace all combat conditions, the artificial horizon must fulfill the following conditions: (1) It must be completely adaptable to acrobatics and insensitive to accelerations. (2) Correction of plane attitude must become a reflex act on the part of the pilot. To warn of an approaching critical situation, such as a critical Mach number, it is suggested that a source of vibration of approximately 50 cycles per second be placed in the hand grip of the control stick.

11637
Eckstrand, G. A., 1960
and M. R. Rockway
THE ROLE OF SIMULATORS FOR SPACECREW TRAINING.——Astronautics, 5 (2): 38-39, 76, 78, 80. Feb. 1960.

Training simulators designed to assist in the development, maintenance, and evaluation of human skills within a space holding facility are discussed. A sketch is included of a training simulator setup for an advanced holding facility. Inter-crew training (system checkout and final crew selection, mission briefing, and establishment of standard operating procedures) is evaluated along with procedures for handling emergencies. Two approaches are presented to the problem of maintaining performance skills during long periods of operational disuse: (1) provision of job aids which can be used to guide performance when required, and (2) provision of an on-board training capability so that skill can be exercised on route.

11638
Eckstrand, G. A., 1961
and M. R. Rockway
SPACECREW TRAINING: A REVIEW OF PROGRESS AND PROSPECTS. —— Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 1710). ASD Technical Report no. 61-721, Dec. 1961. iv+23 p.

A review is presented of current progress and future prospects in the field of spacecrew training. Descriptions of all current astronaut training programs are presented, and a number of general conclusions with reference to such training are drawn based upon the manned space operations which have been conducted to date. In addition to the actual experience which has been gained in training spacecrew personnel, a review is presented of recently completed and current research which is directly relevant to this problem. Several areas in which research should be accelerated are identified. (Authors' abstract)

11639
Flyer, E. S. 1958
A FOLLOW-UP STUDY OF NAVAL ACADEMY GRADUATES WHO ENTERED THE AIR FORCE.—— Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17115). WADC Technical Note 58-62, June 1958. ii+26 p. AD 151 042

Air Force Academy selection and proficiency records cannot be validated against measures of officer effectiveness for some years, but an estimate of the relationship of training grades to officer performance can be obtained from comparable records of Naval Academy (Annapolis) graduates who have entered the Air Force. Midshipman training grades were related to Air Force retainability and to officer effectiveness measures. The retention rate in the Air Force of Annapolis graduates, five to eight years after graduation, is about 73%. Annapolis graduates who resigned their commissions had lower Physical Training grades than those officers remaining on active duty, but differed in no other training proficiency measures. Naval Academy grades predict officer effectiveness reasonably well, with Aptitude-for-Service ratings providing the best single predictors of Air Force officer effectiveness. These results support the use of Aptitude-for-Service ratings and academic grades received at the Air Force Academy as intermediate criteria of officer effectiveness. (Author's abstract)

11640

French, E. G. 1958

A NOTE ON THE EDWARDS PERSONAL PREFERENCE SCHEDULE FOR USE WITH BASIC AIRMEN.—Educational & Psychol. Measurement, 18 (1): 109-115. 1958.

In connection with some research on motivation the Edwards Personal Preference Schedule was administered to 215 airmen in their seventh week of training at Lackland Air Force Base. Examination of means obtained for trainees on 15 scales revealed that many differed markedly from published norms. Basics were significantly above norm in the following scales: Deference, Order, Abasement, and Endurance—below norm: Exhibitionism, Autonomy, Aggression, and Heterosexuality. An experiment was devised to test the stability of the social desirability scale for answers. The test was administered to equal groups of trainees a few hours after their arrival on base under three sets of instructions, also to equal groups of men after seven weeks of training under comparable sets of instructions. The scores on each scale under the two conditions of training and three sets of instructions were analyzed by analysis of variance. The author includes two tables showing obtained means, direction and significance of changes, condition nearest norm, and where highest difference occurred. In conclusion the states that differences from the norm originally observed were due to the recruits' responding to pressures to answer "Air Force way" on variables appearing desirable or undesirable to Tactical Instructor. On scales where there is no unique Air Force answer real differences between new recruits and seven-week men are due to recovery of equilibrium of the seven-week men. It is recommended that items be rescaled for social desirability when a group differing greatly from normative is to be tested.

11641

Gerathewohl, S. J. 1959

PSYCHOLOGICAL PROBLEMS OF SELECTION, HOLDING, AND CARE OF SPACE FLIERS.—Research and Development Command (Army). Bioastronautics Research Unit, Redstone Arsenal, Ala. Report no. CSCRD-16-4, Nov. 13, 1959. 13 p.

Also published (with slight modifications) as: PSYCHOLOGICAL PROBLEMS OF SELECTION, HOLDING, AND CARE OF ASTRONAUTS.—Astronautics, 5 (2): 36-37; 52; 54. Feb. 1960.

The selection, holding, and care of astronauts pose some unusual psychological problems, which can best be solved by new and unique scientific approaches, as well as by applying information on human behavior, motivation, and morale already available through experiences of the past. After establishing the proficiency and health requirements necessary for piloting a vehicle on its prescribed space mission, the best qualified applicants must undergo further education in navigation, rocketry, astronomy, physics, geography, engineering, and other related subjects. An advanced training program utilizing modernistic simulators, actual build-up flights, and aerospace safety and survival techniques will not only serve to maintain and boost the morale of the candidates, but may also constitute a continuous and natural process of selection and specialization. It is the responsibility of everyone involved in this program to observe the individual rights of the astronauts and to secure their normal and adequate status within our society. (Author's abstract)

11642

Hatch, R. S. 1959

AN EVALUATION OF THE EFFECTIVENESS OF A SELF-TUTORING APPROACH APPLIED TO PILOT TRAINING.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 77535). WADC Technical Report no. 59-320, July 1959. v+19 p.

This study concerns the problem of insuring ready recall of a large body of in-flight job information for Air Force pilots. The effectiveness of a voluntary self-tutoring approach utilizing one type of "game appeal" device was examined. Two matched groups of Air Force pilots were pretested on their knowledge of instrument flying information. The device was available to the other group. After a 2-month period both groups were post-tested. Despite the fact that minimal exposure to the machine occurred, players improved significantly on the criterion tests while non-players did not improve. Factors pertinent to the interpretation of the results and implications for further research were discussed. (Author's abstract)

11643

Horowitz, M. W., and R. Fromer 1959

A SET OF DISCRIMINABLE SURFACE COLORS AND SYMBOLS FOR CODING IN ANIMATED TRAINING PANELS.—Educational Research Corp., Cambridge, Mass. (Contract N61339-294); issued by Naval Training Devices Center, Port Washington, New York. Technical Report no. NAVTRADEVCEN 20-OS-52, May 5, 1959. v+19 p. AD 220 477

A preliminary choice of promising color codes and symbol codes was made and tested against preselected backgrounds in order to determine the most appropriate combinations for animated training panels depicting various aircraft systems. Fifteen colors and ten symbols are recorded which are easily discerned.

11644

Jensen, M. B. 1961

ADJUSTIVE AND NON-ADJUSTIVE REACTIONS TO BASIC TRAINING IN THE AIR FORCE.—Jour. Soc. Psychol., 55 (1): 33-41. Oct. 1961.

An 82-item questionnaire dealing with personal adjustments and attitudes was administered to 9194 male basic airmen for psychological screening in medical processing. Item analysis of the questionnaire was based on the responses of 4980 successful and 315 unsuccessful airmen. Effectiveness of prediction of success made by psychology personnel at the onset of basic training was checked against military records and end-of-training ratings by tactical instructors. Certain items in the Personal Report were shown to be of value in separating successful from unsuccessful male basic airmen. Mental pathology is seen as a minor cause of failure in basic training. Rather, immaturity, lack of motivation, personal and social habits, and the social order of the military itself probably account for 95% of the failure of the unsuccessful 5%. Basic training enhances the adjustment of the well-adjusted, but may result in either adjustment or maladjustment in borderline cases. The airman who survives basic training is more apt to be an administrative problem later than a mental-health one.

11645
Jensen, M. B. 1961
THE "LOW LEVEL" AIRMAN IN RETESTING AND BASIC TRAINING: A SOCIOPSYCHOLOGICAL STUDY. — Jour. Social Psychol. 55 (2): 177-190. Dec. 1961.

During May through September, 1952, male basic airmen who failed the Airman Cluster Battery and the Air Force Qualification Test were retested individually, employing among other tests Porteus Mazes, and interviewed. Recommendation of retention or discharge from the Air Force was followed administratively. The careers of 329 retested airmen were followed through basic training and compared with those who trained in the same flights after passing the qualification tests. Tactical instructor ratings of performance were gathered for both groups. Some of the general findings about the retested airmen are: Excluding academic achievement, the retested airmen as a group were not inferior but approximated a normal distribution of abilities; the average Porteus IQ was 112. Failure on AC-IB and AFQT was a resultant of academic retardation, socio-economic and cultural factors, lack of motivation to succeed based perhaps on cultural attitudes, and character and personality defects. At the end of basic training, 316 retested airmen were reassigned, ten discharged as unadaptable because of social ineptness and inability to handle personal emotional problems.

11646
Jones, Glenn H. 1961
FILMS TO TRAIN SPACE SHIP PILOTS. — Amer. Cinematographer, 42 (8): 476-477, 491-493. Aug. 1961.

Project Dyna-Soar being a pilot-manned space craft has vision problems similar to those of an aircraft. A wide-screen film (170°) was taken within a normal aircraft during various flight maneuvers. The final picture was an accurate, simulated view of an approach and landing under both normal and abnormal conditions. The film was designed to be set up before a full-scale cabin mock-up of Dyna-Soar, thus enabling the pilot inside to get an accurate idea of the visibility involved.

11647
Judy, C. J. 1960
A REGRESSION ANALYSIS OF ONE SET OF AIRMAN PROFICIENCY TEST SCORES.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 17018). WADD-TN-60-139, June 1960. iii+11 p.

A set of Airman Proficiency Test scores is described in terms of the variance held in common with selected measures of training, experience, education, aptitude, supervisory opinion, and airman attitudes for 384 mechanics tested in 1956 and 1957. Each of these categories, excepting airman attitudes, could be used to predict the Airman Proficiency Test criterion at some level of effectiveness; but only the training variables and the aptitude variables added significantly to the prediction attainable by using all other available information. Results show the utility of the test scores in defining one important aspect of airman proficiency. (From the author's abstract)

11648
Judy, C. J. 1961
A VALIDATION OF QUALIFICATION REQUIREMENTS FOR WORK IN A USAF SPECIALTY. — Occupational Psychol. (London), 35 (1-2): 71-75. Jan.-April 1961.

The problem of this investigation was to determine the utility of selected education, experience, aptitude, and training variables in predicting a measure of job knowledge. The subjects were 415 Air Force mechanics specializing in the maintenance of a heavy bomber aircraft. Using multiple regression techniques, three groups of variables were evaluated for their predictive power. A group composed of specific high school courses showed no relationship to the criterion. A second group (education level, time in the Air Force, and Air Force training courses not specific to the equipment maintained) were individually predictive of the criterion, but added nothing to the prediction from a composite of the other variables. A third group (Mechanical Aptitude Index, Air Force training courses specific to the equipment maintained, and Air Force maintenance experience) were individually predictive, and in combination with the other qualification variables added significantly to the composite prediction. (Author's summary)

11649
Kalinin, IU., and M. Ulupova 1961
[FLIGHT-CHAMBER TRAINING OF THE COURAGEOUS] Trenirovka otvazhnykh: "komnatnyi" polet. — Znanie—Sila (Moskva), 36 (9): 9-11. Sept. 1961. In Russian.
English translation by U. S. Joint Pub. Research Service (Washington), no. 11431, p. 1-12, Dec. 7, 1961.

Uses of trainers are described for flight training, navigator training, landing routines, airport control tower operations, naval operations, and even automobile driving. Yuri Gagarin was subjected to thorough training simulating conditions in the space craft and instructed on a special trainer preparatory to space flight. Simulators can also be put to use for studying communications with artificial satellites in space, sending a satellite into space, assembling interplanetary stations, landings on other planets, etc.

11650
Kidd, J. S. 1961
A COMPARISON OF TWO METHODS OF TRAINING IN A COMPLEX TASK BY MEANS OF TASK SIMULATION. —— Jour. Applied Psychol., 45 (3): 165-169. June 1961.

Improvement in performance with training in a complex task of radar air traffic control was compared under a condition of constant high input load during training vs. a condition of graduated input load during training. Relative input load was defined as the number of aircraft under the control of a single operator. The test performance of subjects trained under constant high input load was significantly superior on several criteria to that of subjects trained under the graduated input load condition. An explanation was proposed in terms of the heightened frequency of feedback of knowledge of performance experienced by the high constant input load group. (Author's summary)

11651
Kopstein, F. F., 1961
and I. J. Shillestad
A SURVEY OF AUTO-INSTRUCTIONAL DEVICES. —Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171007). ASD Technical Report no. 61-414, Sept. 1961. vii+111 p.

This report summarizes the state of the art of auto-instruction and teaching devices and catalogs instructional devices to April 1961, in the interest of suggesting possible applications to local training or education problems. The first section briefly reviews what auto-instruction is, whether it is an entirely new concept, its practical benefits, auto-instruction terminology, programs and devices, current programming formats, evaluating a program, and discusses prospects for the future of auto-instructional devices: Skinner machines, Pressey machines, Crowder technique, self-organizing systems, audio-visual machines, digital computers as teaching machines, and miscellaneous devices. A list of teaching machine patents is appended. (Authors' abstract) (39 references)

11652
Leamer, B. V. 1961
EDUCATION AND TRAINING IN CIVIL AVIATION MEDICINE.—Aerospace Med., 32 (1): 1-5. Jan. 1961.

The educational program for Civil Aviation Medicine should start by requiring that all aviation examiners be so designated by the Federal Aviation Agency. It should be required that not only commercial pilots and aircrew should be examined by designated examiners, but private pilots and student pilots also. If private and student pilots are to be examined, a rapid acceleration of the designation program will be necessary, and refresher courses must be made available to the physicians throughout the country who wish to be designated. One-day and two-day courses in various locations are suggested, which would emphasize the need of certain physical requirements, and would explain the reasons for listing certain conditions as disqualifying. Although already crowded, the medical school curriculum would be the logical place for the beginning of education in the basic factors of aviation medicine.

11653
Lewis, C. 1959
SIMULATORS TRAIN MERCURY SPACE PILOTS.—Aviation Week, 71 (7): 56-57, 59. Aug. 1959.

The seven American "astronauts" are now approaching the initial stages of the training and indoctrination program involving the use of simulators to familiarize them with the Mercury capsule and its operation and with simulated space conditions. The first training system is a static closed-loop analog simulation of the Mercury mission. The pilot is an active part of the closed-loop system. His work will be confined to flight control coordination and evaluation of control system and displays. More advanced simulation will be offered in a computer-run centrifuge with the basic Mercury instrument panel with animated attitude, rate, altitude, and acceleration instruments, Mercury couch, restraint harness, and three-axis type hand controller. The launch acceleration pattern will be run open loop. Accelerations (up to 20 g) in the re-entry phase will depend to a limited degree upon pilot control. An air bearing orbital-type attitude simulator will be used to train pilots in attitude control during orbital flight. An environmental trainer will have prototype environmental equipment on which the pilot will be trained, first at sea level, later in a vacuum chamber. An escape and recovery trainer will cover the use of recovery equipment, getting out of the capsule in various sea conditions and using the raft. Training will be continued with zero-gravity aircraft flight. A water-tank zero-gravity simulator with zero visibility and disorientation conditions may be employed later. A ball-disk space-flight control simulator will provide practice in using control systems without damping and spring response.

11654
Loebelson, R. M. 1961
SAFETY STARTS WITH TRAINING. —Skyways, 20 (10): 30-31, 52. Nov. 1961.

In a program designed to keep professional pilots and flying executives proficient, Flight Safety, Inc., operates transition training and refresher schools for corporate pilots, Federal Aviation Agency and Air Force flight specialists and inspectors, and pilots from foreign countries. Professional pilots normally require seven days to complete the initial curriculum which involves ground training, instrument procedures training, and flight training in the client-owned airplane.

11655
Lohrenz, C. A., 1961
and B. L. Zymet
SYNTHESIZED EQUIPMENT FOR GROUND BASED RADAR SYSTEMS. I. RADAR OPERATOR TRAINING—THE MAN, THE MACHINE, AND THE SIMULATOR.—Curtiss-Wright Corp. Electronics Div., East Paterson, N. J. (Contract AF 33(616)-5998); issued by Aeronautical Systems Div. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 0(8-6114), Task no. 60172). Technical Report no. 61-411 (I), Oct. 1961. xv+301 p.

The requirements of training for the ground-based radar operator are analyzed by looking at the man and the training structure, the machine he operates, and last, the training devices used by instructor personnel in training the operator to perform his task. The Air Force speciality codes for the radar career field are included for those

that are not familiar with them. Various radar types, including search, precision, height-finding, and tracking, are reviewed from the operator's view point. Next, existing ground-based simulators are reviewed as to their applicability in the more complex radar situations. A hybrid synthetic technique capable of more complete radar environment simulation is promulgated providing the Air Force with a tool for faster and more adequate radar operator training. Furthermore, the design is flexible, allowing easy modification or additions as the need for even more sophisticated training systems arises. (Authors' abstract)

11656
Maccoby, N., and F. D. Sheffield 1958
THEORY AND EXPERIMENTAL RESEARCH ON THE TEACHING OF COMPLEX SEQUENTIAL PROCEDURES BY ALTERNATE DEMONSTRATION AND PRACTICE.—In: Symposium on Air Force Human Engineering, Personnel, and Training Research, p. 99-107. National Academy of Sciences—National Research Council, Publication no. 516. 1958.

Subjects were given two learning tasks, a complex geometric construction and a mechanical assembly task, in order to establish principles concerning optimum methods for combining demonstration and practice. In serial tasks as difficult as these, overt perfromance is very poor after a single complete demonstration, but improves greatly if the demonstration is subdivided into smaller natural units, each of which is practiced, before proceeding to the next section. The optimum use of practice probably involves transition from smaller to larger segments of the task in order to maximize both accuracy of initial practice and serial integration of the task as a whole.

11657
Miller, Elmo E. 1958
TRANSFER EFFECTS OF SPECIAL TRAINING UPON PRE-SOLO FLIGHT TRAINING.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 16 01 11, Subtask 11). Report no. 1, Sept. 18, 1958. iv+[63]p.

Analysis of the learning situation in pre-solo flight training resulted in the development of economical, simple, and administratively feasible training aids for the following areas: procedures, trimming, knowledge of the local area, nose attitudes, and landing approaches. The techniques developed were applied to seventy-two pre-solo students according to a complex (factorial) experimental design so that the effects of particular techniques might be assessed independently. Benefits (statistically significant) resulted from the procedures training, the trim training, and the training for familiarity with the local area. Correlations of some training task scores with pre-solo grades suggest material for new selection tests.

11658
Miller, R. B. 1960
TASK AND PART-TASK TRAINERS AND TRAINING. — American Inst. for Research, Pittsburgh (Contract AF 33 (616)-2080); issued by Wright Air Development Division. Aerospace Medical Division, Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7179, Task no. 71640). WADD Technical Report no. 60-469, June 1960. v+66 p.

Because enough simulators for sufficient and varied practice in job skills are rarely available, simpler devices are needed for training parts of tasks. In addition, learning total jobs one step at a time may be more efficient. Procedures for dividing total performance requirements into training segments lending themselves to distinctive types of trainers are described. Principal variables in the division are phase of learning and time-sharing of activities. Risks of improper part-time training are detailed and principles for reducing such risks are proposed. Classes of trainers identified are: (I) Familiarization Trainers, (II) Instructed-Response Trainers, and (III) Automatized Skill Trainers. Essential training and human engineering variables are described for each of the above classes of devices. Potentialities of the Class II device are emphasized. (Author's abstract)

11659
Miller, Robert E. 1960
PREDICTING ACHIEVEMENT OF CADETS IN THEIR FIRST TWO YEARS AT THE AIR FORCE ACADEMY. —Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Texas (Project no. 7719, Task no. 17109). WADD Technical Note no. 60-37, Jan. 1960. v+14 p.

As cadets progress through the Air Force Academy it becomes possible to secure new criteria against which selection and experimental test batteries may be validated. The present study reports the predictive validities of an operational selection battery and an experimental battery administered to the class of 1959. Academic and leadership criteria maturing at the end of both the first and second years at the Academy (fourth and third classes, respectively) are used. It is found that validities of the selection battery appear to hold up well against criteria maturing in the second year (third class), and that the experimental battery contains predictors which may be worth further development as substitutes for operational tests. Attention is called to the highly selected character of the cadet sample and to possible effects of homogeneous ability groupings in certain academy classes. (Author's abstract)

11660
Miller, Robert E., and J. A. Creager 1960
PREDICTING ACHIEVEMENT OF CADETS IN THEIR FIRST YEAR AT THE AIR FORCE ACADEMY, CLASS OF 1962.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87003) WADD Technical Note no. 60-259, Oct. 1960. ii+8 p.

A battery of experimental tests was administered to the Air Force Academy class of 1962 on entry. Results of these tests and previously administered selection tests were correlated with final academic grades and Cadet Effectiveness Ratings earned in the fourth class year. The predictive validities of the tests tended to show some loss when compared with those from previous classes. Shifts in validity patterns for the same tests against the same or similar criteria were also noted. Nevertheless, all criteria proved to be predictable. Prediction of mathematics and science course grades was best accomplished by the Quantitative composite of the Air Force Officer Qualifying Test, while the English achievement test of the College Entrance Examination Board was the

most adequate for the prediction of English grades. These findings are consistent with those from other Academy classes. Thirteen predictors had significant validity coefficients for the prediction of Cadet Effectiveness Ratings. The best single predictor of this leadership criterion was the experimental Peer Status scale of the Life Experience Inventory. (Authors' abstract)

11661
Miller, Robert E. 1961
PREDICTING ACHIEVEMENT OF CADETS IN THEIR FIRST YEAR AT THE AIR FORCE ACADEMY, CLASS OF 1963.—Aeronautical Systems Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87003). Technical Note no. ASD-TN-61-45, May 1961. iii+6 p.

Applicants for each class at the Air Force Academy take a battery of selection tests during the winter preceding admission of the class and a battery of experimental tests on entry. Results from both batteries are used as predictors of academic and leadership performance at the Academy. Predictive validities were computed in the class of 1963 for tests in these batteries, using the academic average for the fourth class year and the Cadet Effectiveness Rating for the fall semester of that year as criteria. Both criteria were predictable. Validities for the academic criterion attained a value of .51, while for the leadership criterion the highest validity was .30. The Physical Aptitude Examination, frequently the best predictor of the Cadet Effectiveness Rating, was equaled or exceeded by at least six other more economical predictors. Several different sets of predictors were about equally effective in predicting this criterion. An increase in validities of the operational High School Activities Index was noted as compared with recent classes. The trend toward lower validities, observable in the past several classes, did not hold for the class of 1963. (Author's abstract)

11662
Mullins, C. J., 1959
and J. A. Cox
CONSTRUCTION AND VALIDATION OF THE INSTRUCTOR APTITUDE TEST.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17104). Report no. WADC-TN-59-203, Dec. 1959. 7 p.

A test was constructed for predicting success in Technical Instructor Schools, using items previously proved valid for General Instructor School success and for Pilot Instructor School success. It consists of four parts: a verbal section, an arithmetic reasoning section, a social insight section, and an interest section. The test was normed for instructors now performing on the job. Validation coefficients were obtained between test scores and course grades in Technical Instructor Schools at six Air Force bases. Validities ranged from .06 to .63, with five of the six highly significant. These compare favorably with validities of the General Aptitude Index of the Airman Classification Battery for the final school grade criterion. Test scores identified eliminees from Technical Instructor Schools with considerable accuracy. (Authors' abstract)

11663
Mullins, C. J., 1960
and J. A. Cox
EVALUATION OF THE AFROTC FLIGHT INSTRUCTION PROGRAM.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87006). WADD Technical Note no. 60-44, April 1960. ii+6 p.

The Air Force ROTC Flight Instruction Program initiated in 1956 is evaluated by comparison of 1957 Air Force ROTC graduates who were given the training and a similar group who were not. Exposure to the Flight Instruction Program training produced no significant increase in the proportion of Air Force ROTC graduates electing to enter Air Force pilot training; but Flight Instruction Program graduates exhibited a marked advantage over non-Flight Instruction Program trainees in their lower elimination rates from both primary and basic pilot training. An estimate shows an appreciable saving in cost of flying training attributable to the Air Force ROTC light plane training. (Authors' abstract)

11664
Parker, J. F., 1959
and E. A. Fleishman
PREDICTION OF ADVANCED LEVELS OF PROFICIENCY IN A COMPLEX TRACKING TASK.—Psychological Research Associates, Inc., Arlington, Va. (Contract AF 41(657)-64); issued by Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 71605). WADC Technical Report no. 59-255, Dec. 1959. vi+57 p.
AD 236 907, PB 161 734

Two hundred and three Air Force ROTC subjects were administered a large battery of printed and apparatus psychomotor reference tests from which 50 scores were taken. Following administration of the reference tests, subjects devoted 17 sessions distributed over a six-week period to practice on a complex tracking task. The matrix of intercorrelations among these scores was factor-analyzed and 15 ability factors identified. An analysis then was conducted of the extent to which variation in performance in tracking at the different stages of practice could be accounted for in terms of the identified ability factors. The ability factors accounted for only a small portion of the variance in tracking performance. Hypotheses are offered concerning the selection of a different set of reference measures which might be more effective. The analyses of these data do indicate, however, that the prediction of terminal tracking proficiency is better accomplished through a set of external measures than through initial scores taken directly from the tracking task. Early proficiency on the task itself was unrelated to terminal proficiency. (Authors' abstract)

11665
Parker, J. F., 1961
and J. E. Downs
SELECTION OF TRAINING MEDIA.—Matrix Corp. Psychological Research Associates Div., Arlington, Va. (Contract AF 33(616)-5738); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 71607). ASD Technical Report no. 61-473, Sept. 1961. vi+94 p.

The selection of training media in support of military training programs represents an important area of concern. Training equipment exercises considerable influence on the way in which training programs are conducted, upon their effectiveness in accomplishing objectives, and upon the total cost of

the program. This report is designed to assist a training analyst faced with the problem of selecting specific training aids and devices to be used in support of the development of the personnel subsystem of a military system. The translation of statements of desired personnel performances and capabilities, as presented in Qualitative and Quantitative Personnel Requirements Information and task analysis documents, into training objectives is discussed. The effectiveness of various training media in meeting specific training objectives is indicated and justified in terms of available objective evidence. An example is presented illustrating the manner in which training media are selected in support of a typical Air Force operator position. (Authors' abstract) (74 references)

11666
Pollard, J. P. 1961
SOME ASPECTS OF PHYSIOLOGY TRAINING IN NAVAL AVIATION. — Military Med., 126 (2): 133-139. Feb. 1961.

The development of training in high altitude physiology in naval aviation is briefly traced from its beginning prior to World War II until 1 July 1960. This includes a record of its extensive growth during World War II, subsequent collapse during the period of postwar demobilization, and slow but steady regrowth to its present form. The introduction of generations of progressively higher performance aircraft in the postwar years necessitated revitalization of this training program and modification of its content to serve operational needs. Extension of the training is shown into such related fields as the use of full pressure suits and other personal equipment items which are transitional in nature leading into physiological training for orbital and space flight. (Author's summary)

11667
Rabideau, G. F., 1961
and D. L. Schloredt
GUIDES TO TRAINING DEVICES FOR SPACE CREWS. — SAE Jour., 69 (2): 89, 123. Feb. 1961.

Efficient use of space crews requires planning of: (1) personnel selection methods, which should include tests of psychological fitness; (2) adequate training devices which are economical to operate and maintain (audio-visual aids, part-task trainers, and devices which simulate environmental deviations); and (3) training techniques, including overlearning and continued practice of task sequences.

11668
Reeves, E., 1961
and J. W. Frazer
THE EFFECT OF AGEING ON THE G-TOLERANCE OF RATS. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.15-0002.3, Report no. 5). Report no. NADC-MA-6116, June 9, 1961. iii+10 p.

Rats in five different age groups (1, 3, 4, 6, 9, and 12 months) were subjected to 20 positive g, and their survival times measured using an electrocardiographic end point. The results showed a gradual decline in acceleration tolerance with increase of age. Some physical and physiological variables, such as the changes in elasticity of the tissues of the body with age, and a general decreased ability to adapt are offered as possible causes for the decline in acceleration tolerance.

11669
RESIDENCIES IN AVIATION MEDICINE: INFORMATION FOR TRAINING AGENCIES.—Jour. Aviation Med., 29 (8): 621-625. Aug. 1958.

A report is presented of requirements for approved educational and training programs leading to certification of candidates in aviation medicine by the American Board of Preventive Medicine. Information is given on the method of application for approval of residency training programs, eligible training agencies, and organizational and educational requirements of residency programs.

11670
Rockway, M. R. 1961
A PRELIMINARY FORECAST OF A SPACE CREW TRAINING PROGRAM FOR THE 1965-1975 TIME PERIOD. — In: The training of astronauts, p. 53-74. National Academy of Sciences-National Research Council, Publ. no. 873. 1961.

This paper presents a summary of the objectives, approach, and results of the Air Research and Development Command Study Requirement 49756, "Advanced Design Trainer". Various missions and vehicle systems including low-altitude orbital flights and permanent orbital stations are given. The tasks and functions of the crews for these missions are described. The over-all training program is reviewed in relation to academic training, physiological and psychological conditioning, simulator training, transition training, and in-space training.

11671
Rowen, B., 1961
and R. M. White
DYNA-SOAR PILOT TRAINING. — In: The training of astronauts, p. 45-52. National Academy of Sciences-National Research Council, Publ. no. 873, 1961.

The specific tasks which are used to train selected pilots for flight testing the Dyna-Soar I (suborbital rocket flight) are presented. A brief outline is given of the pilot selection requirements, but the training program will prove to be a basis for further selection. Clinical screening and psychophysiological testing are discussed in terms of the pilot's physical and mental capabilities. The flight-test program requires performance in supersonic flight, control, and stability. A discussion is given of briefings of the Dyna-Soar project, basic knowledge in rocket and astronaut theory, a test pilot school, and field training to learn about the component systems. Both dynamic and static simulators for flight control and creating artificial environments are investigated, and survival training on land, sea, and in special environments is considered. Other field training will include astronautic symposia and familiarization with the Cape Canaveral and Atlantic missile range. Additional information for training procedures is expected to be gathered from the X-15 and Project Mercury programs.

11672
Seale, L. M. 1958
and W. B. Webb
ACCIDENT DATA, INSTRUCTOR COMMENTS, AND STUDENT QUESTIONNAIRE RESPONSES AS INDICATORS OF TRANSITION TRAINING PROBLEM AREA.

—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 14 01 11, Subtask 7). Report no. 1, April 25, 1958. ii+7 p.
Also published as: USE OF ACCIDENT DATA, INSTRUCTORS' COMMENTS AND STUDENTS' RESPONSES IN TRANSITION FLIGHT TRAINING.— Jour. Aviation Med., 29 (11): 805-809. Nov. 1958.

A study was made of the usefulness of accident data, instructor comments, and student questionnaires in the evaluation of the effects of transition from one aircraft type to one of two dissimilar types. Sixty student pilots of average ability were asked to indicate the six flight tasks causing most difficulty during training in T-28 aircraft and during transition to the TV-2 jet aircraft (30 students) or the AD-4 propeller aircraft (30 students). Students transitioning to jet aircraft were found to have more difficulty with ground procedures than with the T-28, while students transitioning to AD-4 aircraft had more difficulty in take-offs and landings, and less difficulty in air procedures. Comments of instructors during the transition period showed that students transitioning to the AD-4 aircraft had more difficulty in landing than those in TV-2 aircraft, and less difficulty in ground procedures. Landing difficulties in the AD-4 aircraft were primarily the result of poor landing attitude and inadequate swerve control. In jet aircraft, the most frequent difficulty encountered involved control of the fuel system. Analysis of pilot-error accidents from 1955 to 1957 in which student pilots had less than 60 hours in the aircraft revealed a significantly greater number of ground accidents and fewer air accidents in AD-4 aircraft than in TV-2 aircraft. It is concluded that student questionnaires, instructor comments, and accident data are useful indicators of areas of student difficulty during the transition process.

11673
Slattery, L. C. 1960
AIR FORCE NURSES PROGRESS TOWARD THE SPACE AGE.—Military Med. 125 (7): 482-488. July 1960.

A brief review is presented of the organization of the Air Force Nursing Service and of flight nurses' participation in the air evacuation of patients during the Korean conflict. The phases of instruction for newly-commissioned Air Force nurses in the care of mass casualties (Disaster Casualty Control) are discussed. Phase I is concerned with indoctrination regarding the composition of nuclear weapons and the principal medical effects caused by their use. Phase II gives training in the principles of mass casualty care (Survival Care and Triage). Phase III provides practice sessions in simulated crash rescue and disaster situations. Phase IV deals with planning, organizing, and coordinating a program of preparedness for disaster situations. The need is cited for revision of the Flight Nurse Curriculum in order to include instruction concerning the problems of man existing beyond the atmosphere.

11674
Slattery, L. C., 1961
and M. A. Goddard
ON THE EDGE OF SPACE. — Amer. Jour. Nursing, 61 (6): 42-44. June 1961.

Training of nurses assigned to missile bases involves orientation on the following topics: hazards associated with toxic exposure to fuels and other chemicals; the use of liquid oxygen; the extremes of heat and pressure; and psychological effects of anxiety, isolation, and monotony on the morale of personnel and dependents. Instruction is given in the treatment of casualties resulting from routine and emergency situations. The responsibilities of nurses in first aid and safety programs are described. Techniques of nursing patients in space will be adapted to conditions imposed by the weightless state. Feeding and bed care procedures and the possibility of utilizing the weightless state for the treatment of cardiac cases and arthritics are discussed.

11675
Slayton, D. K., 1961
and A. B. Shepard
ASTRONAUTS DISCUSS MERCURY TRAINING. — Aviation Week and Space Technol., 74 (25): 67, 71, 73, 74-75, 77, 79. June 19, 1961.

The two astronauts describe their training program for Project Mercury. Training for weightlessness was carried out by aircraft maneuvers which produced zero g for 15-30 seconds. The interior of one airplane was prepared so that movement in the weightless state was carried out. In a human centrifuge at a simulated altitude of 27,000 feet the astronauts developed various techniques for adjusting to high accelerations and high altitudes. Training for working under heat loads was carried out in temperatures up to 250° F., while exposure to high concentrations of CO_2 was done in a special chamber. Survival training on water included exercises in distilling water and learning methods of sun protection. During the latter stages of training, there was an intensive period of monitoring of the astronauts' health to insure their well-being. The over-all psychological effect of the training period was to instill confidence in the astronauts.

11676
Slayton, D. K. 1961
PILOT TRAINING AND PREFLIGHT PREPARATION. — In: Proceedings of a conference on results of the first U. S. manned suborbital space flight, p. 53-60. Washington, D. C.: National Aeronautics and Space Administration, 1961.

The astronaut training program consists of: (a) an academic program in which each man is trained in astronomy, meteorology, astrophysics, geophysics, space trajectories, rocket engines, physiology, and Mercury systems operation; (b) static training in which the astronaut uses flight simulators to practice attitude control and stabilization of his craft; (c) dynamic training including exposure to weightlessness and high g forces, and experience in spin control and flying proficiency; (d) an egress and survival training program; and (e) specific mission preparation for each man for an individual space craft and launch vehicle.

11677
Snyder, R. Z. 1961
A3J-1 SPIN SIMULATION PROGRAM ON THE NAVY HUMAN CENTRIFUGE. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (BuMed. Subtask MR005.15-0005.6, Report no. 9). Report no. NADC-MA-6104, March 17, 1961. iii+14 p.

The Navy acceptance tests for the A3J-1 include a spin test of five turns before starting recovery.

Pilot ability to recover the aircraft while subjected to spin type acceleration loads was evaluated through the operation of the human centrifuge, so as to simulate an A3J-1 spin of eleven turns, with either steady or oscillatory loading during either normal or inverted spins. It was found that the pilots were capable of performing the required recovery procedures while exposed to the various predicted loads. (Author's summary)

11678
Strollo, M. 1960
[MENTAL EFFICIENCY IN LEARNING TO FLY] Efficienza mentale nell'apprendimento del pilotaggio. —Rivista aeronautica (Roma), 36 (3): 365-386. March 1960. In Italian.

A discussion is presented on learning in general (by conditioned or voluntary processes, by trial and error, by transfer of previous knowledge to a new situation) and on learning to fly. A progressive organization of perceptual-motor functions characterized by psychomotor performance and sensory-perceptive activity (exteroceptive and proprioceptive) is related to the process of learning to fly. Mention is made of motor activity during learning as influenced by the repetition of acts and the time required for the maturation of acquired knowledge. Mental abilities evaluated include the candidate's personality, intelligence, motivation, mental potential, capacity for induction and deduction, and habits. With the advent of modern equipment, sensory-motor ability has become refined, thereby changing the standard methods of training. It is concluded that in order to develop a complex ability, such as flying, constant and adequate mental efficiency is necessary.

11679
Trites, D. K., 1959
A. L. Kubala, and B. B. Cobb
CRITERION DIMENSIONS OF ADAPTABILITY TO PILOT TRAINING.—School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-26, Feb. 1959. 13 p.

A factor analysis of 22 variables obtained for aviation cadets during pilot training revealed five interpretable factors: Peer Respect, Peer Acceptance, Military Conformity, Academic Achievement, and Flying Achievement. Several of these could be matched with factors extracted in an earlier study, indicating relatively stable behavior dimensions. Hypotheses derived from the construct of adaptability were supported by comparison of factor scores for groups of subjects classified according to training outcome as pass, ability fail, motivational fail, or emotional fail. This is considered evidence for the validity of the construct. (Authors' abstract)

11680
Trites, D. K., 1958
B. B. Cobb, and W. F. Brown
PREDICTION OF FLIGHT TRAINING ATTRITION BY GRADE SLIPS FOR FIRST TEN FLIGHTS.—Jour. Aviation Med., 29 (11): 827-831. Nov. 1958.

An analysis was made of the relationship between success or failure in primary and basic flight training and the number of critical comments written by instructors during the first ten flights in PA-18 light aircraft in primary training. A highly significant correlation was found between the comment score and failure in basic or total training. The relationship was greater in student officers than in aviation cadets who had higher average pilot stanine scores. Of students predicted to fail on the basis of a cutting score of 16, approximately 3.6 student officers failed for every one who passed, and approximately 1.9 cadets failed for every one passing. Of 1401 students completing training, only 43 would have been incorrectly eliminated by the comment score.

11681
Valentine, L. D. 1961
AIR FORCE ACADEMY SELECTION VARIABLES AS PREDICTORS OF SUCCESS IN PILOT TRAINING. —Aeronautical Systems Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 87003). Technical Note no. ASD-TN-61-52, Sept. 1961. iii+6 p.

Of the first class graduating from the Air Force Academy, 172 entered Flying Training. Scores from the Academy selection tests, given five years earlier, were correlated with pass/fail criteria in Primary and Basic Flying Training, and with final grades in Basic Training. None of the College Entrance Examination Board scores were predictive of success in Flying Training. The Pilot composite of the Air Force Officer Qualifying Test had moderately high validity for passing both Primary and Basic Training. Neither of the sets of selection tests showed much discrimination for final grades of the successful students. (Author's abstract)

11682
Voas, R. B. 1961
ASTRONAUT TRAINING. —Spaceflight (London), 3 (5): 155-157. Sept. 1961.

The first phase of astronaut training is, in effect, the selection procedure which consists of a rigorous, two-week long series of physical, physiological, and stress tolerance tests. The training program is divided into six areas of activity: (1) education in the basic sciences; (2) familiarization with the conditions of space flight; (3) training in the operation of Mercury spacecraft; (4) participation in the spacecraft development program; (5) aviation flight training; and (6) integration of the astronaut with ground support and launch crew operations.

11683
Voas, R. B. 1961
SOME IMPLICATIONS OF PROJECT MERCURY EXPERIENCE FOR FUTURE ASTRONAUT TRAINING PROGRAMS. —In: The training of astronauts, p. 41-44. National Academy of Sciences-National Research Council, Publ. no. 873. 1961.

The training of the astronauts for Project Mercury follows the contribution of the pilot to the vehicle development. With man's increased activity in operating the spacecraft various training requirements will be modified, and more training in operating the vehicle will be needed. A greater realization of malfunctions and how to correct them is necessary, and the pilot must be able to make maximum use from less-than-optimal controls. Higher levels of skill are dictated, and greater selectivity of astronauts based on knowledge and capability is implied. As inflight training decreases, there will be a greater necessity for training by simulators as this will be the major method for maintaining flight proficiency.

The need for properly disseminating new information to the astronauts should be filled more readily.

11684
Voas, R. B. 1961
PROJECT MERCURY ASTRONAUT TRAINING PROGRAM. — In: The training of astronauts, p. 22-40. National Academy of Sciences-National Research Council. Publ. no. 873. 1961.

A general over-all outline of the training program is given. A brief discussion is presented of the astronaut selection program and basic considerations for the training program. Training in vehicle operation includes lectures, field trips, and study programs of the various capsule systems. Simulators for training in attitude control during orbit and retrofire, navigation, control of tumbling, environmental control of the cabin, and management of procedures are discussed. Training in various scientific disciplines is described along with the various lecture courses that each astronaut takes. Space flight conditions such as disorientation, weightlessness, reduced pressure, etc. are described and simulated for the astronauts. A physical fitness program for the trainees is discussed pertaining to weight control, breathing control, and general physical conditioning. Countdown procedures and ground communications and recovery-survival methods are part of ground activity training. Maintenance of flight skills as a method to maintain vigilant decision making is accomplished by regular flights in high-performance jet aircraft. The significance of this program on future space flight is discussed.

11685
Watson, E. R. 1961
PILOT TRAINING REQUIREMENTS. — Air Line Pilot, 30 (2): 16-18, 20. Feb./March 1961.

A review is presented of FAA (Federal Aviation Agency) Circular Memo 59-72B, Sept. 7, 1960 which is concerned with the evaluation of airline pilot training programs. The question of how much training time should be required is discussed. FAA regulations governing training time in basic training, upgrading training, and recurrent training are given. These training periods include time in ground school, flight training, flight simulator, link trainer, and initial equipment line check.

11686
Wherry, R. J., and L. K. Waters 1960
FACTOR ANALYSIS OF PRIMARY AND BASIC STAGES OF FLIGHT TRAINING: ADVANCED JET PIPELINE STUDENTS. — Naval School of Aviation Med., Pensacola, Fla. (Research Project no. MR005.13-3003, Subtask no. 10). Report no. 4, June 20, 1960. ii+11 p.

An eleven-variable matrix of primary and basic stages of flight training and of an index of success in the advanced phase of jet flight training was factor analyzed by a full centroid method. Six factors were extracted and identified as flight capacity, verbal and mathematical facility, T-34 instructor, T-28 T-P-A instructor, instruments-usage facility, and precision flight ability. Ninety-six per cent of the explained variance of total advanced flight grade was attributable to the flight capacity factor. (Authors' abstract)

11687
Wherry, R. J., and L. K. Waters 1960
FACTOR ANALYSIS OF PRIMARY AND BASIC STAGES OF FLIGHT TRAINING: ADVANCED MULTI-ENGINE PIPELINE STUDENTS. — Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3003, Subtask no. 10). Report no. 6, Nov. 30, 1960. ii+11 p.

An 11-variable matrix of primary and basic stages of flight training and an index of success in the advanced phase of jet flight training was factor analyzed by a full centroid method. Five factors were extracted and identified as flight capacity, verbal facility and mathematical skills, T-34 instructor, T-28 T-P-A instructor, and instruments-usage facility. Eighty-six per cent of the explained variance of Total Advanced Grade was attributable to the factor identified as flight capacity. (Authors' abstract)

11688
Willingham, W. W. 1958
A NOTE ON THE RELATION OF AGE TO ATTRITION.—U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 14 02 11, Subtask 1). Report no. 25, April 15, 1958. ii+6 p.

In a sample of naval aviation cadets, an analysis was made of the relationship between age and various types of failure. The data indicated that age is negatively related to success primarily due to the fact that older men are more likely to withdraw voluntarily. The data showed relatively small relationships between age and other types of failure. (Author's summary)

11689
Zimkin, N. V. 1960
[ON THE IMPORTANCE OF THE SIZE OF LOAD, RATE OF MOVEMENTS, DURATION OF, AND INTERVALS BETWEEN EXERCISES ON THE EFFECTIVENESS OF MUSCULAR TRAINING] O znachenii velichiny nagruzki, tempa, dlitel'nosti uprazhenii i intervalov mezhdu zaniatiiami dlia effektivnosti myshechnoi trenirovki. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 860-869. July 1960. In Russian, with English summary (p. 869).

English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 46 (7): 1000-1012. Feb. 1960.

Experiments carried out by the author and his co-workers are reviewed in an effort to determine the effectiveness of muscular training in reference to variations in work load, rate and duration of exercise, and intervals between sessions. During the initial stages of training, the best results are obtained with moderate load, rate, and intervals. Extreme heat tolerance was higher in individuals who exhibited less rise in body temperature at the end of a training session after one month of training. Longer intervals between training sessions (one every day, or one every two days) were more effective in raising resistance to dizziness from rapid head movements. Nonspecific resistance (resistance to X-radiation measured in rats) was greater after training with moderate loads. Severe muscular loads reduced nonspecific resistance. Good results from muscular training were obtained only within certain ranges of load, rate, duration, and in-between session intervals, which varied for different disciplines.

d. Performance and Fitness

[*General psychological aspects under 5*]

11690
Adams, O. S., and W. D. Chiles 1960
HUMAN PERFORMANCE AS A FUNCTION OF THE WORK-REST CYCLE.—Lockheed Aircraft Corporation, Marietta, Ga. (Contract AF 33(616)-6050); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio. (Project no. 7184, Task no. 71582). WADD Technical Report no. 60-248, March 1960. iii+18 p.

Investigations were made of the effect on performance of four different work-rest period schedules (2 hours on and 2 off, 4 on and 4 off, 6 on and 6 off, and 8 on and 8 off) pursued over a period of 96 hours. The performance of 16 male college students (with four subjects being assigned to each of the four work-rest period schedules) was measured on a battery of psychomotor tasks involving arithmetic computation, pattern discrimination, monitoring, and vigilance. Additional data were obtained from information recorded in an experimenter's logbook and from responses to a subject questionnaire administered at the end of testing. Performance scores continued to improve throughout the 96 hours for each of the four schedule groups, and group differences in levels of performance were not statistically significant. However, there was a suggestion in the data that the performance of the subjects in the 8-hour groups was poorer on those tasks which were inherently less interesting. Although the data obtained from the experimenter's logbook and on the subject questionnaire did not differentiate significantly among the groups, there were indications that the 2- and 4-hour cycles resulted in more favorable subject adjustment than did the 6- and 8-hour cycles. (From the authors' abstract)

11691
Adams, O. S., and W. D. Chiles 1961
HUMAN PERFORMANCE AS A FUNCTION OF THE WORK-REST RATIO DURING PROLONGED CONFINEMENT. — Lockheed-Georgia Co., Marietta, Ga. (Contracts AF 33(616)-6050 and AF 33(616)-7607); and Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171002). ASD Technical Report no. 61-720, Nov. 1961. iii+44 p.

Two B-52 combat-ready crews using a 4-hours-on-duty and 2-hours-off-duty schedule while confined for 15 days in a simulated advanced system crew compartment were tested separately with a battery of five performance tasks and four psychophysiological measures. Although wide between-group and between-subject differences occurred in the scores for both performance and psychophysiological measures, it is concluded that, with a minimum amount of selection, highly motivated crews can maintain acceptable performance levels on a 4-on and 2-off schedule for a period of two weeks and possibly longer.

11692
Alexander, G. 1961
FLIGHT PROVES MAN CAN FUNCTION IN SPACE. — Aviation Week and Space Technol., 74 (20): 31-32. May 15, 1961.

A description is given of the pilot functions performed and the stresses and loads (weightlessness, peak gravity and re-entry loads) to which pilot and capsule were subjected during the 15 minute Mercury-Redstone flight on May 5, 1961. The astronaut (Cdr. Shepard) maintained constant voice radio communications with Project Mercury ground stations; exercised manual control of the capsule during the weightless state, working one axis at a time; controlled the firing of the retrorockets to test the operation and sequence of the system; and made adjustments during the firing period to correct the normal wobble induced by the canted angle of the motors. Throughout the flight only primary systems were required, and only one malfunction of a capsule device was encountered.

11693
Balke, B. 1959
AN EXPERIMENTAL STUDY OF "PHYSICAL FITNESS" OF AIR FORCE PERSONNEL.—U. S. Armed Forces Med. Jour., 10 (6): 675-688. June 1959.

Work capacity, a sensitive and realistic measure of "physical fitness" was determined on about 500 military and civilian Air Force personnel for the purpose of collecting material for the standardization of physical performance capacity. A treadmill test permitted an evaluation of results in physical as well as in physiologic terms. On the basis of results, physiologic considerations, and observations of men at various stages of physical training, an arbitrary rating scale of work capacity is suggested. According to this pilot study 42% of the test population had to be rated as "poor" and 40% as "fair." Only 18% could be considered as having a "good" or better physical condition. Sedentary living habits, more than aging or other factors, were apparently the main antagonists of good physical fitness. (Author's summary)

11694
Balke, B. 1959
MAN IN SPACE: EXPERIMENTAL STUDIES ON PHYSIOLOGICAL ASPECTS OF TRAINING AND SELECTION FOR MANNED EXTRATERRESTRIAL FLIGHTS.—In: Bioastronautics—advances in research, p. 122-172. School of Aviation Medicine, Randolph Air Force Base, Tex. [Unnumbered] Report, March 1959. AD 226 473

Two experiments were performed on human subjects to study the critical frontiers of a man's performance capacity before and after conditioning by physical and altitude training. The volunteers were subjected to a variety of demanding situations most likely to occur during space flights, such as extreme altitude, heat, carbon dioxide accumulation, physical exhaustion, water loss, and food deprivation. A comparison of the results and observations of the 10-day and 8-day sealed-chamber experiments shows that more thoroughly conditioned and cross-trained subjects tolerate more complex and more strenuous stress situations with less inflictions of their functional reserves.

11695
Brown, B. Porter, and Harold I. Johnson 1959
MOVING-COCKPIT SIMULATOR INVESTIGATION OF THE MINIMUM TOLERABLE LONGITUDINAL MA-

NEUVERING STABILITY.—National Aeronautics and Space Administration, Washington, D. C. NASA Technical Note D-26, Sept. 1959, 46 p. AD 225 564

Tests were made on a moving-cockpit simulator (normal acceleration and pitch simulator) to determine the minimum tolerable maneuvering stability. Quantitative measurements of the effects of force gradient, position gradient, aircraft damping, and pitching-motion cues, with respect to a formation flying task, are presented. (Authors' abstract)

11696
Erdbrink, W. L. 1961
RELATION OF SMALL VISUAL ACUITY DEFECTS TO THE ABILITY TO LEARN IN FLIGHT TRAINING AND PERFORM IN OPERATIONAL FLYING. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 3, Report no. 1). Dec. 31, 1961. ii+13 p.

The present study was instituted in 1953 in order to evaluate the relationship of small visual acuity errors and the ability to complete flight training and to perform in operational flying. Since 1953, 124 individuals have been placed in the study. Excluding the nineteen individuals placed in the study in 1961, the total studied through 1960 would be 105. In these eight years, 66 of the individuals have been designated as naval aviators, 44 of whom are actively flying today, 40 in Service Group 1. Of the 44 actively flying aviators, only 20 had a progression of their myopia by a mean spherical equivalent of -0.37 diopter. These aviators were designated only because of the existence of this study. (Author's abstract)

11697
Fleishman, E. A., and G. N. Ornstein 1960
AN ANALYSIS OF PILOT FLYING PERFORMANCE IN TERMS OF COMPONENT ABILITIES.—Jour. Applied Psychol., 44(3): 146-155. June 1960.

Measures of flying proficiency in 24 separate maneuvers were obtained on a sample of student pilots. The intercorrelations among these maneuver performances were subjected to factor-analytic study. The interrelationships were best interpreted in terms of ability factors, most of which had been identified previously in laboratory studies of experimental perceptual-motor tasks. The factors were identified as Control Precision, Spatial Orientation, Multilimb Coordination, Response Orientation, Rate Control, and Kinesthetic Discrimination. The results seem to indicate the usefulness of such ability categories in describing complex skills. Similar analyses of the interrelationships among component performance measures of other complex jobs may provide one way of defining the ability requirements underlying proficiency in those jobs. (Authors' summary)

11698
Foley, F. E., S. H. Bear, J. A. Jarman, and W. R. Whitsell 1959
REHABILITATION OF THE FLYER FOLLOWING THORACOTOMY.—Jour. Aviation Med., 30 (2): 113-117. Feb. 1959.

A large number of intrathoracic conditions incompatible with flying are amenable to surgical correction, and the subjects can be restored to flying duty by such surgery. A flyer may be returned to duty after a small pulmonary resection, but in the more extensive pulmonary resections it is questionable. Twenty-nine consecutive thoracic surgical procedures performed on 27 flyers are described, of which only two remain permanently incapacitated for flying due to their original disease or the results of surgery.

11699
Folley, J. D. 1961
A PRELIMINARY PROCEDURE FOR SYSTEMATICALLY DESIGNING PERFORMANCE AIDS.—American Inst. for Research, Pittsburgh, Pa. (Contract AF 33(616)-7233); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171004). ASD Technical Report no. 61-550, Oct. 1961. iv+34 p.

Performance aids are devices or documents that facilitate task performance by humans in a system. These supplementary aids to performance can enhance the overall quality of a system by assisting in achievement of more nearly optimal man-machine function allocation, by reducing the level of requirements on selection, training, and manning, or by raising on-the-job performance levels. Four steps in the design of performance aids are presented: (1) identification of task elements for which aids should be provided; (2) determination of appropriate functional characteristics of aids for these task elements; (3) specification of the physical design characteristics of the aids to carry out the functions; and (4) evaluation, modification, and updating of the aids. Supplementary data on capabilities of performance aids are presented for use with the procedure. The procedure is untried and of necessity uses stopgap solutions to problems on which much research or development is needed. (Author's abstract)

11700
Folley, J. D., and S. J. Munger 1961
A REVIEW OF THE LITERATURE ON DESIGN OF INFORMATIONAL JOB PERFORMANCE AIDS.—American Inst. for Research, Pittsburgh, Pa. (Contract AF 33(616)-7233); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171004). ASD Technical Report no. 61-549, Oct. 1961. iv+43 p.

Performance aids are items of auxiliary equipment or documents provided to enhance on-the-job performance. Military reports and psychological journals were surveyed to identify reports of research on the design of performance aids. Most research on this topic was done prior to 1958. No studies attempted to identify the significant variables in this design of aids. The preponderance of the work was concerned with developing and trying sample aids. Several studies indicated that procedural aids can facilitate trouble-shooting performance. The extent to which other kinds of aids can facilitate performance of other kinds of tasks is unknown. An annotated bibliography is presented. (Authors' abstract) (57 references)

11701
Freedman, T. 1959
PHYSICAL CONDITIONING OF TEST PILOTS.—Jour. Aviation Med., 30 (3): 155-157. March 1959.

Also published in: Soc. Exper. Test Pilots Quart. Review, 3 (3): 33-37. Spring 1959.

The flight surgeon thinks of physical conditioning as the total state of health, both mental and physical. For this, problem areas must be defined and preventive or corrective action must be taken. For the test pilot, two aspects of physical fitness are diet and exercise, and obesity control is one of the major problems. It was determined that a physical conditioning regimen, in order to be beneficial, should involve a high metabolic work load associated with total body function, such as three to four hours' daily activity, including running three miles. Unfortunately the application of this routine to operational air crews is usually not feasible. To further the interest and ability of test pilots, it is necessary to have a palatable physical conditioning program that is supervised and progresses gradually. One program which has been proposed involves (1) stretching type exercises, followed by steam room exposure and massage, and (2) more strenuous activity, such as games involving running and swimming. The success of such a program is dependent upon a physical education expert working in close cooperation with the physician.

11702
Gerathewohl, S. J. 1959
SURVIVAL IN SPACE.—Space Jour., 1 (5): 9-13. March-May 1959.

Protecting man in a space environment is the primary concern of space travel. It is stated that the success of a space pilot is about 90% purely an engineering problem, although natural ability and training skill account for the other 10%. Rocket power, pressure breathing, oxygen systems, temperature control, sealed cabins, meteor bumpers, power steering, antitumbling devices, ejection capsules, artificial gravitation, electronic computers, etc., have been tailored to man's demands possibly to such a state of automation that he may even be bored on his space venture. Mention is made of the selection of space crews and rocket pilots, and of the psychological adjustments facing the space crew. The greatest problem involves the implications of a seemingly complete break from the Earth and the protective social matrix in a small, isolated, closely confined container with a few companions. More data is needed on the effects of confinement and social isolation under hazardous flight conditions.

11703
Graybiel, A. 1959
THE SIGNIFICANCE OF NYSTAGMUS IN AVIATION MEDICINE.—In: Medical aspects of flight safety, p. 296-304, 1 unpaged leaf. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The significance of nystagmus in aviation medicine is discussed briefly from three viewpoints, namely, the clinical aspects, the use of nystagmus as a test of fitness or aptitude for flying, and the effect of nystagmus on visual perception during flight. It is concluded that the use of nystagmus tests is of great importance to medical specialists but that the low incidence of labyrinthine disease in pilots does not justify at this time their regular use in the aviation examining room. Nystagmus tests disclose important individual differences among healthy persons but are of limited value in the selection of flyers. However, they are of great importance in elucidating the role of the semicircular canals not only in aviation but in the total human economy. Nystagmus influences visual perception during flight, but further investigation is needed to determine its full significance. Some of these influences are beneficial while others are illusory and hence potentially harmful. (Authors' summary) (26 references)

11704
Hoyt, K. K. 1961
FAA UPGRADES MEDICAL PROGRAM. — Skyways, 20 (8): 26-27. Aug. 1961.

The article reviews the improvement in medical standards required for flying under Federal Aviation Agency (FAA) sanction as well as the changes in the FAA medical program. The number of Aviation Medical Examiners has been increased to 4,500, and seminars on aero-medical problems have been held in universities for the examiners. The FAA has been conducting basic research in aero-medicine, concentrating on cardiovascular studies. Studies are also planned for investigating aging in pilots. Requirements for pilots have been changed as follows: (1) all Class I examinations for transport pilots must be given by FAA physicians; (2) a flight limit of 60 years of age has been applied; (3) less emphasis has been placed on sight and hearing; (4) more emphasis is placed on conditions such as heart attacks, diabetic coma, or sudden hemorrhaging; and (5) electrocardiograms are required after 35. Through higher standards it is hoped that many defects can be caught and treated in time, thus insuring greater safety in the air.

11705
Kidd, J. S., and R. G. Kinkade 1959
OPERATOR CHANGE-OVER EFFECTS IN A COMPLEX TASK.—Ohio State Univ. Lab. of Aviation Psychology and Research Foundation, Columbus (Contract AF 33(616)-3612); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71583). WADC Technical Report no. 59-235, Aug. 1959. iii+12 p.

The two experiments covered in this report were concerned primarily with the loss in system performance due to operator change-over and extended work duration. Using 12 laboratory-trained controllers in a simulated air traffic control task, it was found that (a) a significant but short-duration decrement occurred at operator change-over, (b) performance was highly stable over the 3.5-hr. work period, (c) a prominent "end-spurt" occurred, and (d) the degree of prechange-over participation by the replacement controller could modify the extent of performance loss at change-over. These findings were evaluated with respect to studies of warm-up, preparatory set, and work fatigue effects observed in other task settings. (Authors' abstract)

11706
Kidd, J. S. 1961
SOME SOURCES OF LOAD AND CONSTRAINT ON OPERATOR PERFORMANCE IN A SIMULATED RADAR AIR TRAFFIC CONTROL TASK. — Ohio State Univ. Lab. of Aviation Psychology and OSU Research Foundation, Columbus (Contract AF 33(616)-6166); issued by Wright Air Development

Division. Aerospace Medical Lab., Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71583). WADD Technical Report no. 60-612, March 1961. iv+15 p.

Two general factors relevant to human performance in a man-machine system were subjected to experimental analysis: (a) the influence of task load on operator capacity, and (b) the effects of situational constraints on operator adaptability. Four variables, traffic input rate, control zone area, control team organization, and arrival sequencing procedures, were manipulated. Results from the observation of six 2-man teams indicated that physically defined constraints were more detrimental than those imposed by rules or organization structure. Procedures intended to enhance performance which depend on operator predictions or anticipations were observed to have a limited utility. Under high load stress, operator's actions seemed entirely determined by the immediate circumstances. (Author's abstract)

11707
Kidd, J. S. 1959
A SUMMARY OF RESEARCH METHODS, OPERATOR CHARACTERISTICS, AND SYSTEM DESIGN SPECIFICATIONS BASED ON THE STUDY OF A SIMULATED RADAR AIR TRAFFIC CONTROL SYSTEM.—Ohio State Univ. Lab. of Aviation Psychology and OSU Research Foundation, Columbus (Contract AF 33(616)-3612); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71583). WADC Technical Report no. 59-236, July 1959. iv+29 p.

The methodological and conceptual basis for a program of study of air traffic control radar simulation is reviewed. The program of system research was planned around objectives of (1) establishment of general principles relating to human engineering aspects of air traffic control systems, and (2) development of a general theory of the capacities and limitations of individuals and small groups in the performance of the decision-making functions required by complex man-machine systems. From a review of fourteen experiments conducted on the traffic control simulator since 1952, the system characteristics that influence operator performance are defined as distribution of responsibility, input organization, and procedural flexibility.

11708
Kiørboe, F. 1959
THE SIGNIFICANCE OF NYSTAGMUS OBSERVED IN ROUTINE OTOLOGIC EXAMINATIONS OF FLIGHT PERSONNEL.—In: Medical aspects of flight safety, p. 290-295. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Twenty-seven (2%) out of 1338 normal pilot candidates presented spontaneous or positional nystagmus during examination of vestibular function using Frenzel glasses. In doubtful cases, this was supplemented with Hallpike's caloric test. If nystagmus persisted and a reasonable cause could not be found, the candidate was rejected. An examination every second year of all Danish military pilots revealed cases with spontaneous and positional nystagmus. The etiology of these cases was found to be intoxication, infection, stress, trauma, labyrinthosis, Ménière's disease, disseminated sclerosis, or unknown cause. These cases are discussed in detail. All subjects were grounded during the periods when nystagmus was manifest. As soon as the symptoms vanished and they were found to be normal after repeated examinations, permission to fly was granted. The possibility that nystagmus detected in five cases cited could be the initial symptom of organic nervous disease, resulted in the recommendation that these persons not be allowed to fly as pilots-in-control.

11709
Krimshtein, A. E. 1961
[A METHOD FOR STUDYING OCCUPATIONAL PROFICIENCY AND INDIVIDUAL APTITUDES OF PILOTS IN THE EVALUATION OF POSITION IN SPACE] Metodika dlia izucheniia professional'noi podgotovlennosti i individual'nykh osobennostei letchikov v otsenke prostranstvennogo polozheniia. —Voenno-meditsinskii zhurnal (Moskva), 1961 (1): 73-74. Jan. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (1): 97-99. Washington: U. S. Joint Pub. Research Serv., no. 9169 (1374-N/38), April 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

A method employing simulated instrument panels and projection of airplane silhouettes on slides is described for use in the evaluation of a pilot's aptitude and proficiency in determining his own position in space by instrument readings and the flight direction of enemy aircraft from silhouettes.

11710
Lamb, L. E. 1959
MEDICAL ASPECTS OF INTERDYNAMIC ADAPTATION IN SPACE FLIGHT.—Jour. Aviation Med., 30 (3): 158-161. March 1959.

The success of an astronaut's flight may depend on his ability to make a series of interdynamic adaptations. The ability to make sequential adaptations to a variety of different biological stresses is greatly influenced by individual characteristics. Undesirable cardiovascular responses detected in apparently healthy persons indicate that many normal, healthy people are not suited for the journey into space. This report attempts to highlight some acute individual problems likely to occur at launch and during flight. The problems include bradycardia, tachycardia, cardiac arrest, pain at ligaments due to increased g forces, changes in electrolyte and mineral levels, and loss of normal postural adaptation mechanisms and arteriolar tone.

11711
Lamb, L. E. 1959
THE PROBLEM OF ELEVATED BLOOD PRESSURE OR HYPERTENSION IN THE PILOT.—In: The first international symposium on cardiology in aviation, p. 99-105. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].

Also published in: Amer. Jour. Cardiol., 6 (1): 30-34. July 1960.

An opinion survey of 27 authorities relative to the normal level of blood pressure was made. Most replies indicated that 140/90 mm. Hg was the accepted upper limit of normal for blood pressure in persons under forty years of age and that 150/90 mm. Hg was the accepted limit of normal for per-

sons past the age of forty years. Opinions were expressed and are reported relative to the significance of intermittent blood pressure elevations, the level of blood pressure which should be an indication for therapy when blood pressure elevation was the only finding, and information, if any, relative to improvement in prognosis resulting from therapy. It is suggested that pilots with elevated blood pressure, but without evidence of vascular complication or evidence of any other form of complication of elevated blood pressure, may continue flying without therapy unless the diastolic pressure is persistently elevated above 100 mm. Hg. (Author's summary, modified)

11712
Madden, J. M. 1961
THE METHODS AND FOUNDATIONS OF JOB EVALUATION IN THE UNITED STATES AIR FORCE.—Aeronautical Systems Div. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7734, Task no. 773402). Technical Report no. 61-100, Oct. 1961. v+58 p.

This report summarizes the history of job evaluation and gives a critical review of the technical literature as a background for the Air Force job evaluation plan. The Air Force plan is described with the rationale for each phase. A discussion of unsolved problems includes an outline of research needed to discover solutions of these problems. An Appendix lists a 190-item bibliography with abstracts. (Author's abstract)

11713
Malmström, G., 1960
B. Nordenström, and N. Sundgren
THE PROBLEM OF ISCHEMIC HEART DISEASE IN AIRLINE TRANSPORT PILOTS.—Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 9 (1): 1-6. 1960.

Post-mortem observations of the frequent occurrence of coronary atherosclerosis in young people suggest its unsuspected occurrence in airline pilots. Measures to prevent disaster resulting from cardiac attacks in pilots include periodic cardiac examinations, grounding of pilots with cardiac irregularities likely to interfere with the proper operation of aircraft, and the use of a two- or three-pilot system on scheduled flights.

11714
Miller, J. G. 1961
SENSORY OVERLOADING.—In: Psychophysiological aspects of space flight, p. 215-224. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

The maximum and optimal channel capacities of individuals, processes of adjustment or compensation for information input overload, the costs to a person of forced performance at various rates of information input, and the cost of adjustment processes to overload are examined. In a specific study of the effect of information input overload upon behaving systems at the levels of the cell, organism, individual, group, and social institution, a similarity was found in the relations between rate of information input and output at all levels. For each system, if the rate of information input in bits per second is increased, the rate of output follows it exactly as a linear function for a period of time. Then it begins to level off until it reaches the channel capacity or maximum rate of output possible for the system. It maintains this channel capacity even though the input rate increases, until, as the input rate increases still more, the output falls, sometimes to zero, and the system can no longer transmit information.

11715
Mishurin, V. M. 1959
[ON THE STUDY OF NEUROSES IN AVIATORS] Ob izuchenii nevrozov u letchikov.—Voenno-meditsinskii zhurnal (Moskva), 1959 (2): 62-67. Feb. 1959. In Russian.

English translation in: Military Medical Journal, 1959 (2): 98-105. New York: U. S. Joint Pub. Research Service, no. 1634-N, June 4, 1959. (Available from Office of Technical Services, U. S. Dept. of Commerce)

A group of 21 fliers with neuroses and asthenic conditions was investigated together with a control group to determine the casual factors which lead to a nervous breakdown. The study included a regular hospital examination, anamnesis, and interviews, according to a special program set up by the Scientific Research Testing Institute of Aviation Medicine for the study of individual psychological characteristics of the fliers. The examination of motor-conditioned reflexes with speech reinforcement was carried out according to a modified Ivanov-Smolenskii method. In the majority of the fliers the causal factor in the production of the neurosis was a combination of service and life conflicts producing temporary or chronic neuro-psychic strains. The nervous breakdown depended in part on individual psychological characteristics. Nineteen fliers showed disturbances in the cortical processes. A lack of equilibrium of the cortical processes together with a weakness of the inhibitory processes characterized five fliers. The symptomological overlap indicated that there is no difference in principle between the general pathological mechanisms operating in neurosis and in asthenic states. Considerable disturbances of the cortical processes during the verbal presentation of conditioned stimuli in the Ivanov-Smolenskii test suggested a predominance of the first signal system and disturbances in the flow of cortical processes in the second signal system.

11716
Phillips, P. B. 1961
THE WHAT AND WHY OF THE NEW FEDERAL AVIATION AGENCY REGULATIONS (PSYCHIATRY).—Aerospace Med., 32 (4): 296-299. April 1961.

An established medical history or clinical diagnosis of any of the following conditions is disqualifying: a character or behavior disorder which is sufficiently severe to have repeatedly manifested itself by overt acts, a psychotic disorder, chronic alcoholism, drug addiction, epilepsy, or a disturbance of consciousness without satisfactory medical explanation of the cause. An established history of a psychotic disorder or evidence of active psychosis is disqualifying due to the unpredictability of its recurrence. Chronic alcoholism and drug addiction are conditions in which the individual cases are reviewed. The hazard of epilepsy lies in the completely incapacitating nature of the illness when a seizure occurs. A "disturbance of consciousness without satisfactory medical explanation" is a challenging category which may involve fainting, states of altered consciousness, reactions to hypoglycemia, hyperventilation, or a class of conditions of which the etiology is difficult to determine. Disqualification also will result if the applicant has any other disease of the nervous system, mental ab-

normality, or psychoneurotic disorder which renders him unable safely to perform his duties, or which can be expected to do so in two years.

11717
Pokrovskii, B. L. 1959
[EXPERIMENTAL EXAMINATION OF THE SENSORIMOTOR REACTIONS IN THE PROCESS OF THE MEDICAL BOARD EVALUATION OF FLIGHT PERSONNEL] Eksperimental'noe issledovanie sensomotornykh reaktsii v protsesse vrachebnoi ekspertizy letnogo sostava.—Voenno-meditsinskii zhurnal (Moskva), 1959 (10): 42-46. Oct. 1959. In Russian.
English translation in: Military Medical Journal, 10: 70-76. New York: U. S. Joint Pub. Research Service, no. 2102-N, Jan. 4, 1960. (Available at Office of Technical Services, U.S. Dept. of Commerce)

An experimental investigation of the simple reaction time and complex reaction time (modified IU. A. Petrov's method) was carried out in three groups of fliers, namely, (a) those with poor piloting technique but without pathology, and (b) those with nervous system disorders. The visual display, used for establishment of the complex reaction time, required learning the relationship between three colored lights and a set of keys which extinguishes them and then relearning it after a change in the pattern. The healthy pilots were characterized by an average reaction time of less than 0.9 sec., three or less errors, improvement in quality of work after the pattern change, and a uniform reaction-time curve. An average reaction time exceeding 0.9 sec., more than three errors, deteriorated work after change of the set, and wide fluctuations in reaction time are indicative of a nervous system disorder or poor psychological suitability for flight.

11718
Récamier, J. 1959
[DISORDERS DURING FLIGHT: ORIGIN OF NEUROVEGETATIVE DYSTONIA IN PILOTS] Malaises en vol: sur une origine de dystonie neurovégétative chez les pilotes.—Médicine aéronautique (Paris), 14 (2): 193-196. 1959. In French, with English summary (p. 196).

Neurovegetative dystonia, sometimes resulting from chronic appendicitis following amebiasis, presents many problems (vertigo, vision disorders, shivering, syncope) to pilots during flight. The importance of gastrointestinal examination in flight personnel, and especially in chronic appendicitis patients with a history of intestinal amebiasis, is discussed. The author suggests that pilots presenting symptoms of neurovegetative dystonia be exempt from flight pending an adequate diagnosis. Two cases are cited of manifest autonomic nervous system disorders in jet pilots with chronic appendicitis following amebiasis.

11719
Rosenberg, S. 1959
A LABORATORY APPROACH TO INTERPERSONAL ASPECTS OF TEAM PERFORMANCE.—Ergonomics (London), 2 (4): 335-348. Aug. 1959.

A review is presented of selected studies on certain problems of Air Force team performance, including feedback (knowledge of results) to individuals and teams, team reassembly, and the effects of task on choice of team-training methods. Three types of feedback were differentiated for the purpose of the experiments described: direct feedback, in which the individual's own response only was known, confounded feedback, in which the individual's score was averaged with that of his partner, and other's feedback, in which the individual was given the score of his partner. In individual performance, direct feedback was found to improve the score better than confounded feedback, which in turn was more effective than other's feedback. In group performance, however, confounded feedback did not produce poorer results than direct feedback. This finding has implications for the problem of team reassembly, indicating that adjustment to the particular team may be an important factor in team performance. Pre-trained individuals behaved similarly to untrained individuals in response to type of feedback. Several task variables to be considered in team training, including compensatory relationships between team members, were considered. Little distribution of responsibility in the performance of complex tasks was noted in an experiment to test compensatory relationships, suggesting that, in this case, concentration on the task itself supersedes adjustment to the team. The studies indicate that the usefulness of individual training prior to group assembly is doubtful.

11720
Rusanov, V. N. 1959
[EXPERIENCE IN THE WORK OF THE DEPARTMENT OF THE FLIGHT-MEDICAL EVALUATION BOARD IN A DISTRICT HOSPITAL] Opyt raboty otdeleniia vrachebnoi ekspertizy letnogo sostava v okruzhom gospitale.—Voenno-meditsinskii zhurnal (Moskva), 1959 (1): 71-73. Jan. 1959. In Russian.
English translation in: Military Medical Journal, 1959 (1): 109-113. New York: U. S. Joint Pub. Research Serv., No. 1555-N, May 14, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

The work carried out by the flight-medical board in 1957 in a district hospital is reviewed. Each patient admitted for evaluation receives a complete clinical examination with special attention to flight experience in his history. In addition, special tests are made and specialists consulted. A psycho-neurological examination is recommended for each flier admitted to the hospital. Patients with vascular disturbances, poor anoxia tolerance, or inadequate middle ear ventilation are examined in a decompression chamber at 5000 m. altitude without supplementary oxygen, and at 12,000 m. altitude with supplementary oxygen. Roentgenography is extensively employed. A large proportion (24%) of the patients were admitted with vascular tone disturbances, the majority of them with the diagnosis of neurocirculatory asthenia, a smaller number with hypertension. In the former group tests are aimed at differential diagnosis of neurosis and thyrotoxicosis. Pilots suffering from hypertension with essential functional cardiovascular disturbances or thyrotoxicosis are grounded, or permitted to perform restricted flight work only. Myocardial fibrosis with initial symptoms of circulatory insufficiency, found in pilots over 30-35 years, also leads to grounding. Cases of acute rheumatic fever or peptic ulcers are evaluated individually after treatment. Moderate chronic gastritis patients are treated and returned to flight work.

11721
Ryan, E. D. 1961
EFFECT OF DIFFERENTIAL MOTIVE-INCENTIVE CONDITIONS ON PHYSICAL PERFORMANCE.—Research Quarterly, 32 (1): 83-87. March 1961.

Four matched subgroups were given a grip

strength test under one of four motive-incentive conditions. There were no differences in performance between the groups that received threat of electric shock, knowledge of results, constant exhortation, or were simply asked to do as well as possible. Further, there were no differences in performance between groups at various levels of strength. (Author's abstract)

11722
Seifert, R. 1959
[REVIEW OF TEST METHODS FOR PSYCHOMOTOR PERFORMANCE] Referat über Untersuchungsmethoden der Psychomotorik.—Deutsche Versuchsanstalt für Luftfahrt (Germany). Report no. 124. 1959. In German.
Reprint from: Diagnostica (Göttingen), 5 (4): 135-154. 1959.

Various methods of testing psychomotor performance on tasks pertinent to flying ability are described. The applicability and importance of the criteria involved are discussed in relation to flying ability in general and to jet flying in particular. It is concluded that the performance factors under consideration lend themselves better to examination of pilot candidates, but are not so useful for jet pilot performance tests.

11723
Shepard, A. B. 1961
PILOT'S FLIGHT REPORT, INCLUDING IN-FLIGHT FILMS.—In: Conference on Medical Results of the First Manned Suborbital Space Flight, p. 109-116. [1961?].

A narrative is given by the astronaut of MR-3 ballistic flight of the (1) period prior to launch, (2) the flight itself, and (3) the postflight debriefing period. Feelings and reactions are described and comments pertinent to the three areas are made.

11724
Tillisch, J. H., and J. Paris 1960
ENDOCRINE DISEASES IN AVIATION MEDICINE. —Aerospace Med., 31 (12): 999-1003. Dec. 1960.

A general survey is made of the various endocrine diseases which may disqualify air crew members. The presence of a condition such as Addison's disease, Cushing's syndrome, a pituitary tumor, pancreatic islet cell tumor, or idiopathic diabetes insipidus would disqualify an air crew member. It is important that efforts be made to diagnose diabetes early, especially diabetes mellitus; for this, the family background is important because the disease is genetically transmitted. The pros and cons of the federal regulation which allows a person with diabetes not requiring hypoglycemic agents to fly are presented.

11725
Voas, R. B. 1961
A DESCRIPTION OF THE ASTRONAUT'S TASK IN PROJECT MERCURY. — Human Factors, 3 (3): 149-165. Sept. 1961.

The astronaut performs eight basic functions during Mercury flight: (1) monitors the environmental control system, electrical system, attitude control system, and communication system, and in the event of malfunction determines the nature of the problem, its effect on the mission, and takes over manual control where necessary; (2) programs or sequence-monitors the critical events of vehicle launch and re-entry; (3) controls vehicle attitude; (4) navigates; (5) maintains communications in order to receive important navigation, fuel management, and trajectory data while keeping the ground informed on flight progress; (6) makes in-flight research observations; (7) maintains good physical condition and applies special skills for meeting acceleration, weightlessness, heat, and other phenomena to be encountered in space flight; and (8) prepares for the period of ground launch and countdown and the period of waiting for pickup on the surface of the sea. The astronaut's contributions to the development of the Mercury vehicle are outlined, and the possible applications of Mercury human factors experience to future space flight programs are considered.

11726
Voas, R. B., J. J. Van Bockel, R. G. Zedekar, and P. S. Backer 1961
RESULTS OF IN-FLIGHT PILOT PERFORMANCE. —In: Conference on Medical Results of the First Manned Suborbital Space Flight, p. 97-108. [1961?]

The three sources of data reviewed in this report, the onboard pilot-observer camera film, the flight voice communications, and the spacecraft attitude record during manual control, indicate that astronaut Alan Shepard met all requirements of the MR-3 mission, that he monitored and reported accurately the critical events of the flight, that he controlled the attitude of the spacecraft within normal limits, that he was alert at all times to novel or unprogramed events, and that he showed no tendency to become fixated on irrelevant instrumentation or activities. In addition to the basic activities required to insure a successful mission he made several attitude maneuvers to evaluate the manual control systems and spent some time examining the Earth's surface and reporting what he was able to see. His performance of these activities was not only within the limits required for a successful mission but the quality of the performance was comparable to that achieved on the procedures trainer under optimal environmental conditions. The close correspondence between attitude maneuvers on manual control in the simulator and those in flight indicate that the trainers used in the Mercury program were relatively successful in reproducing the vehicle characteristics in flight. (Authors' concluding remarks)

11727
Voas, R. B., J. J. Van Bockel, R. G. Zedekar, and P. W. Backer 1961
RESULTS OF IN-FLIGHT PILOT PERFORMANCE. —In: Proceedings of a conference on results of the first U. S. manned suborbital space flight, p. 61-66. Washington, D. C.: National Aeronautics and Space Administration, 1961.

The performance of A. B. Shepard on his suborbital flight on May 5, 1961, is discussed. The onboard pilot observer film, the flight voice communications, and the spacecraft attitude record during manual control show that the pilot met all requirements of the mission. In addition to the basic activities required to insure a successful mission, he made several attitude maneuvers to evaluate the manual control systems and spent some time examining the Earth's surface and reporting what he was able to see. During the short ballistic flight, Shepard was able to operate a com-

plex vehicle with no significant reduction in performance while exposed to unusual environmental conditions, such as a 5-minute period of weightlessness.

11728
Voas, R. B., 1961
J. J. Van Bockel, R. G. Zedekar, and P. W. Backer
RESULTS OF INFLIGHT PILOT PERFORMANCE STUDIES FOR THE MR-4 FLIGHT. — In: Results of the second U. S. manned suborbital space flight July 21, 1961, p. 33-46. Washington, D. C.: National Aeronautics and Space Administration, [1961].

The paper evaluates the performance of the astronaut Virgil I. Grissom on his suborbital flight of July 21, 1961, compares the observations of the pilot of the MR-3 flight with those of the MR-4, and compares the pilots' evaluations of the Mercury training devices. Observations of the pilots include vision, auditory phenomena, vibration, weightlessness, and orientation. The use of the centrifuge and of other training devices is discussed. An appendix is presented giving the verbatim transcription of the communication between ground and spacecraft during the MR-4 flight.

11729
Wherry, R. J., 1961
N. Stander, J. Leight, and W. B. Lecznar
GENERAL ON-THE-JOB CRITERIA OF AIRMAN EFFECTIVENESS APPLIED TO THREE CAREER FIELDS. — Ohio State Univ. Research Foundation, Columbus (Contract AF 41(657)-270); and Aeronautical Systems Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7717, Task no. 17154). Technical Report no. ASD-TR-61-98, June 1961. viii+84 p.

This report describes the development and analysis of experimental criteria for evaluating job performance. Three criterion measures were constructed and administered at two Air Force bases to airmen selected from three career areas which correspond to three aptitude groups defined by Air Force classification tests. Each of the three instruments was subjected to a factor analysis; the resulting factor scores, in combination with test scores and operationally derived performance ratings, were also factor analyzed. Six factors were identified, with each factor defined by at least two of the major variables. Short forms of two of the criterion instruments were prepared for further use. The results suggest suitability of these scales across the three job areas. (Authors' abstract)

11730
Wilson, C. L. 1959
PHYSICAL FITNESS TESTS.—In: Project Mercury candidate evaluation program, p. 49-80. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959.

Several tests which are being incorporated into the physical fitness evaluation for Project Mercury crew selection programs are presented in detail: Harvard Step Test, Flack Test, Valsalva Overshoot Test, Cold Pressor Test, Treadmill Test, Partial Pressure Suit Test, and Tilt Table Test. It was determined that the candidates who had a higher total score on all the tests and are at the top of the ranking list are in better physical fitness than those who had lower total scores. The candidates in a better state of physical fitness are more desirable for Project Mercury.

11731
Zimkin, N. V. 1961
[CONFERENCE ON PROBLEMS OF ADAPTATION, TRAINING, AND OTHER METHODS OF INCREASING BODY RESISTANCE, 25-28 JANUARY 1961] Konferentsiia po probleme adaptatsii, trenirovki i drugim sposobam povysheniia ustoichivosti organizma, 25-28 ianvaria 1961 g. — Fiziologicheskii zhurnal SSSR (Moskva), 47 (7): 934-937. July 1961. In Russian.

The majority of papers were concerned with the discovery of adaptation mechanisms and measures for enhancing the organism's resistance to unfavorable agents (physical training, drugs, etc.). Nonspecific increase in resistance via non-specific adaptation mechanisms was obtained after administration of Dibazol, "Zhen'shen'", Eleutherococcus, vitamin B_{12}, ascorbic acid, Proserine, eserine, or cortisone. Various experiments were reported where these agents alone or in combination raised the tolerance to hypoxia, hypothermia, hyperthermia, and acceleration in the animal organism. A number of reports dealt with increased resistance resulting from regular exposure to hypoxia. Preliminary adaptation of rats to hypoxia increased their resistance to hypothermia, burn sequelae, and hyperthermia. Hemispherectomy affected hypoxia tolerance differentially in rats and dogs. Other reports described research on the organism's adaptation to ambient heat or cold, the importance of muscular work in increasing non-specific resistance, research on fatigue, development of resistance to drugs by cancer cells, and neural adaptation.

e. Duties

11732
Diringshofen, H. von 1959
[AVIATION MEDICINE IN MILITARY PRACTICE] Luftfahrtmedizin in der militärischen Praxis.— Truppenpraxis (Darmstadt), 1959 (1): 46-51. Jan. 1959. In German.

The principal duties of the flight surgeon and the major objectives of aeromedical research are outlined briefly. Flight surgeons should be primarily concerned with the following tasks: taking charge of medical supervision of pilots and checking on their physical and mental fitness to fly; conducting an aeromedical orientation program for aviators; assisting in accident investigation; and acting as consultants in pilot selection procedures. With the rapid progress of high-altitude, high-speed, and space flight, the role of the aviation psychologist and physiologist becomes increasingly vital. Problems as those associated with "time reserve" or reaction time are examples of how human engineering ties in with aeromedical research. Finally, flight sanitation and accident prevention represent important and extensive fields of activity. Among the former, the author lists studies of protective measures against anoxia, low atmospheric pressures, hypo- or hyperthermia, and acceleration.

11733
Dobrokhotov, S., and S. Koloskov 1959
[THE PROFESSIONAL CONDUCT OF THE FLIGHT SURGEON] O printsipialnosti aviatsionnogo vracha.—Sovetskaia aviatsiia (Moskva), 193 (3363): 2. Aug. 18, 1959. In Russian.

The professional responsibilities of a flight surgeon call for a man of high integrity and skill, who can exercise independent and objective judgment. The present eclectic methods applied in making quarterly medical examinations of pilots are deplored, and a need for standardization of medical examinations is expressed.

11734
Farabaugh, D. F. 1958
PREVENTIVE MAINTENANCE FOR PILOT AND PASSENGER HEALTH.—Business Commercial Aviation, Dec. 1958: 28-30.

It is suggested that all major air lines employ a physician specialized in aviation medicine. Constant surveillance of the pilot's physical, mental, psychological, and medical problems, with the chief purpose of maintaining his health, will benefit both the pilot by strengthening his confidence and lengthening his flying career, and the company by maintaining high efficiency standards of its personnel. The company flight surgeon will be in charge of proper administration of influenza vaccinations, supervise first-aid procedures, and take care of aviation-occupational disease problems. He will advise on the use of drugs, on passenger safety and passenger health in flight, and on numerous other medical problems ordinarily not understood or thought of by lay people or even by practicing physicians not trained in aviation medicine.

11735
Freedman, T. 1960
THE FLIGHT SURGEON AND THE ASTRONAUT.—Astronautics, 5 (2): 34-35; 88; 90. Feb. 1960.

The duties and responsibilities of the flight surgeon in the spacecrew holding facility should be based upon the principle that space exploration is a long-range, step-wise program which will extend indefinitely into the future. Aside from keeping the facility sanitary and free from disease vectors, and aside from the physical and psychological evaluations of the future astronaut, the flight surgeon must utilize all available knowledge on the hazards of space flight so as to minimize the avoidable risks and widen the margin of safety and comfort. To fit into the classic concept, the aerospace flight surgeon must be imbued with certain personal attributes of integrity, resourcefulness, and human understanding; he must have a working knowledge of the many disciplines reporting to him and should meet certain professional requirements (as implied on an included holding facility medical department organization chart).

11736
Lay, F. I. 1959
NEXT STOP—OUTER SPACE.—Amer. Jour. Nursing, 59 (7): 971-973. July 1959.

The responsibilities of Air Force nurses in combating and ameliorating medical hazards in space flight are discussed. Whether at a rocket launching site or aboard a space ship, emphasis is placed upon the prevention of, rather than restoration after, disease or injury. In such a scheme, the nurse is responsible for maintaining a healthy environment, including the regenerative processes for air, food, and water in the space ship. She must teach, not only the space traveler, but also those who provide for his nutritional, physical, and emotional requirements at home or at a military base. Aside from providing nursing care for the sick and injured, she must be concerned with the preparation and the future rehabilitation of men who will exist in an entirely new environment.

11737
McRuer, D. T., I.L. Ashkenas, and E. S. Krendel 1959
A POSITIVE APPROACH TO MAN'S ROLE IN SPACE.—Aero-Space Eng. 18 (8): 30-36. Aug. 1959.

Following a discussion of the popular notions of man's role in space, attention is focused upon the increase of space vehicle system reliability, such as component development, intermittent operation, and planned use of redundancy. Described are the human qualities capable of increasing system reliability such as the ability to control and actuate systems, the human as a power output device, the ability to organize data and make decisions, and observation and memory functions. The human component environmental requirements are summarized which are negative consequences of man's presence in space, including those dealing with respiration, food, environment (weightlessness, temperature control, radiation hazard, g forces, cabin pressure, seating, sleeping, etc.), social factors, and control and display requirements. Examples are given or problems to be explored, from the behavioral rather than medico-environmental aspects of human functioning, to serve to structure the environmental program. Experiments will involve control and actuation; adaptive servo-human controller comparisons; actuation, muscle power, and energy conversion ability; organization and decision; and observation and memory.

11738
Marchesseau, and Fabre 1961
[ROLE AND IMPORTANCE OF THE FLIGHT SURGEON IN FRANCE WITH REGARD TO AIR SAFETY] Rôle et importance du médecin de l'air en France dans la sécurité aérienne. — Revue internationale des services de santé des armées de terre de mer et de l'air (Paris), 34 (1-2): 21-24. Jan.-Feb. 1961. In French, with English summary (p. 21).

The flight surgeon's role in the prevention of aircraft accidents is emphasized. He is responsible for selecting the best possible candidates for flight training by means of psychological and physiological examination; for indoctrinating candidates in flight physiology and human limitations during flight; for recommending and supervising regulations for mental hygiene; for cooperating with human engineers in aircraft design; and for training candidates on the use of protective equipment.

11739
MEDICAL EXAMINATION OF FLYERS.—New England Jour. Med., 262 (24): 1242. June 16, 1960.

The requirement is discussed that student and private pilots be given medical examinations by designated medical examiners, and that the examining

physicians be thoroughly trained and acquainted with their duties. Purpose of the ruling is (1) to maintain a group of medical examiners clearly responsive to the needs of public safety in the performance of examinations and issuance of medical certificates to airmen; (2) to permit the administration of training programs to maintain the quality of performance of medical examiners and to permit the dissemination of special instructions pertaining to the needs of civil aviation, and (3) to bring into the program those qualified physicians demonstrating an interest in the medical certification field. (Quoted in part)

11740
Mishurin, V. M. 1959
[A STUDY OF THE INDIVIDUAL PSYCHOLOGICAL CHARACTERISTICS OF FLIERS AND MEDICAL BOARD EVALUATION] Izuchenie individual'nykh psikhologicheskikh osobennostei letchikov i vrachebnoletnaia ekspertiza.—Voenno-medisinskii zhurnal (Moskva), 1959 (10): 46-48. Oct. 1959. In Russian.

English translation in: Military Medical Journal, 10: 77-81. New York: U. S. Joint Pub. Research Service no. 2102-N, Jan. 4, 1960. (Available at Office of Technical Services, U. S. Dept. Commerce)

A study of individual psychological characteristics was conducted with three groups of fliers: (1) healthy but retarded in flight training, (2) neurotics and asthenics, and (3) healthy with good flight performance. A psychological characterization was constructed for each flier after analysis of the following data: anamnesis, detailed analysis of reactions in flight, medical history, clinical examinations, and individual mental functions as determined by psychological and physiological methods, including an objective evaluation of the mobility and equilibrium of cortical processes (modified Ivanov-Smolenskii method). Certain psychological characteristics unfavorable to flight training were differentiated. These appeared generally in combination with certain negative characteristics of higher nervous activity, e.g. increased emotionality together with inertia of the cortical processes was the most frequent cause of poor assimilation of flight training.

11741
Pinc, B. W. 1960
THE PHYSIOLOGIST AND THE HOLDING FACILITY. —Astronautics, 5 (2): 40-41, 44. Feb. 1960.

Operationally, the physiologist functions in the following capacities within a spacecrew holding facility: (1) as officer in charge of the simulator facility and associated equipment, establishing standard operating procedures and overseeing the simulator during manoccupied chamber operations; (2) as staff consultant on physiological problems which may arise during the course of simulation, indoctrination or integration programs; (3) as staff consultant on personal equipment and life-support assemblies; (4) as instructor in the indoctrination and integration program; (5) as evaluation-team member; and (6) as physiological-base-lines consultant, assisting medical officers in determinations of vital capacity, circulation times, BMR's, minute volumes, etc.

11742
Schreuder, O. B. 1958
PREVENTIVE ASPECTS OF AVIATION MEDICINE IN A COMMERCIAL AIRLINE OPERATION.—A.M.A. Arch. Ind. Health, 17 (2): 170-173. Feb. 1958.

Functions of commercial airline medical services are briefly reviewed, including the preservation of the health of ground and aircrew employees, control of flight fatigue, handling of potential problems associated with jet operations, provision for the comfort and well-being of passengers, including patients, and prevention of the transportation of communicable disease by infected vectors or persons.

11743
Spiegel, F. S. 1960
CHANGING CONCEPTS IN PHYSICAL STANDARDS FOR FLYING.—Aerospace Med., 31 (11): 941-948. Nov. 1960.

Physical standards for flight personnel have not changed significantly in 20 years, but the interpretations of medical findings and their application in the flying environment change as individuals are required to perform more and more complex functions. No individual should be considered medically qualified to perform flying duties if he possesses any physical, mental, or emotional defect or disability which could or would adversely affect the safety of flight or unduly jeopardize his welfare or that of his crew and passengers. Some of the misconceptions regarding the need for a "normal" electrocardiogram in pilots are discussed, in the light of a mass survey in which variations of normal are separated from the abnormal. Recommendations for minor changes in visual requirements and weight standards are made. The use of paper electrophoresis is also mentioned to identify individuals with abnormal hemoglobins in order to restrict some of these individuals from aerospace operations.

11744
Stuhlinger, E. 1961
OPERATOR REQUIREMENTS.—In: Psychophysiological aspects of space flight, p. 9-18. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

The psychophysiological requirements of human operators of space vehicles are examined. During space flight, the operator should provide objective and subjective information about his environment and himself, make observations of unexpected events for which the programmed instruments are not prepared, and supervise and adjust automatic instruments. On the Moon, man's purpose will be to search the surface and retrieve samples. Similar duties will have to be performed for landings on planets.

11745
Taylor, A. 1959
THE VETERINARIANS' PART IN AIR FORCE SPACE RESEARCH.—Military Med., 124 (6): 422-427. June 1959.

A wide basic knowledge of varied biological disciplines—anatomy, physiology, histology, chemistry, bacteriology, pharmacology, medicine, and food hygiene—equips the veterinarian with skills valuable to the Air Force's biomedical research and development program. General areas of life sciences research in which veterinarians are utilized include animal services (inspection and quarantine, housing, feeding, and care), pathology (post-mortem confirmation of clinical findings, consultation in disease and parasite control, extrapolation of results of animal experiments for prediction of human effects and capabilities), biophysics, bio-acoustics, biochemistry, flight feeding, radiobiology, and administration and management. This paper also gives details of various assignments wherein veterinarians with

specialized and advanced training participate in the solution of highly technical problems involved with flight in the future.

11746
Wilbur, C. E. 1958
THE ROLE OF THE FLIGHT SURGEON IN AVIATION SAFETY. —A.M.A. Arch. Indus. Health, 17 (1): 64-66. Jan. 1958.

The role of the flight surgeon in the prevention of military aircraft accidents is illustrated by an analysis of factors in the decline of the major damage accident rate in carrier landings. It is emphasized that the hazardous nature of military aviation is due to the constantly increasing performance requirements of aircraft without sufficiently rapid advances in engineering safety factors.

f. Attitudes and Morale

11747
Bair, J. T. 1960
ATTITUDES OF NAVY MIDSHIPMEN TOWARD AVIATION.—Aerospace Med., 31 (1): 57-60. Jan. 1960.

During the summers of 1957 and 1958, a two-week indoctrination course in aviation was given at the Naval Air Command in Pensacola, Florida, to 1249 midshipmen. The course consisted of learning about different types of aircraft, including jets, and some ground school course material, particularly procedures. The men were questioned about aviation in general and their attitude toward flying before and after the course was reflected in an increased number of men wanting to fly. The men overwhelmingly endorsed the idea of the indoctrination course and wondered if it could not be extended to other areas of the Navy as well.

11748
Bair, J. T., 1960
and R. K. Ambler
A SURVEY OF MORALE IN THE U. S. NAVAL SCHOOL, PRE-FLIGHT.—Naval School of Aviation Medicine, Pensacola, Fla. Special Report no. 60-2, March 15, 1960. iii+[18] p.

The level of morale among cadets and aviation officer candidates of the U. S. Naval Pre-Flight School was investigated by administration of an anonymous attitude questionnaire. Results of the testing indicate a high level of morale at the School, with most subjects expressing high positive feelings towards their experiences with the training program. Morale was observed to be substantially higher in 1959 than in 1953 and 1956. Suggested causes of the increase in morale include: (1) the continuous effort of the School to improve student morale; (2) continuous improvement in course content and in the administration of the School; and (3) attraction of the more seriously motivated student to the School by the introduction of the required five-year contract. The testing technique is recommended for the assessment of morale at various stages of training. Repetition of the test in Pre-Flight at three-year intervals and after implementation of major policy changes is also recommended.

11749
Cureton, E. E. 1960
DIMENSIONS OF AIRMAN MORALE. — Univ. of Tennessee, Knoxville (Contract AF 41(657)-247); issued by Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17130). WADD-TN-60-137, June 1960. viii+71 p.

In an attempt to determine and measure aspects of airman morale, 167 questionnaire items were assembled and administered to a thousand airmen. By cluster and factor-analytic techniques, eight scales were derived, one of them defined as a measure of General Morale. Three of the scales are fairly independent of each other, but closely related to the General Morale Scale: satisfaction with the Air Force as a Whole, with Management and Communication, and with the Unit and its Leadership. The remaining four scales are relatively independent of all other scales: satisfaction with the Immediate Supervisor, with the Air Force as a Military Organization, with the Job, and with the Civilian Community. The supervision scale is the only one clearly defined as measuring a uniquely identified facet of morale. For the other scales, a different approach in the analysis could yield another equally defensible set. Technical appendixes give the analytical and statistical details. (Author's abstract)

11750
Ewart, E. S. 1958
A SURVEY OF POTENTIAL MORALE, MOTIVATION, AND RETENTION PROBLEMS AT BALLISTIC MISSILE SITES.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17119). WADC Technical Note 58-66, Oct. 1958. v+36 p. AD 203 399

A survey was made of potential morale, motivation, and retention problems at ballistic missile sites, and a review of the technical literature and opinions bearing on apparent critical problems. Morale and motivation problems in four major areas are considered: environmental factors (confined working conditions, and isolation during working hours); job conditions (monotony, hazard, shift work); personnel problems (supervision and management, crew organization); and career factors (status and recognition, job security, career potential, and assignment). The problem areas and proposed solutions are viewed in the broad context of analogous conditions in other military and industrial situations. The greatest potential for enhancing morale and providing motivation to get things done lies in the area of improved management and leadership practices. (Author's summary and conclusions, modified) (89 references)

11751
Hori, H., 1960
G. Fushimi, A. Nagasawa, Y. Kurihara, Y. Oshima, and H. Hagihara
(THE PSYCHOLOGICAL RESEARCH FOR PILOT STUDENTS. II. ON THE RESULTS OF THE SURVEY OF LIFE HISTORY). — Koku igaku jikkentai hokoku [Report of the Aero Medical Experimental Group] (Japan), no. 33, March 1, 1960. 28 p. In Japanese, with English summary.

Pilot students were asked various questions regarding family life, school, physical conditions, and mental attitudes about various situations. The

significant findings are as follows: (a) there was little relation between environmental circumstances and the desire to become a pilot; (b) school records were generally satisfactory or above average, especially in science and mathematics; (c) a strong and long standing desire to become a pilot was typical; (d) daily training was most influential in the attainment of social esteem, will power, emotional stability, and flexibility; and (e) the desire to become a pilot was reflected in many phases of life, even in the choice of friends.

11752
Whitlock, G. H. 1960
THE STATUS OF MORALE MEASUREMENT, 1959.—Univ. of Tennessee, Knoxville (Contract AF 41 (657)-247); issued by Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17130). WADD-TN-60-136, May 1960. vi+29 p.

A review and critical analysis of attempts to measure morale was conducted to determine effective methods of morale measurement among Air Force personnel. The major causes of the inadequate state of morale measurement are the failure to distinguish clearly between validity and relevance, confusion in the selection of morale criteria and in the definition of variable interrelationships, and the lack of agreement on the definition of morale. It is concluded that (1) the factors resulting from factor analyses of morale questionnaire data are dependent on the items used, the groups tested, and the methods of analysis; (2) the morale concept transcends the immediate job situation; (3) use of the same methods of factor analysis or the same questionnaire produces good agreement on morale factors among different investigators; (4) a fair degree of agreement exists among different investigators on the general scope of morale but not on the number of dimensions of morale; (5) existing evidence favors a general morale factor on which most typical items will load; (6) the number of scales determined a priori in a questionnaire always exceeds the number of factors analytically determined; and (7) the value of previous factor analyses would be enhanced by refactorization. (73 references)

11753
Whitlock, G. H., 1960
and E. C. Cureton
VALIDATION OF MORALE AND ATTITUDE SCALES.—University of Tennessee, Knoxville (Contract AF 41(657)-247); issued by Wright Air Development Division. Personnel Lab., Wright-Patterson Air Force Base, Tex. (Project no. 7719, Task no. 17130). WADD Technical Report no. TR-60-76, June 1960. vi+20 p.

This paper completes reporting of the development of scales for measuring morale among Air Force personnel. A previously developed questionnaire keyed for eight scales was given to an independent sample When the scores were compared with criteria derived from interviews, ratings, and Air Force records, validities were uniformly low. Although none of the validities are high enough for useful prediction, the scales do measure expressed attitudes with considerable reliability. (Authors' abstract)

g. Personal Factors
(Age, Sex, Race, Body Measurements, etc.)

11754
Åstrand, I. 1958
PHYSIOLOGICAL METHODS FOR ESTIMATING THE PHYSICAL WORK CAPACITY IN WORKERS ESPECIALLY OF THE OLDER AGE GROUPS.—Ergonomics (London), 1 (2): 129-136. Feb. 1958

A submaximal test for estimating the physical work capacity was developed and compared with a more complicated bicycle test. The testing procedure was a modified Harvard step test which in its original form is a maximal test. The pulse rate was counted during work. The step test was satisfactory for testing persons in good physical condition. For testing persons engaged in industrial work an intensity corresponding to 600 kgm./minute for men and 400 kgm./minute for women is suggested, the step heights for these intensities being 27 and 22 centimeters, respectively. The step test will be of value in placing workers in the proper occupation and preventing physical insufficiency due to disease at an early stage, thereby avoiding overstrain of workmen engaged in heavy manual labor.

11755
Bente, D., 1960
and E. Wanderer
[REACTION TIME IN AN ENDURANCE REACTION TEST AS A FUNCTION OF AGE] Die Altersabhängigkeit der Reaktionszeit im Dauerreaktionstest. —— Vita humana (Basel), 3 (4): 207-219. 1960. In German, with English summary (p. 218).

Mean reaction times were determined from reaction time curves registered for subjects in all age groups (range 20-80 years). The subjects responded to visual signals of two degrees of complexity in a paced task. The reaction time increased parallel to age (correlation coefficients between age and reaction time were 0.63 for simple tasks, 0.64 for complex tasks). Average increase of reaction time per decade was 0.078 respectively 0.084 sec. The difference between both correlation coefficients was nonsignificant. The degree of the deceleration with age is independent from the degree of the complexity of the required reaction. In subjects over fifty years of age the curve frequently assumes a typical shape referred to as the curve of the aged. It seems that the aging individual is relatively slow in adapting himself to his efficiency level which becomes particularly obvious in an increasingly complex situation. (From the authors' summary)

11756
Beyer, D. H. 1961
WEIGHT CONTROL—A NEW AIR FORCE PROGRAM. —Aerospace Med., 32 (9): 814-817. Sept. 1961.

Data are presented showing the results of a cross-sectional type pilot study of the relationship between age and weight among 13,272 U.S. Air Force officers on flying status, height 68 to 72 inches. Although not definitive, these data suggest that there is a weight increase with group-age increase during the two decades between 20 and 40 years. Although mean group-weight is the same for age groups 30-39 and 40-49, the percentage of men whose weights are at least 15% above standard increases with group-age for the three decades from 20 to 49 years. These data suggest

that weight reduction and weight control problems can be expected with the introduction of new standards. (Author's summary, modified)

11757
Brebner, J., 1961
and J. Szafran
THE 'PSYCHOLOGICAL REFRACTORY PHASE' AND AGEING. —— Nature (London), 190 (4771): 195-196. April 8, 1961.

A study is made of the relationship of age to the ability of a subject to respond to two simultaneous series of signals. The results show that the mean response lag tends to increase with the subject's age. However, it is possible that regular practice in responding to routine activity may decrease an older person's lag time in response to a high-information signal.

11758
CARDIOVASCULAR EVALUATION OF WEST POINT CADETS—A FOUR-YEAR REPORT.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-29, March 1958. 6 p.

Blood lipid variables were measured over a 4-year period at 2-year intervals on the entire 1956 class of West Point cadets. The data showed increasing stability as the subjects grew older. The most reliable blood parameter among those evaluated in this age group was cholesterol. Personal and family history items were recorded for each subject. A family history of heart disease and a positive deviation from standard weight were the only items that yielded a significant relationship with any of the blood lipid variables. If similar data are collected and recorded over the next three decades, it will be possible to determine if any of the measurements taken at age 20 will predict coronary disease in a military population. (Authors' abstract, modified)

11759
Cassin, S., 1961
and C. S. Herron
CEREBRAL ENZYME CHANGES AND TOLERANCE TO ANOXIA DURING MATURATION IN THE RABBIT. —— Amer. Jour. Physiol., 201 (3): 440-442. Sept. 1961.

Newborn rabbits tolerate 30-35 minutes of anoxia; adult rabbits withstand anoxia for 3-5 minutes. Rabbits varying in age from less than 24 hours to adulthood were studied. Succinic dehydrogenase and cytochrome oxidase activities were very low at birth, but gradually increased until 15-18 days postnatally. Between 15-18 days a "critical period" in the development of these enzymes was reached; adult levels of activity were attained. It is also at this critical period in time that the tolerance of the developing rabbit to anoxia becomes as poor as that of the adult. The increase in oxidative enzyme activity is in agreement with the hypothesis that the metabolism of the mammal is transformed from predominantly anaerobic at birth to aerobic with maturation. (From the authors' abstract)

11760
Clauser, C. E. 1959
ANTHROPOMETRIC STUDIES.—In: Project Mercury candidate evaluation program, p. 18-25. Ed. by C. L. Wilson. Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADC Technical Report no. 59-505, Dec. 1959.

A sophisticated anthropometric record of each Project Mercury candidate was obtained. Some of these data have already been applied toward the design of the life-support capsule and the Astronaut personnel equipment. Estimates of the lean-body weight by the Behnke formula agree very well, in general, with independent estimates of the same factor by the radioactive K^{40} method. No attempt was made to rank or rate these men in terms of anthropological measures. The function has been to describe the sample. It could assign such rating only after careful studies of the correlations between anthropological measures and the various aspects of each person's performance. This body of data is unique. There has been no other study in which such a diverse mass of clinical, physiological, psychological, and anthropological data has been collected on the same sample. The present data, with future extensions, may provide the basis for a long-term study of the interrelationships of these disciplines. Although studies of present data are underway in a limited fashion, they can become more meaningful when a larger sampling is available. At that time, an illuminating contribution to the relationship of man's physical constitution and physiological performance must result. (Author's summary and conclusions)

11761
Cohen, S. I., 1961
A. J. Silverman, and B. M. Shmavonian
INFLUENCE OF PSYCHODYNAMIC FACTORS ON CENTRAL NERVOUS SYSTEM FUNCTIONING IN YOUNG AND AGED SUBJECTS. —— Psychosomatic Med., 23 (2): 123-137. March-April 1961.

Ten young and ten old subjects (matched for IQ and for physical and mental health) were presented pure tones, neutral phrases, and phrases "charged" for each age group, while continuous GSR (skin-resistance) recordings were obtained as a measure of central nervous system activity. The subjects were interviewed to evaluate their degree of "memory" for the experiment and their perception of the meaning of and affective response to the test situation and stimuli. The findings did not allow any definite formulations regarding young and aged individuals. The results indicated that studies assessing perceptual and cognitive functions should take into consideration the influence of: (1) reception and conduction of specific sensory inputs; (2) the level of non-specific CNS activation; and (3) the psychological adaptive mechanisms activated by the psychodynamic implications of the experimental stimuli and the emotional arousal produced. (24 references)

11762
Crook, M. N., 1958
E. A. Alexander, E. M. S. Anderson, J. Coules, J. A. Hanson, and N. T. Jeffries
AGE AND FORM PERCEPTION.—Tufts University, Medford, Mass.; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 57-124, June 1958. iii+58 p.

The effect of human age from 20 to 50 on the ability to recognize visual forms was experimentally investigated with a variety of materials and testing

arrangements. With optimum viewing conditions and long exposure time little or no age effect was found. With short exposures, reduced contrast, and overlays of visual noise, age effects appeared and increased in amount as conditions became more severe. Reduction of luminance produced a marked age effect which seemed very closely related to the physiologic age changes of the human eye. (Authors' summary)

11763
Diamond, S. 1958
THE PREVENTION OF REFRACTIVE VISUAL DEFECTS IN AGING AIRLINE PILOTS.—Jour. Aviation Med., 29 (10): 733-738. Oct. 1958.

Comparative studies were made of refraction and accommodation in pilots who were without visual defects or who had developed defective distant vision as a result of insurmountable hyperopia in the presbyopic and pre-presbyopic years. Periodic determinations in 13 pilots with visual acuity varying from 20/25 to 20/60 revealed a physiologic gradual decline of accommodative amplitude from 3.58 to 2.72 diopters between the ages of 42 and 53. The decline was similar to that observed after the age of 44 in 62 normal pilots. The average hyperopia of the defective group was 1.12-1.29 diopters, compared to a normal of 0.34. Defective distant vision occurred when the presbyopic decline in accommodative amplitude resulted in a ratio of hyperopia to accommodative amplitude of one-third or more. It is concluded that maintenance of normal vision throughout the presbyopic years requires a level of manifest hyperopia at age 20-30 no greater than 1.00 diopter, allowing for a -0.60 myopic shift between the ages of 20 and 30, and an increase of 0.60 during middle age.

11764
Döbeln, W. von, 1960
and L. Laurell
[ANTHROPOMETRIC DATA AND CABIN SPACE]
Antropometriska data och kabinutrymme. —— Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 9 (1) : 7-8. 1960. In Swedish.

Body measurement statistics collected in 1959 on 109 Swedish Air Force pilots are compared with similar data collected on U. S. Air Force pilots in 1950. Data are tabulated on age, weight, standing and sitting heights, knee height, loins-knee distance in the sitting position, and reach. Swedish pilots were 1.5 per cent taller than American pilots. The establishment of a maximum height limit for Swedish Air Force aspirants is recommended instead of increasing cabin heights to satisfy the comfort of all personnel. An increase in cabin dimensions might produce undesirable aerodynamic effects.

11765
Döbeln, W. von 1961
FAT FREE BODY WEIGHT OF SWEDISH AIR FORCE PILOTS.—Aerospace Med., 32 (1): 67-69. Jan. 1961.

"Lean body weight" or "fat-free body weight" appears to be a better expression of body size for many purposes than total body weight, but a simpler method of determination is needed than the usual elaborate and time-consuming procedures. As a result of this study, it is determined that height, femoral condylar breadth, and bistyloid radioulnar breadth can be used to estimate the fat-free body weight. The assumption is made that the composition and build of the fat-free body of Swedish and United States Air Force pilots is the same and that the difference is only in height.

11766
Domey, R. G., 1961
and R. A. McFarland
DARK ADAPTATION AS A FUNCTION OF AGE: INDIVIDUAL PREDICTION. —— Amer. Jour. Ophthalmol., 51 (6): 1262-1268. June 1961.

Mean dark adaptation thresholds were determined for 241 male subjects, divided into groups of 30 subjects per decade, ranging from the teens through age 89 years. The results correspond closely with the regression equation and allow its application to individual performance for the accurate prediction of terminal levels of dark-adaptation sensitivity. The duration of the individual tests of 13 minutes was only 1/3 the usual time and should prove useful in screening large groups of subjects.

11767
Glanzer, M., 1958
R. Glaser, and M. Richlin
DEVELOPMENT OF A TEST BATTERY FOR STUDY OF AGE-RELATED CHANGES IN INTELLECTUAL AND PERCEPTUAL ABILITIES.—— American Institute for Research, Pittsburgh, Penna.; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 56-138, March 1958. 24 p.

A 14-test battery was constructed to measure age-related changes in behavior relevant to skilled performance of 544 Air Force officers between the ages of 21 and 50. The following considerations determined the content and format of the battery: job representativeness, sensitivity to age changes, scope, feasibility of administration, and reliability. Eight of the tests indicated significant decrease with age: understanding verbal materials, learning and remembering, showing ingenuity, visualizing and interpreting mechanical principles, changing orientation, identifying marginally visible objects, interpreting data from instruments, and interpreting spatial patterns. The size of the correlation coefficients, ranging between -0.11 and -0.33, did not indicate major losses with age. It is suggested that more pronounced declines with age reported in previous studies may be the result of the use of tests that are not relevant to the life activities of the population tested. (Authors' summary, in part) (37 references)

11768
Goetzinger, C. P., 1961
G. O. Proud, D. Dirks, and J. Embrey
A STUDY OF HEARING IN ADVANCED AGE. —— Arch. Otolaryngol., 73 (6): 662-674. June 1961.

The effects of age and sex upon hearing sensitivity and discrimination were studied by a battery of eight auditory tests in 15 male and female subjects within the age groups of 60-69, 70-79, and 80-89. Auditory acuity (for pure tones and speech) and discrimination decreased, while the difference score increased with advancing age. Speech reception threshold and discrimination ability test measures indicated neither sex nor ear differences. Hearing loss for speech did not exceed the 30 db. level for any of the groups. A high correlation (0.90) was found between the speech reception

threshold and the 500-2000 c.p.s. average threshold. Partial correlations between the discrimination tests and chronological age, and between discrimination tests and the 500-2000 c.p.s. average hearing level appeared to indicate that the discrimination difficulties of the aged are associated with changes involving all levels of the auditory mechanism. (35 references)

11769
Gough, H. G., and I. Krauss 1958
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. II: DESCRIPTION OF THE ASSESSED SAMPLE.—Univ. of California. Inst. of Personality Assessment and Research, Berkeley (Contract AF 18(600)-8); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7730, Task no. 77353). WADC Technical Report 58-91(II), Sept. 1958. viii+27 p. AD 208 700

This is the second of a five-part report covering an extensive psychological assessment of a group of Air Force captains. It represents sociological and psychological descriptions of the sample of 343 captains participating in the field-testing phase of the assessment. The typical member may be characterized as being a reserve officer who entered the service during World War II as an enlisted man and who received his commission through flying school. He is eligible for promotion to the grade of major. He is married and desires an Air Force career. His intelligence score is above the mean for the general adult population, but below the level defined by Terman and others as superior. His personal adjustment and psychiatric stability are judged to be excellent. In social technique he is characterized by factors of leadership and dominance, capacity for status, and achievement motivation. Tests of social acuity and social insight place him in an average rank among groups of equivalent education or occupational status. His vocational interest profile is basically a "military officer" profile similar to the pattern observed in other studies of military officers. (Authors' abstract)

11770
Hammel, H. T. 1960
THERMAL AND METABOLIC RESPONSES OF THE ALACALUF INDIANS TO MODERATE COLD EXPOSURE. — Univ. of Pennsylvania. Dept. of Physiology, Philadelphia (Contract AF 33 (616)-6306); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71820). WADD Technical Report no. 60-633, Dec. 1960. iv+44 p.

The oxygen consumption and body temperatures of nine adult, male Alacaluf Indians were measured while exposed to moderate cold for 8 hours. The metabolic rate of the average Indian was 60 per cent higher than the average BMR of the white man at the beginning of the night and fell only slightly throughout the night. A few bouts of shivering increased the metabolism in bursts during the night. When comparing the Alacaluf Indians with other ethnic groups exposed to the same tests, three patterns appear: (a) the unacclimatized white man starts his metabolic rate at a near basal level and increases it markedly as his body temperature falls, (b) the Central Australian aborigine starts with a metabolic rate near basal and slides slowly downward as his rectal and skin temperatures fall to a little lower values than the white man's, and (c) the Alacaluf Indian starts with a very high metabolic rate which declines slightly as the rectal temperature falls following the pattern of the white man, and the skin temperatures of the trunk fall a little more than the white man's while the foot temperature falls a little less. (Author's abstract)

11771
Hornowski, J., W. Kramarz, W. Pawlicki, and J. Podgórski 1960
[AGE OF THE AVIATOR—OBJECTIVE EVALUATION TEST (PRELIMINARY COMMUNICATION)] Wiek pilota—próba obiektywnej oceny (doniesienia wstępne). — Lekarz wojskowy (Warszawa), 36 (1): 12-17. 1960. In Polish, with French summary (p. 17).

A proposal is made that the biological age of man be determined by physical examinations, compared with chronological age, and a designation assigned as to "younger" or "older" in comparison with the chronological age. Using this method, 1000 pilots were examined and found to be "older" than their chronological age (aging was more rapid). This test may be used in the elimination of pilots over 29-30 years of age from flying. (Authors' summary, modified)

11772
Hubach, J. C 1958
[THE OLD AIR LINE PILOT] De oude verkeersvlieger.—Aeromedica acta (Soesterberg, Netherlands), 5 (1956-57): 197-210. [1958]. In Dutch, with English summary (p. 210).

It is contended that a fifty-year-old pilot should be looked upon as a "middle-aged" rather than an "old" man; all the more so, because the health of the strictly selected and supervised pilot usually exceeds that of the over-all population. Brief mention is made of a number of theories on the problem of aging. It is pointed out that the following factors make the determination of aging quite difficult: (1) aging is the result of a great many endogenous and exogenous factors; (2) the different organs of the body deteriorate neither equally nor synchronously by aging; (3) compensatory mechanisms of the body can make up for functional or anatomical impairments; and (4) hereditary and constitutional factors play a part in individual adaptability and power of resistance. Statistics show that middle-aged pilots and automobile drivers cause fewer accidents than the below-30-year group. It is argued that the heretofore enforced arbitrary retirement age of 50 years cannot be justifiably upheld, and that it should be increased to 55 ± 5 years without danger to safety, provided that the pilots concerned meet the physical and competency requirements. (Author's summary, modified)

11773
Iakovlev, N. N., L. G. Leshkevich, A. F. Makarova, N. K. Popova, V. A. Rogozkin, and N. R. Chagovets 1960
[AGE FACTORS IN THE REACTION OF THE ORGANISM TO EXECUTION OF PHYSICAL EXERCISE] Vozrastnye osobennosti reaktsii organizma na vypolnenie fizicheskikh uprazhnenii. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 834-841. July 1960. In Russian, with English summary

(p. 840-841).
English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 46 (7): 970-978. 1960.

Intensification of cardiac activity associated with graded physical exercise was found to be the result of an increase in the rate rather than intensity of cardiac contractions. In adolescents, systolic pressure increased slightly, while diastolic arterial pressure decreased considerably. In a number of adults over 50 years of age, systolic pressure was reduced, and the diastolic pressure increased after physical exercise. Physical exercise caused a greater increase in lactic acid level in adolescents and older adults and was more frequently associated with reduction in blood sugar than in individuals in the 16- to 40-year age range. Response to training, i.e., the ability of the organism to adapt itself to increased muscular activity, diminished with age. (From the authors' summary, modified)

11774
Ivanov, P. N., 1961
A. P. Mansurov, and S. I. Sozinov
[DEVELOPMENTAL ANOMALIES OF THE OSSEOUS SYSTEM IN FLIGHT PERSONNEL] Anomalii razvitiia kostnoi sistemy u lits letnoi professii. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (3): 60-62. March 1961. In Russian.
English translation in: Military Medical Journal, 1961 (3): 92-95. Washington: U. S. Joint Pub. Research Serv., no. 9572 (1374-N/40), June 29, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

X-ray examination of spine, ribs, and skull of 109 clinically healthy aviators revealed developmental anomalies of these areas in 54 individuals. Thirty-nine subjects had single manifestations; fifteen subjects had multiple anomalies. The most frequently observed anomaly of the skull concerned the frontal suture. Congenital anomalies of ribs included bifurcation, variations of width, and extra ribs. Most common were developmental anomalies of the vertebral column, confined primarily to the lumbosacral area. A three-year follow-up failed to reveal any adverse effects of flying. It is concluded that congenital anomalies of the osseous system are frequently encountered and are not a contraindication for military service or flight duty.

11775
Jorgensen, M. B. 1961
CHANGES OF AGING IN THE INNER EAR: HISTOLOGICAL STUDIES. —— Arch. Otolaryngol., 74 (2): 164-170. Aug. 1961.

The effects of aging on the structure of the inner ear were studied in 25 temporal bones from patients 2 months to 85 years of age. There is a progressive loss of ganglion cells in the basal part of the cochlea due to age as well as a significant thickening of the capillary walls in the stria vascularis. These changes in the stria vascularis are related to arteriosclerosis and confirm the findings of previous work. The capillary thickening is thought to affect the function of the inner ear in various ways.

11776
Kidera, G. J. 1958
TWENTY-YEAR STUDY OF PHYSIOLOGICAL MEASUREMENT IN ONE HUNDRED SENIOR AIRLINE PILOTS. —— Jour. Amer. Med. Assoc., 168 (9): 1188-1190. Nov. 1, 1958.

Unusually complete sets of physical and laboratory measurements were obtained from 100 men who had been participating actively in the piloting of commercial aircraft for 20 years. This group underwent a rigorous process of selection not only at the beginning but also throughout the duration of their careers as fliers. The average age was 30.5 years at the beginning and 50.5 years at the termination of the study. The most striking changes were a gain of 5.4 kg. (12 lb.) above the initial mean weight of 71.4 kg. (157.5 lb.), a decline of 969 cc. from the initial mean vital capacity of 4,962 cc., and an increase of 5.0 and 4.5 cm., respectively, in the girth of the abdomen and unexpanded chest. Blood pressure and heart rate remained remarkably constant, but impairment of near vision was striking, since 91 men required presbyopic correction by 1957. Audiometric losses were found, amounting to 2.85% for the right ear and 4.6% for the left, but these were roughly equal to those found in the general population. There was no evidence, in this study, of occupational predilection for any particular physical disorder. (Author's summary)

11777
Lalli, G., 1961
and G. Venditti
[BEHAVIOR OF ESTERIFIED CHOLESTEROL AND OF SOME HEPATIC FUNCTION TESTS IN FLYING PERSONNEL] Comportamento del colesterolo esterficato e di alcune prove di funzionalità epatica nel personale aeronavigante. —In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 470-476. Roma, 1961. In Italian.

Esterified cholesterol in blood serum was determined in 543 subjects of the Italian Air Force, along with the MacLagan and Wehrmann-Wunderly reactions and correlated with normal values, age, pilots and flight specialists, and the effect of alcohol consumption. The average value for esterified cholesterol was calculated as 116 ± 37 mg./100 cc. On a group of subjects 41-50 years of age, esterified cholesterol expressed in absolute values represented the unique peak possibly correlated to age in a significant manner. The correlation was inconsistent, possibly because there is an increase of free cholesterol with age. The MacLagan reaction presented an average value in all subjects of 3.05 ± 2.17 barium sulfate units (U.S.B.) and showed no correlation with age or esterified cholesterol, but a slight correlation with the Wuhrmann-Wunderly reaction (average value 3.02 ± 2.94 U.S.B.). Values registered for pilots and aviation personnel were not statistically significant. To study the effect of alcohol consumption, the subjects were divided according to those drinking less than 50 ml. per day, and those consuming more than 50 ml. of alcohol. Between the two catagories, only esterified cholesterol expressed in absolute values showed differences that were statistically rather than clinically significant. Included are representative tables.

11778
Leavitt, W. 1959
HOW USAF'S AGING TIGERS BEAT THE CLOCK. —— Air Force, 42 (2): 44-46. Feb. 1959.

The Air Force accentuates the accumulated skill of the experienced pilot as a significant factor in successful performance. To take advantage of that experience, and at the same time heed the problems of aging, constant vigilance is exercised to keep the pilots in that state of physical perfection which they had to show when they were admitted for flight training. The program involves constant check-up of eyesight, stringent annual physical examinations (with electrocardiograms required for all personnel over 40), and the establishment of a personal relationship between the flight surgeon and the airman so that newly-developed ailments are immediately detected. General comparisons are made on the physical and mental fitness of the younger, middle, and older groups of flyers (ages 24-29, 30-39, 40 and over, respectively), and their possible contributions to the Air Force program are evaluated.

11779
MacHattie, L., 1961
P. Haab, and D. W. Rennie
ESKIMO METABOLISM AS MEASURED BY THE TECHNIQUE OF 24-HOUR INDIRECT CALORIMETRY AND GRAPHIC ANALYSIS. — Univ. of Buffalo School of Medicine, New York; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8240-16). Technical Report no. 60-43, Oct. 1961. 35 p.

A graphical method is described for visualizing metabolism that greatly simplifies and clarifies indirect calorimetry. The interrelations of many metabolic variables, including heat production, water metabolism, and fractions of total energy derived from fat, carbohydrate, and proteins are visualized at a glance from measurements of oxygen consumption, carbon dioxide elimination, and urinary nitrogen excretion. Indirect calorimetric measurements were analyzed by this graphical method to determine the 24-hour metabolism of a small group of Alaskan Eskimo males living in their native village environment. Data obtained agree closely with those obtained earlier in the year by a different method (food analysis) from the same village. The advantages of indirect calorimetry over food analysis are outlined and the feasibility of applying this general approach to larger, more representative groups of Eskimos is discussed.

11780
Madden, W. F. 1960
A METHOD FOR DERIVING PERSONALITY QUESTIONNAIRE ITEMS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3003, Subtask 5). Report no. 1, Nov. 1, 1960. vii+ 169 p.

A neglected aspect in the construction of personality questionnaires has been the methods used in the construction (or writing) of the trial items themselves. In this study, a method was devised which attempted to integrate the needs of the subject in his effort to reveal information about himself together with requirements of the test constructor who must utilize the subject's response data for predictive purposes. A trial questionnaire, the D-R Inventory (Men) was constructed from items derived by an application of the method. A sample of 162 college men was tested and correlated against three criteria measures; success in engineering training, leadership, and adequacy of social living. The leadership criterion yielded a correlation above chance. (Author's abstract)

11781
Mohler, S. R. 1961
AGING AND PILOT PERFORMANCE. — Geriatrics, 16 (2): 82-88. Feb. 1961.

The development of methods for the accurate determination of the functional age of pilots, in terms of physiologic, psychologic, behavioral and social, and pathologic aspects, would allow a more realistic assessment of the performance capacity of pilots than does chronological age. Factors of potential importance in the assessment of functional age include cardiovascular status (total available hemoglobin, red cell mass, vascular pressure reflexes, susceptibility to hypoxia, cardiac output, coronary blood flow, myocardial reserve), "yellowing" of the lens of the yye, glare, rate of change of accommodation, brightness threshold in dark adaptation, critical flicker fusion, contrast sensitivity, pitch discrimination, pure-tone threshold, frequency difference limen, comprehension of speech, proprioceptive function, pulmonary function (anatomic dead space, uniformity of ventilation, maximal oxygen intake), energy reserve capacity, blood levels of certain hormones, sensorimotor performance, and onset of artherosclerosis, cataracts, glaucoma, deafness, and emphysema.

11782
Orlady, H. W. 1959
THE CASE AGAINST COMPULSORY RETIREMENT. —The Airline Pilot, 28 (8): 4-11; appendix, p. 11-14. Aug. 1959.

Studies to date indicate that (1) Chronological age does not adequately measure functional or physiological age. The primary attribute of the air line pilot, in addition to the basic flying skills, is the mature skill and judgment developed through experience. (2) Present standards and procedures reflect functional or physiological age regardless of chronological age, and may disqualify pilots of any age. (3) The majority of in-flight incapacitation cases result from such afflictions as acute indigestion, diarrhea, food poisoning, etc., and are not related to chronological age. The only way to get positive protection against in-flight incapacitation is to (a) maintain present physical and proficiency standards providing for individual testing of pilots; (b) provide a fail-safe crew whereby, on a large aircraft, any pair of flight crew members can safely function in normal or emergency situations in the event of in-flight incapacitation; and (c) provide an integrated program of initial and recurrent training for all crew members. Representative opinions on pilot aging and the broader aspects of the aging process are included in the appendix.

11783
Peters, H. B. 1961
THE RELATIONSHIP BETWEEN REFRACTIVE ERROR AND VISUAL ACUITY AT THREE AGE LEVELS. — Amer. Jour. Optometry, 38 (4): 194-198. April 1961.

A new graphical method is presented to show the relation between refractive error and visual acuity that clearly shows the influence of myopia, hypermetropia, astigmatism and various combinations of these. Graphs are presented to show this relation at three age levels, 5-15, 25-35, and 45-55. Uncorrected visual acuity for those with myopia and

certain myopic astigmias remains constant with increasing age, while it decreases with age for those with hypermetropia and certain hypermetropic astigmias. The graphs are useful to clinicians in estimating consistency of examination data and to those developing vision screening tests in estimating the types of refractive errors to be found in the "pass" or "fail" groups for each visual acuity cut-off point at each age level. (Author's summary)

11784
Platner, W. S. 1961
THE EFFECT OF STRESS ON THE AGING PROCESS. — Missouri Med., 58 (4): 373-376. April 1961.

The reactions to stress of old and young individuals are compared. Bodily changes and the mechanisms associated with the loss of ability to adapt during the aging process are reviewed. Studies dealing with the effects of (1) methyl testosterone administration on the aged, (2) graded exercises on energy expenditure and heart rate of older men, and (3) cold stress on mice are described. Additional approaches to the investigation of the aging process include comparative studies of whole populations, studies of aging in separate organ systems or in individual cells, and transplantation of old tissues to young hosts.

11785
Riley, E. C., 1961
J. H. Sterner, D. W. Fassett, and W. L. Sutton
TEN YEARS' EXPERIENCE WITH INDUSTRIAL AUDIOMETRY. — Indus. Hygiene Jour., 22 (3): 151-159. June 1961.

Data from audiograms of 2789 males and 2875 females are presented and discussed to demonstrate age and sex as factors in hearing levels. The test groups were selected to minimize possibilities of disease or prior noise exposures affecting the results. Agreement with reports of other observers is excellent. A significant difference in hearing of men and women is found. Data establish a reasonably reliable norm for presbycusis. (Authors' abstract)

11786
Rohles, F. H. 1961
and J. Fineg
GROSS BODY MEASUREMENTS OF YOUNG CHIMPANZEE.—Air Force Missile Development Center. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689301). Technical Documentary Report no. MDC-TDR-61-36, Dec. 1961. v+31 p.

This report presents 73 body measurements on 21 chimpanzees. The results can be employed by scientists concerned with designing restraint systems for chimpanzees participating in space flight. (Authors' abstract)

11787
Schreuder, O. B., 1959
and J. G. Constantino
THE CARDIOVASCULAR SYSTEM OF THE AGING PILOT.—In: The first international symposium on cardiology in aviation, p. 77-82. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiology, 6 (1): 26-29. July 1960.

Although there is a serious concern that early cardiovascular disease may curtail a pilot's flying career, it was determined that the older pilots enjoyed relatively good general health. The reasons for this are: (1) they are a highly selective group; (2) the periodic physical examination disclosed some medical conditions which were corrected; (3) the majority of pilots are health conscious; (4) some pilots were forced to discontinue their pilot duties because of personal or technical reasons or due to having incurred a serious illness or injury other than cardiovascular disease; and (5) from an economic standpoint, the pilot knows that his job depends upon his continued good health and good physical condition. The good health of the pilots has not, however, eliminated the problems of acute coronary infarction.

11788
Sendroy, J., 1959
and L. P. Cecchini
INDIRECT ESTIMATION OF BODY SURFACE AREA AND VOLUME.—Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 31 01 00.01.01 (Vol. 17, p. 215-224), May 6, 1959.

A convenient and rapid photographic technique of obtaining data which can be used for the calculation of human body surface area, is described. The results, which are in good agreement with values obtained by a reliable method of readings from a chart, provide additional support for the application of the increasingly important photographic method of quantitation in human biology. Data have also been obtained, which suggest that the surface area of dogs may satisfactorily be estimated by the same previously reported chart method used for human beings. Empirical equations for the calculation of body volume (and density) in man, based essentially on measurements of weight and height, have been developed and tested in respect to measured values obtainable from the literature. Statistical evaluation, and the criteria of convenience and rapidity in use, rather than more restrictive theoretical considerations, indicate the superiority of predominantly empirical relationships as the methods of choice for the prediction of body volume. Comparison of the reliability of the results, with those obtainable by established methods of quantitation, indicates that these equations may be useful as approximate but most convenient indices of gross body composition. (Authors' abstract) (38 references)

11789
Sendroy, J., 1960
and H. A. Collison
NOMOGRAM FOR THE DETERMINATION OF HUMAN BODY SURFACE AREA FROM HEIGHT AND WEIGHT.—Naval Medical Research Inst., Bethesda, Md. (Project no. MR005.12-3001.01). Report no. 2 (Vol. 18, p. 199-204), July 2, 1960.
Also published in: Jour. Applied Physiol., 15 (5): 958-959. Sept. 1960.

Based on the same principles and experimental data previously used by Sendroy and Cecchini for the graphical determination of human body surface area, a new chart, in the form of a nomogram, is presented. The results obtained by this latter chart are within ± 0.0035 m.^{2} of those found by the former. An extension of previous work now makes possible the calculation from one chart, of surface area values of all humans, of whatever size, from the prenatal to the largest known. (Authors' abstract)

11790
Sendroy, J. 1959
SURFACE AREA TECHNIQUES AND THEIR RELATIONSHIP TO BODY COMPOSITION.—Naval Medical Research Inst., Bethesda, Md. Lecture and Review Series no. 59-2, March 20, 1959. p. 7-14.

Methods of surface area measurement are reviewed and the applicability of each to the determination of various aspects of body composition is considered. Formulae, or indirect methods, are most often used, since the drawbacks of tedious, time-consuming direct measurements are thereby eliminated. Photographs have also been used to determine body surface. At present, there appears to be no completely reliable, accurate way of predicting body composition directly, such as the amount of fat in a person, by body surface area calculations. (44 references)

11791
Simonson, E. 1961
EXPERIMENTAL HYPOXEMIA IN OLDER AND YOUNGER HEALTHY MEN. —— Jour. Applied Physiol., 16 (4): 639-640. July 1961.

Arterial oxygen saturation was measured by means of an earlobe oximeter in 68 older (mean age 59.5) and 58 younger (mean age 23.4 years) healthy men while breathing a 10% O_2, 90% N_2 mixture for a period of 10 min. The drop of the arterial oxygen saturation was more pronounced in the older men, and the difference in reaction was statistically highly significant. (Author's abstract)

11792
Thompson, C. A. 1958
APTITUDE DIFFERENCES RELATED TO REGION OF ENLISTMENT OF BASIC AIRMEN.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task 17104). WADC Technical Note 58-65, Sept. 1958. iii+19 p. AD 202 846

Regional differences in mean performance on aptitude variables were found with basic airman samples tested in 1950 and 1953. This study examines trends in over-all regional differences for a 1957 basic airman sample. Regional differences on specific variables are examined in terms of AFQT (Armed Forces Qualification Test) mental category. The sample was 4,447 basic airman processed at Lackland Air Force Base in Sept. and Oct. 1957. Geographical regions are Army areas of enlistment and the territories. The variables are the AFQT, the five Airman Classification Battery Aptitude Indices (AC-2A), and the individual tests of the Airman Classification Battery. Major regional differences in mean performance of the 1957 basic airman sample were consistent with regional differences reported for 1950 and 1953 samples. Low-aptitude airmen made the principal contribution to over-all regional differences on specific aptitude variables. High aptitude airmen tended to exhibit slight differential mean performance by geographical region. The territorial sample's performance was a typical of the perfor nance of continental samples. (Author's abstract)

11793
Tupes, E. C. 1959
PERSONALITY TRAITS RELATED TO EFFECTIVENESS OF JUNIOR AND SENIOR AIR FORCE OFFICERS.—Wright Air Development Center. Personnel Lab., Lackland Air Force Base, Tex. (Project no. 7719, Task no. 17110). WADC Technical Note no. 59-198, Nov. 1959. 10 p. AD 231 256

It has been determined that officer candidates in training can produce reliable personality ratings of their peers that are predictive of effectiveness ratings as Air Force junior officers. This study repeats the investigation with field-grade officers. It was found that the factor structure underlying peer ratings of personality traits of senior officers closely resembled that of the junior officers. With one exception, there was agreement between junior and senior officers on the relative importance for officer effectiveness of 30 personality traits. The two groups showed even greater similarity in the relationships of the personality trait ratings to Officer Effectiveness Reports. Hence any officer selection program which screens on personality variables essential to junior-officer success will also select for traits characteristic of effective field-grade officers. (Author's abstract)

11794
Valentine, L. D. 1960
A FACTOR-ANALYTIC STUDY OF THE USAF OFFICER ACTIVITY INVENTORY.—Wright Air Development Division. Personnel Lab., Lackland Air Force Base, Texas. (Project no. 7719, Task no. 17108). WADD Technical Note no. 60-40, March 1960. iii+22 p.

This analysis was designed to determine the actual number of distinct fields of interest that can be identified by an interest inventory scaled for 16 officer career fields. Two factor-analytic techniques were applied to the 16 job-interest scores from the USAF Officer Activity Inventory for a sample of new officers. The analyses each yielded five significant factors (Combat and Operations Interest, Administrative Interest, Technical Interest, Quantitative Interest, and Personnel Interest) with corresponding factors defined by almost identical clusters of interest scales. In each analysis, one of the factors, Administrative (Personnel), was a subset of scales included in the broader Administrative factor. Thus, four distinct interest areas were defined, whose definition established their equivalence to the four interest measures included in the Air Force Officer Qualifying Test, and confirmed the judgment that four interest scales were adequate in the officer test battery. The factor analyses, presented in detail in the appendixes, are of special interest in showing how an incomplete hierarchical structure can be handled by the Schmid-Leiman hierarchical factor model. (Author's abstract)

11795
Willingham, W. W. 1958
THE RELATION OF AGE TO SUCCESS IN FLIGHT TRAINING.—Jour. Aviation Med., 29 (2): 136-138. Feb. 1958.

A study was made of the relation of age to various types of attrition among cadets at the U.S. Naval Pre-flight School during a 5-year period. A strong relation was found between increased age and failure to complete the course, with the highest correlation between age and attrition on request. Flight failure, medical failure, and disciplinary failure were slightly more frequent in older cadets. It is concluded that older cadets are more likely to have well-oriented civilian interests which support a desire to leave the flight training program.

8. MEDICAL PROBLEMS AND PHARMACOLOGY

[Medical personnel under 7]

a. General

11796
Bedwell, T. C. 1961
MEDICAL SUPPORT AT MISSILE BASES. —In: Lectures in aerospace medicine, 16-20 Jan. 1961, [section] 18. 30 p. Brooks Air Force Base, Texas: School of Aviation Medicine, 1961.

The discussion is limited to the occupational health problems and the medical support in regard to operations of the intercontinental ballistic missiles. The evaluation of these problems led to the development of a preventive medical and occupational health program including physical examinations, environmental health surveillance, and medical care of personnel and their families. A program of training personnel in self- and first-aid was initiated. The problem of fitting the individual to his job, being of great importance to the overall missile program, is discussed in light of the individual's performance in his environment. Occupational hazards at missile sites and support bases such as handling and exposure to many toxic fuels, dangerous electrical equipment, sound effects, radiation exposure and physical accidents are discussed from the viewpoint of prevention and protection. Various types of equipment for protection and detection are discussed.

11797
Berry, C. A., and A. H. King 1959
AEROMEDICAL PROBLEM CASES: THREE YEARS' EXPERIENCE IN AVIATION MEDICINE CONSULTATION CENTER.—Aerospace Med., 30 (11): 806-815. Nov. 1959.

Also published as: AVIATION MEDICINE CONSULTATION PROBLEM CASES.—Arch. Environmental Health, 3 (6): 695-703. Dec. 1961.

Also published in: Escape and survival, p. 46-62. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

To assist in evaluating problem aeromedical cases, three U. S. Air Force Aviation Medicine Consultant Centers were established. From 1956 to 1958 the centers evaluated 1,159 cases and recommended return to flying status in 51% of the cases. The referral and reporting procedures are presented. Tabulations for flying experience, age, rank, time in service, rating, and diagnoses are discussed. The majority of patients (74%) were pilots, and 40% of them had logged between 1,000 and 3,000 hours. An over-all look at the system categories of diagnoses reveals that 409 (34% of the total diagnoses) had cardiovascular conditions. About 57% of the cardiovascular cases were either arrhythmias or conduction defects found on the electrocardiogram. "Loss of consciousness" cases accounted for 27% of the cardiovascular diagnoses or 9% of the total. Neuropsychiatric diagnoses formed the second largest group, with 211 diagnoses or 18% of the total. Eye conditions represented the third largest category, or about 12% of the total diagnoses.

11798
FLYING MEDICS PLAN DISASTER OPERATION.—Aviation Week, 69 (21): 111, 113, Nov. 24, 1958.

A disaster assistance program has been developed by the Flying Physicians Association to gather necessary medical specialists quickly for utilization by the government at no cost. The 1500 members are capable of swiftly assembling several hundred airplanes, each with a doctor, two trained nurses, and an important cargo of medical supplies at any point in U.S. This program could be extended through voluntary cooperation with private plane owners and non-flying physicians.

11799
Knauf, G. M. 1960
MICROWAVE EXPOSURE AND MISSILE PROPELLANTS AS OCCUPATIONAL HEALTH PROBLEMS. —Amer. Jour. Public Health, 50 (3): 364-367. March 1960.

Two areas of medical practice in the Air Force are briefly discussed, based on 13 literature references: the biological effects of microwave (radar) energy and the toxic hazards of rocket and missile propellants. In both areas, there is a need to educate personnel to know the dangers involved and safe handling procedures, to offset the effects of accidental exposure, and to recognize the signs of chronic exposure.

11800
Leavitt, W. 1958
MAN IN SPACE.—Air Force Magazine, 41 (3): 109-125. March 1958.

A discussion is presented of the medical aspects of spaceflight including the problem of multiple-g acceleration and body-weight increase at high-speed blastoff, zero gravity, visual orientation, weightlessness, sleep oxygen-carbon dioxide supply, hazards of cosmic rays, and psychological problems. Planned flights to test the medical data during actual spaceflight are described using the X-15 which will fly at 100-mile-plus altitudes and subject pilots to periods of up to six minutes of zero gravity. The launching of lunar trips from space stations is mentioned, along with interplanetary flight. The development of space suits for these latter flights is stressed, and provision of the basic needs of shelter, air, and food stores on the moon or a planet surface is outlined.

11801
Malmejac, J., J. Sutter, G. Chardon, M. Porot, and H. Luccioni 1961
[PSYCHOLOGICAL SURVEILLANCE OF FLYING PERSONNEL] Surveillance psychologique du personnel navigant.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 69-73. Roma, 1961. In French.

Since mental problems cause a decrease in the aptitude of flying personnel, an evaluation of personality made by a team of psychologists, neurologists, psychiatrists, and physiologists is described. Two different but complementary areas examined include the aptitudes of physiological adaptation, and behavior. In the first part a series of physiological tests is given. For example, a subject's behavior is observed, along with electrocardiographic examination, during exposure to various auditory and light stresses

while in the decompression chamber. Also used is the electroencephalogram under conditions of hyperpnea and light stimulation in conjunction with psychotechnical tests of the type used for selection of flying personnel. Regarding behavior, psychological study is concerned with: (1) description of the psychological aspects and indication of the problems of the self; (2) determination of the organization of temperament and character; and (3) search for average and deep types of affectivity. Also used are projective tests, clinical examinations, and interrogation of the subject.

11802
Margaria, R. 1959
SPATIAL FLIGHT PHYSIOLOGY.—Scientia medica italica, English Edition (Roma), 7 (4): 605-637. April-June 1959.

A general discussion is presented of the problem of life in interplanetary space and the means of making possible human spaceflight. Included among the problems to be solved are the following: isolation of the space traveller in a pressure-tight compartment; provision for continuous adequate oxygen supply and removal of carbon dioxide; effects of high acceleration on the circulation, brain, vision, muscles, etc.; protection from acceleration forces; subgravity, and its effects on body orientation and food ingestion; thermoregulation and habitation in the space vehicle; caloric and nutritional requirements during spaceflight; hazards of ionizing radiations; and the physiological effects of flight on the circulatory and respiratory system. It is postulated that the greatest functional stress during spaceflight will fall on the central nervous system, particularly on the cerebral cortex.

11803
Norton, J. A. 1961
PREVENTIVE MEDICINE IN JET AND SPACE FLIGHT.—In: Human factors in jet and space travel, p. 187-213. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

Preventive medicine consists in thinking ahead so as to be prepared for any combination of contingencies related to maintaining good health. Preventive medicine is presented with particular reference to high-performance jet aircraft. The topics covered include crew selection, crew conditioning, arthropod vectors of diseases, drinking water, nutritional requirements, food-service sanitation, noise, waste disposal, effective temperature index, and industrial health. (43 references)

11804
Phillips, P. B. 1960
"IS HE FIT TO FLY?"—Aerospace Med., 31 (8): 644-648. Aug. 1960.

To meet the need for a group of experienced flight surgeons representing several clinical specialties, a "Special Board of Flight Surgeons" was established at the Naval Aviation Medical Center in Pensacola, Florida, to examine naval aviation personnel referred for specialized studies, with the purpose of determining whether such personnel are physically qualified and aeronautically adapted for flight duty. A review shows that, during the first two years of the Board's operation, 336 people were referred for evaluation. The general clinical types into which the individuals were classified included opthalmology, neuropsychiatry, cardiology, motion sickness, and others. The majority of individuals were disqualified by the Board.

11805
Rickenbacker, E. V. 1958
MEDICINE AND AVIATION.—Jour. Amer. Med. Assoc., 167 (11): 1376-1378. July 12, 1958.

Important progress has been made in the elimination of causative factors affecting the mental or physical health of those exposed to aviation. New methods of physical adjustment to air travel have been developed. Through the combined efforts of the medical, aeronautical, and astrophysical sciences manned flight into outer space will be brought about in the not-too-distant future.

11806
Schreuder, O. B. 1958
OCCUPATIONAL HEALTH IN INTERNATIONAL AIRLINE OPERATION.—Jour. Aviation Med., 29 (1): 37-39. Jan. 1958.

The health program for ground employees and aircrews involved in international airline operation is described. The ground employees program includes preplacement and periodic physical examinations, accident treatment, improvement of the work environment, and the institution of precautionary measures for hazardous maintenance operations. The program for aircrew members comprises preselection and annual physical examinations, a health education campaign, improvement of the physical environment, selection of adequate layover facilities, and preventive measures to guard against diseases encountered in global operation. Special problems of jet aircraft transportation are briefly considered.

11807
Stanmeyer, W. R. 1959
THE DENTIST AND THE SPACE AGE.—Military Med., 124 (6): 417-421. June 1959.

Personnel in the atomic-powered submarine, in the Antarctic, and in the sealed space capsule are subjected to a common stress of prolonged confinement in an unnatural environment. The dental profession, from work with submarine and Antarctic personnel over periods of five and three years, respectively, offers a dual approach to the solution of problems attendant to space travel and living by (1) attempting to answer those problems that are specific to the oral structures, and (2) by assisting the physiologist and the biologist, using the oral structures as tools for diagnosis. With submarine personnel, studies have been made on cariogenic rates, soft tissue health, effects of atmospheric contaminants (as reflected in mucous membrane changes and condition of the lips), and the effects of carbon dioxide on the parathyroid gland (as illustrated in the metabolism of serum calcium and phosphorus, and by the histologic changes in the calcifying tooth structure). Data on Antarctic personnel yielded information relative to dental selection, toothaches and cold air, alveolar osteitis, viral and bacterial infections, bacterial activity (as determined by measuring acid production rates in dental plaques after carbohydrate rinses when working outdoors at temperatures as low as -75° F.), vitamin tolerance, and non-specific stresses. Continued studies are being conducted on carbon dioxide, increased noise levels, and loss of periods of light and dark as forerunners of cariogenic activity. As a tool in the selection of personnel, the condition of the teeth and

soft tissues can give insight into the subject's tenacity of purpose, thoroughness of self-care, respect for physical fitness, and probably fear of pain. This area of space dentistry is still unstudied, as are better methods of diagnosis of pulpal and periodontal health and operative dentistry.

11808
Szmyd, L., and C. M. McCall 1960
RESTORATIVE DENTISTRY WORKLOAD OF U. S. AIR FORCE DENTAL SERVICE. — School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-27, Jan. 1960. 6 p.
Also published in: Armed Forces Med. Jour., 11 (9): 1011-1019. Sept. 1960.

An analytical survey was made of the present restorative dentistry workload of the U. S. Air Force Dental Service. It was estimated that 2,810,448 restorations were required, with an average of 3.88 restorations per man. The proportion of enlisted men needing restorative dentistry varied from 89.7 per cent for basic airmen to 56.6 per cent for master sergeants. A reduction of the required number of restorative procedures in relation to equivalent age groups in the civilian population was evident only at the non-commissioned officer level. The discrepancy between the estimated restorative workload and the total number of restorations actually performed in 1958 (1,762,680) suggests the necessity for expansion of the capability of the restorative dentistry section of the U. S. Air Force Dental Service.

11809
Tillisch, J. H. 1960
INTERNAL MEDICINE: ITS ACCOMPLISHMENTS AND FAILURES IN AVIATION.—Aerospace Med., 31 (8): 621-626. Aug. 1960.

Rather than answer questions, this article asks questions about and discusses yet unsolved problems which internal medicine physicians face in practicing aviation medicine. Two of the major problems are the determination of physiological requirements for flight fitness, and the establishment of criteria for the air transportation of patients. The criteria for pilot selection are still not firmly established, e.g., disqualifications due to hypertension, endocarditis, surgically-repaired congenital or acquired heart defect, other coronary diseases, loss of vision accompanying migraine, gastroenteritis, and diabetes are considered.

11810
Vickers, A. 1958
THE ROYAL FLYING DOCTOR SERVICE OF AUSTRALIA.—Med. Jour. Australia (Sydney), 1958 (5): 130-132. Feb. 1, 1958.

A discussion is presented of the history, operational aspects, and significance of the Royal Flying Doctor Service of Australia. The Service was initiated in 1928 to provide emergency and routine medical care and air transportation of patients to inhabitants of the inland areas of Australia. The organization operates from 12 bases and is supported by voluntary donations and government grants. Communication between doctors and patients is accomplished by radios located throughout the area served. The Service has provided a significant impetus to the settlement of isolated areas of Australia.

11811
Villalobos Pereda, J. 1960
[THORACIC SURGERY AT ALTITUDE] Cirugía torácica en altura. — Revista de la Asociación médica de la provincia de Yauli (La Oroya), 5 (1-4): 54-68. Jan.-Dec. 1960. In Spanish.

Seventeen cases are presented of thoracopulmonary diseases occurring in persons living at high altitude which required surgery. Thoracic surgery was found to be possible at altitude (Cerro de Pacco, 4,400 meters, and Huriaca, Peru, 2,900 meters) and without major differences from that performed at sea level. Surgery was not influenced by altitude but depended upon the selection of cases, preoperative study, anesthesia, and surgical technique.

11812
Vorobiev, A. I. 1959
MEDICAL SERVICES FOR JET AIRLINER PASSENGERS IN THE USSR.—Jour. Aviation Med., 29 (11): 785-786. Nov. 1958.

Observations by medical personnel and questionnaires submitted to passengers flying in TU-104 jet airliners revealed an effect of altitude or airsickness in only 3% of passengers. The most affected passengers were aged people making their first flight, and had prior medical conditions such as lung trouble, high blood pressure, or coronary sclerosis. Symptoms generally developed after 2-4 hours of flight, and were markedly relieved by brief use of an oxygen mask. Airsickness was experienced chiefly during ascent and descent, or in conditons of turbulence. Susceptible passengers are advised to take suitable drugs 30 minutes before take-off, and to read and relax during flight. Centers are maintained at all Soviet airports for the provision of rest, food, and medical supervision to flight crews. Cabin pressure of the TU-104 during flight at 29,000-36,100 feet is maintained at 570-600 mm. Hg, requiring no additional oxygen supply. Both cabin and portable oxygen installations providing oxygen sufficient to supply the crew throughout flight, and the passengers for 30 minutes, are available for emergency use.

11813
Weinrauch, H., and A. W. Hetherington 1959
COMPUTERS IN MEDICINE AND BIOLOGY.—Jour. Amer. Med. Assoc. 169 (3): 240-245. Jan. 17, 1959.

A series of conferences sponsored by the Air Research and Development Command have disclosed various applications of computers to medical problems. It is expected than analog computers may help to speed up mathematical calculations of a vast amount of data involved in specific biological problems. Automatic data-processing machines are being used in increasing numbers for solving mathematical equations or carrying out lengthy statistical calculations required in mass standardization studies of drugs, toxins, and vaccines, as well as in preventive medicine and in clinical investigations. Computers are used to simulate biological systems, e.g., Berman and Schoenfeld's models of enzyme systems. The Air Force has developed a variety of small computers for in-flight use. Mathematical techniques aiding in the application of computers in biological problems are outlined.

11814
Willingham, W. W. 1958
NON-MEDICAL CORRELATES OF MEDICAL COMPLAINTS.—U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 16 01 11, Subtask 4). Report no. 6, Sept. 15, 1958. ii+8 p.
Also published in: Jour. Aviation Med., 30 (1): 29-34. Jan. 1959.

Naval cadets having a high incidence of medical complaints were evaluated in terms of biographical information, aptitudes, performance measures, and social groupings. Results indicated that these individuals were no different from a normal population except in terms of a slight inferiority on performance measures. In addition, they tended to come from certain formal groups rather than being randomly distributed. (Author's summary)

11815
Wuiffien Paliine, P. M. van 1958
[LIPOTHYMIA] Lipothymie.—Médecine Aéronautique (Paris), 13 (2): 141-156. 1958. In French, with English summary (p. 155).

The term "lipothymia" is applied to cases in which total or partial loss of consciousness occurs in normal, healthy young men without any clearly defined cause. In addition to the routine aeromedical examination, special tests were carried out on a group of pilot candidates and pilots who had suffered fainting spells. Included were (1) an orthostatic tolerance test, (2) a cold-pressor (Hines and Brown) test, (3) E.E.G. and simultaneous E.C.G. recordings before and after intake of glucose, hyperventilation, and photostimulation, (4) a psychological interview, and (5) a stipple test. Data for a pulse-blood-pressure diagram were recorded. Evaluation of the findings from 71 cases led to the establishment of 4 types: (a) the orthostatic, (b) the vasovagal, (c) the "emotional", and (d) the epileptiform type. Emotional hyperventilation and hypoglycemia should be accepted with reservation as possible causes of fainting. Fear and anxiety may induce mental blocks, but will never lead to loss of consciousness. To violent emotions pilots react in two basic ways: either by akinesia and mutism ("Totstell" reflex) or by hyperkinesia ("motion storm") and panic. There is no indication that fainters are more susceptible than non-fainters to these types of reaction. Proneness to faint per se is no reason for rejection, provided that a detailed physical examination has not revealed any pathological findings. In the flying careers of lipothymics, no accidents or incidents attributable to a "human factor" could be discovered. An analysis of all the flight accidents which had occurred throughout the last few years revealed that only four lipothymics were involved. In three of these cases, the accidents were due to purely technical causes, and in the one remaining case the cause of the accident could not be clearly established. (Author's summary, modified)

b. Sicknesses

11816
Ades, H. W. 1961
ELECTROENCEPHALOGRAPHIC FINDINGS IN RELATION TO EPISODES OF ALTERED CONSCIOUSNESS IN AVIATORS. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 1, Report no. 3). Feb. 14, 1961. iv+24 p.

Electroencephalograms taken on pilots with a history of accidents or unconscious episodes in flight were compared with those on a Control Group of 1375 aviation candidates. Certain EEG features were found to be much more commonly recurrent in the incident-accident groups than in the Control Group. Implications of these findings are discussed with respect to possible use of EEG as a selective device for aviators and with respect to the relationship between apparent cerebral instability and other physiologically unfavorable factors whose coincidence may trigger an unconscious episode. Recommendations for further investigation and baseline EEG recordings are made. (Author's abstract)

11817
Backenstoe, G. S. 1959
PROCHLORPERAZINE IN AIRSICKNESS.—Pennsylvania Med. Jour., 62 (9): 1341-1343. Sept. 1959.

Prochlorperazine (a phenothiazine derivative) was administered to 396 persons known to be susceptible to airsickness, and of whom 261 had been previously treated with little success with other drugs. Good or excellent results were obtained in 307 of the total number of cases; prochlorperazine produced more satisfactory results in 165 of the 261 persons previously treated with other agents. The preferred dosage was one 5-mg. tablet one hour before flight. The author states that the drug appears to be a highly effective anti-emetic, anti-nauseant, and psychotherapeutic agent, and as such is especially useful for the treatment of airsickness where psychic factors often play a major causative role.

11818
Benson, A. J., and B. F. Tindall 1961
ACCEPTABILITY OF SPIN DURING STABILIZED FALL FOLLOWING EJECTION IN A FULLAND 4-G SEAT. — RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/Memo 169, Nov. 1961. [iv]+5 p.

A pattern of rotation (simulating that which subjects experience in the Fulland 4-g ejection system from about 38,000 feet) is investigated as it relates to nausea and vomiting. Twenty-eight subjects (11 aircrewmen, 1 experienced parachutist, and 16 laboratory staff members) were subjected to the simulated pattern in the laboratory on a turntable. All subjects kept their heads still during the experiment. None of the subjects vomited, four had symptoms of nausea – only two of these severe. Aircrewmen using this ejection seat system should be instructed to move their heads as little as possible during the angular motion.

11819
Berry, C. A., and H. H. Wayne 1958
DYSBARISM: GRADE IV CHAMBER REACTIONS OR INSTANCES OF NEUROCIRCULATORY COLLAPSE OCCURRING IN THE U.S. AIR FORCE, 1950-1955. —School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-85, June 1958. 17 p.

During the period 1950 to 1955, there were 125 grade-IV dysbarism reactions (i.e. requiring admission to a hospital) reported in the Air Force. These reactions are classified into 5 groups briefly charac-

terized as follows: circulatory reactions following bends with recovery at ground level or within 2 hours; circulatory reactions with recovery followed by delayed reaction; circulatory reactions progressing to shock; initial syncope without previous symptoms; and neurologic signs and symptoms. Among the reactors, 90 to 97% were above 30,000 feet for less than 20 min., and 50 to 60% for less than 10 min. Age and body linear density (weight/height ratio) did not differ significantly among the reactor groups. Bends was the most frequently reported first symptom. Loss of consciousness was the most frequent symptom reported with delayed and neurologic reactions. (Author's abstract)

11820
Berry, C. A. 1961
DYSBARISM: AN INFLIGHT CASE AND A DISCUSSION OF THE PRESENT STATUS.—Aerospace Med., 32 (2): 107-112. Feb. 1961.

The case is reviewed of a U. S. Air Force pilot, aged 45, who developed severe neurological signs and symptoms after flying a T-33 aircraft with a cabin altitude between 26,000 and 28,000 feet for approximately one hour and 25 minutes. He has retained residual weakness of the left upper and right lower extremities, memory and speech defects, and sensation alterations of the right face. (Author's summary, modified)

11821
Berry, C. A., and A. H. King 1959
SEVERE DYSBARISM IN ACTUAL AND SIMULATED FLIGHT: A FOLLOW-UP STUDY OF FIVE CASES.—U. S. Armed Forces Med. Jour., 10 (1): 1-15. Jan. 1959.

Dysbarism constitutes a constant potential hazard in high-altitude flight and may have severe manifestations at altitudes as low as 22,000 feet. Follow-up examinations were conducted on three low-pressure chamber and two in-flight dysbarism cases, and the pertinent details of the original episodes were reviewed. The follow-up intervals varied from 1 month to 15 years. The altitudes at which the reactions occurred varied from 29,000 to 43,000 feet. In two instances, reactions occurred at 30,000 feet after the subjects had been exposed to a peak altitude of 43,000 feet. The exposure times ranged from 5 to 30 minutes over 30,000 feet prior to the onset of difficulties. The cases reported confirm a generally held opinion concerning the relationship of obesity and dysbarism. All but one of the patients were moderately obese at the time of the reaction and follow-up. Hemoconcentration to a marked degree was noted in three of the five patients, even after intravenous fluid therapy. The question of residua, as well as susceptibility and disposition to dysbarism are also discussed.

11822
Berry, C. A. 1958
SEVERE DYSBARISM IN AIR FORCE OPERATIONS AND TRAINING.—U. S. Armed Forces Med. Jour., 9 (7): 937-948. July 1958.

An increased exposure of Air Force personnel to altitudes in excess of 30,000 feet has led to more reported cases of decompression sickness in both operational aircraft and low-pressure chambers. Eight Air Force in-flight (operational) reactors who survived have been reported in addition to four deaths. A plan for reporting of these cases has been initiated. During the period 1950-1955, there were 125 severe dysbarism reactions reported in the Air Force. These reactions were classified into five groups which could briefly be characterized as (1) circulatory reactions following bends, with recovery at ground level or within two hours afterward; (2) circulatory reactions with recovery and then delayed reaction; (3) circulatory reactions progressing to shock; (4) initial syncope without previous symptoms; and (5) neurologic signs and symptoms. Of the reactors, 90 to 97% were above 30,000 feet for less than 20 minutes, and 50 to 60% for less than 10 minutes. Bends was the most frequently reported first symptom. Loss of consciousness was the most frequent symptom reported during the altitude exposure. Skin reactions were most frequently associated with delayed (group 2) and neurologic (group 5) reactions. Some are made for further study of the problem and for treatment of the reactors. (Author's abstract)

11823
Chiodi, H. 1960
[CEREBRAL FORM OF MOUNTAIN SICKNESS—POSSIBLE ETIOPATHOGENIC MECHANISM] Mal de montaña a forma cerebral—posible mecanismo etiopatogénico. —— Anales de la Facultad de medicina, Universidad nacional mayor de San Marcos de Lima (Peru), 43 (2): 437-447. 1960. In Spanish.

A case is reported of chronic mountain sickness with cerebral manifestations (right hemiparesis with hyperreflexia tendinosa without contracture, positive Babinski sign) occurring in a patient living in Mina Aguilar, Peru (3,900 m.), and working at an altitude of 4,515 m. A study of cerebral minute volume demonstrated a lack of sensitivity in cerebral vessels to the dilatory effects of hypoxia and a normal vasoconstriction reaction due to hypocapnia. Hypoxia decreased oxygen pressure at the level of the central nervous system, a local reaction, possibly explaining the cerebral symptomatology. (21 references)

11824
Corso, J. E. 1961
NEW MEDICATION FOR TREATMENT OF MOTION SICKNESS. —— New York State Jour. Med., 61 (8): 1278-1280. April 15, 1961.

After briefly discussing the difficulties encountered in evaluating the effectiveness of motion sickness preparations, this paper describes results obtained by treating ocean liner patients with Bucladin (containing an antinauseant drug of the antihistaminic class, buclizine hydrochloride, together with pyridoxine hydrochloride, scopolamine hydrobromide, atropine sulfate, and hyoscyamine sulfate). It is administered by the sublingual method. Data concerning 100 patients are presented. The majority of the patients (90%) showed results classified as excellent. For the most part these patients received medication therapeutically rather than for prophylactic purposes.

11825
Dermksian, G. 1959
THE PROBLEM OF LOSS OF CONSCIOUSNESS IN FLYING PERSONNEL.—In: The first international symposium on cardiology in aviation, p. 83-97. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiology, 6 (1): 45-53. July 1960.

Aviation cadets and flying personnel with and without previous histories of syncope were subjected to special procedures designed to stress the cardiovascular system to determine the cardiovascular mechanisms of syncope and the criteria predictive of a tendency to syncope. A review of 130 previous episodes of clinical syncope indicated that the known factors most frequently associated with syncope were orthostatic influences, pain, breath-holding, hyperventilation, and psychic trauma. Syncope was produced experimentally in 35% of the 105 subjects studied. In most instances syncope was associated with cardiac arrhythmia or sudden bradycardia, and was produced by breath-holding with orthostasis. Arrhythmia was prevented or abolished by the intravenous administration of atropine. The experimental procedures failed to distinguish between persons with a previous history of syncope and those without, and therefore had no predictive value.

11826
Donnell, A. M., 1960
and C. P. Norton
SUCCESSFUL USE OF THE RECOMPRESSION CHAMBER IN SEVERE DECOMPRESSION SICKNESS WITH NEUROCIRCULATORY COLLAPSE: A CASE REPORT.—Aerospace Med., 31 (12): 1004-1009. Dec. 1960.

The case of a 39-year-old pilot who experienced severe decompression sickness during a routine simulated altitude run is presented. Because the individual became moribund shortly after the run, it was decided to treat him as though he were a diver with bends manifesting serious symptoms. During the prolonged slow decompression and recompression, improvement of his condition was gradual but sustained. His confusion and disorientation steadily decreased. The diagnosis of decompression sickness is based on the clinical picture of symptoms developed during reduction in atmospheric pressure (to less than one-sixth of an atmosphere), later progressing to severe neurological defects. The patient's excess weight fits in well with the commonly-held view that obesity predisposes to decompression sickness.

11827
Franks, W. R. 1959
THE SUMMATION OF SOME PHYSIOLOGICAL FACTORS LEADING TO INCIDENTS IN THE AIR.—In: Medical aspects of flight safety, p. 41-51. North Atlantic Treaty Organization, Advisory Group for Aeromedical Research and Development. AGARDograph no. 30, 1959.

An examination of the circumstances surrounding nine non-fatal cases of loss of effective consciousness occurring among aircrew while in the air suggests that similar mechanisms are responsible for fatal accidents attributed to the human factor. Several causative factors are reviewed: (1) hypoxia; (2) hypoglycemia; (3) hyperventilation; (4) excessive heat due to possible failure or inadequacy of the cockpit cooling system in high performance aircraft; (5) high positive accelerations, and (6) vertigo caused by disorientation. In addition to the physiological responses, three pathological factors are considered which may cause syncope. These include alcoholic hangover, influenza, and poisoning with various cockpit atmosphere contaminants such as carbon dioxide, and carbon monoxide, and toxic breakdown products from the oxidation of jet engine lubricants. For the immediate treatment of syncope in the air, the oxygen system combined with the g-suit or the pressure suit offers valuable and dramatic aid. On the ground, treatment consists of oxygen inhalation with 3.5% carbon dioxide added to prevent the loss of muscle tonus. (30 references)

11828
Glaser, E. M., 1959
and R. A. McCance
EFFECTS OF DRUGS ON MOTION SICKNESS PRODUCED BY SHORT EXPOSURES TO ARTIFICIAL WAVES.—Lancet (London), 1959, vol. 1 (7078): 853-856. April 25, 1959.

The motion-sickness-preventing action of various drugs (perphenazine, hyoscine hydrobromide, cyclizine hydrochloride, meclozine hydrochloride) and of a lactose placebo were tested on 77 soldiers, aged 19-25 yrs., in a cross-over double-blind experiment during exposures to sharp wave motion lasting one hour. A group of 66 students served as controls and received no drugs. Previous experiences of motion sickness (rough sea, seasickness, flying, airsickness, car sickness, and sickness on swings) among the experimental subjects and controls are tabulated. Hyoscine hydrobromide (1 mg.) gave significantly better protection than other treatments. Fifty mg. cyclizine hydrochloride provided somewhat better protection than the lactose placebo, but meclozine hydrochloride and perphenazine were no better than the placebo. In single exposures lactose appeared to provide significant protection from motion sickness when compared with the effects of no treatment at all.

11829
Goodman, M. W. 1961
THE SYNDROME OF DECOMPRESSION SICKNESS IN HISTORICAL PERSPECTIVE.—Naval Medical Research Lab., New London, Conn. (Project no. MR005.14-3100-2.05). Report no. 368 (vol. 20, no. 22), Dec. 21, 1961. iv+10 p.

A historical survey is presented encompassing the period from Homer to Costeau. It includes a section on caisson and tunneling operations. The major section of the paper concerns the slow evolution of the concept of decompression sickness, outlining the many theories that have been suggested or developed to explain the mechanism of this syndrome. This report gathers into one document much material valuable to Naval medical officers, researchers, and all those concerned with safety aspects of diving and underwater exploration. (From the author's summary)

11830
Graybiel, A., 1960
J. C. Meek, D. E. Beischer, and A. J. Riopelle
OBSERVATIONS OF CANAL SICKNESS AND ADAPTATION IN CHIMPANZEES IN A "SLOW ROTATION ROOM".—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-6001, Subtask 1). Report no. 55, Oct. 31, 1960. 9 p.

Two chimpanzees, one with normal and one with disturbed vestibular function, were subjected to rotations varying from 1.9 to 10.0 r.p.m. in a slow rotation room. The normal animal showed a form of "canal sickness" similar to that observed in normal humans. Adaptation to the slow rotation stimulation was observed after exposure of this animal to subcritical stimulation for two days. No sickness was

observed in the animal with abnormal vestibular function. (Authors' abstract)

11831
Ivanov, P. N., 1960
A. G. Kuznetsov, V. B. Malkin, and E. O. Popova
[DECOMPRESSION PHENOMENA IN THE HUMAN ORGANISM UNDER CONDITIONS OF EXTREMELY LOW BAROMETRIC PRESSURE OF THE ATMOSPHERE] Dekompressionnye iavleniia v organizme cheloveka v usloviiakh kraine nizkogo barometricheskogo davleniia atmosfery. — Biofizika (Moskva), 5 (6): 704-709. 1960. In Russian, with English summary (p. 709).

The presence of gases was observed on X-ray pictures of the wrist area in subjects at a barometric pressure of 41 mm. Hg or below in the decompression chamber. However, "bends" were reported in only 3 out of 72 cases. Subcutaneous emphysema due to altitude under conditions of rarefied atmosphere is markedly unstable; the probability of its occurrence increases with lower barometric pressure. There are considerable individual differences in development of altitude emphysema. The subjects maintain a normal state in the first few minutes after development of emphysema. Pain sensations appear 3-5 minutes after development of emphysema. (Authors' summary, modified)

11832
Johnson, W. [H.], 1961
J. Meek, and A. Graybiel
THE EFFECTS OF UNILATERAL AND BILATERAL LABYRINTHECTOMY ON CANAL SICKNESS IN THE SQUIRREL MONKEY.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1). Report no. 65, Dec. 30, 1961. ii+10 p.

Six squirrel monkeys which readily developed canal sickness when exposed to slow rotation were divided into two groups and subjected either to a unilateral left labyrinthectomy or a bilateral labyrinthectomy. Following surgery both groups of animals demonstrated vestibular dysfunction in unsteadiness of gait and absence of response to caloric testing of the operated ears. After bilateral labyrinthectomy all three monkeys developed a complete insensitivity to canal sickness. A similar lack of symptoms was seen initially in the monkeys subjected to unilateral labyrinthectomy; however, this behavior proved to be temporary, and by six months the animals had nearly returned to the presurgical level of sensitivity to canal sickness. (Authors' abstract)

11833
Johnson, W. H., 1961
and N. B. G. Taylor
SOME EXPERIMENTS ON THE RELATIVE EFFECTIVENESS OF VARIOUS TYPES OF ACCELERATIONS ON MOTION SICKNESS.—Aerospace Med., 32 (3): 205-208. March 1961.

A comparison of the relative importance of linear and angular accelerations in causing motion sickness was made by exposing 800 aircrew trainees to 8 possible situations of simple harmonic motion on a 2-pole or 4-pole swing. With the head free and the eyes open, the incidence was less than with the head free and the eyes closed. This is attributed to the subject's selection of a visual reference point and use of this to assist him in holding his head steady.

11834
Johnson, W. H. 1961
SOME VESTIBULAR PROBLEMS IN SPACE FLIGHT. — Annals Otol. Rhinol. Laryngol., 70 (3): 777-784. Sept. 1961.

The present knowledge of the effects of space flight on the nonauditory labyrinth is reviewed. Motion sickness is primarily caused by motion, although there are contributing factors. Whether or not angular acceleration or linear acceleration is the causative motion is debated. The relation of nausea and vomiting to motion sickness is discussed. It is suggested that weightlessness by itself is not nauseating, but that angular acceleration of the head will produce nausea during the weightless state. Vertigo will be a constant hazard during preweightlessness and weightlessness due to rotation of the rocket, tumbling movements of the capsule, and nodding of the head when the trunk rotates in the plane of vehicular rotation. (22 references)

11835
Kern, J. D. 1960
THE ETIOLOGY AND PATHOLOGICAL PHYSIOLOGY OF DECOMPRESSION SICKNESS.—Naval Medical Research Lab., New London, Conn. (Research Project no. MR005.14-3100-2.02). Report no. 345 (Vol. 19, no. 20), Dec. 15, 1960. iv+26 p.

The author has made a rather comprehensive analysis of the available literature covering the physiological phenomena experiences of personnel subjected to pressure changes incident to diving and flying. He discusses the etiology of the common and rare symptoms and presents the reader with useful brief descriptions of different types of cases. A synopsis is included following the references and a detailed index is provided. (Author's abstract) (33 references)

11836
Kottenhoff, H. 1960
HOW EFFICIENT ARE OPTICAL INVERSION METHODS WITH ADULTS TO TEST THEIR MOTION-SICKNESS SUSCEPTIBILITY? — Acta psychologica (Amsterdam), 17 (2): 96-99. 1960. In English.

Adults wearing right-left and up-down inverting spectacles were subjected to rocking and rotating motions in appropriate chairs for periods up to ten minutes, and the degree of motion sickness elicited was compared to that of children subjected to the same tests. It was found that motion sickness susceptibility degrees are highest for children tested with inversion methods, second highest for adults tested in this manner, and lowest for children tested in a purely mechanical fashion. It is concluded that optical inversion methods in combination with appropriate mechanical body motion appear superior to mechanical test methods alone with both children and adults.

11837
Kottenhoff, H. 1960
ON USING INVERTING SPECTACLES WITH CHILDREN TO TEST THEIR MOTION SICKNESS SUSCEPTIBILITY. — Acta psychologica (Amsterdam), 17 (2): 92-96. 1960. In English.

When right-left and up-down inverting spectacles were placed on children who were simultaneously rocked and rotated on appropriate chairs for a to-

tal period up to ten minutes, the elicited degree of motion sickness in these children was significantly greater than the slight symptoms, if any, which were produced by employing only the mechanical chair devices without simultaneously inverting the chair rider's vision. The combined use of optical plus mechanical stress therefore appears of value in testing children's susceptibility to motion sickness. (From the author's summary and conclusions)

11838
Kottenhoff, H., 1958
and L. E. H. Lindahl
VISUAL AND EMOTIONAL FACTORS IN MOTION SICKNESS: PRELIMINARY COMMUNICATION.— Perceptual and Motor Skills, 8 (3): 173-174. Sept. 1958.

Twelve adults and sixteen children were subjected to mechanical rocking and rolling motions while fixating a rotation Bárány drum for 5 minutes. No symptoms were observed. Exposure to the same conditions while wearing visual-field-inverting (disorienting) spectacles caused various degrees of motion sickness. Children were found to be more susceptible to motion sickness than adults; this difference was more marked when vision was inverted. However, adults with inverted vision were more susceptible than children without inverted vision.—In considering the effects of emotional and personality factors upon motion sickness susceptibility, it is concluded that this susceptibility can be correlated to anxiety and introversion, but not necessarily to neurotic and psychosomatic problem in individuals.

11839
Kovalenko, E. A., 1961
and IU. A. IUrkov
[THE GASEOUS COMPOSITION OF THE BUBBLES FORMED IN HIGH-ALTITUDE TISSUE EMPHYSEMA] O gazovom sostave puzyrei vysotnoi tkanevoi emfizemy. — Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 5 (4): 26-29. July-Aug. 1961. In Russian.

English translation by U. S. Joint Pub. Research Service (Washington), no. 10837 (CSO: 6695-N), Nov. 3, 1961. 6 p.

Twenty-three albino rats were rapidly decompressed to 7-8 mm. Hg in an altitude chamber and remained in the rarefied atmosphere for 60-70 seconds. Samples of the liberated gas were withdrawn subcutaneously after the 10th, 20th, and 40th second of decompression and microanalyzed. Emphysematous swelling regressed during return to normal atmospheric pressure. Three rats died of acute hypoxia and respiratory arrest; in others anoxic symptoms disappeared within 10-15 minutes after recompression. During the first 10 seconds the subcutaneous bubbles were composed of 73.7% N_2, 10.62% CO_2, and 16% O_2. With advancing emphysema the CO_2 concentration in the subcutaneous bubbles increased while the N_2 content dropped. Death ensued from anoxia rather than from the boiling of the body fluids.

11840
Kowada, S. 1961
ON THE PREVENTION OF DECOMPRESSION SICKNESS, WITH SPECIAL REFERENCE TO INTERNAL ELIMINATION OF NITROGEN UNDER PURE OXYGEN INHALATION. — Bull. Tokyo Med. and Dental Univ., 8 (1): 1-19. March 1961.

Four subjects breathing pure oxygen were measured as to the amount of nitrogen eliminated and the total amount in the body. Elimination of nitrogen for up to 30 minutes can be divided into five parts, each part being a straight line of a logarithmic curve. The significance of the straight line is that elimination is uniform and is declining exponentially. The elimination coefficient for the period of 8-30 minutes is 0.0272. The quantity of nitrogen eliminated every two minutes is found to be less than that obtainable from the elimination equations of previous workers. The average amount of nitrogen in the body at normal atmospheric pressure is 15.8 cc. per kg. of body weight, and the average of total nitrogen per subject for four subjects was 917 cc.

11841
Lamb, L. E., 1960
H. J. Green, J. J. Combs, S. A. Cheeseman, and J. Hammond
INCIDENCE OF LOSS OF CONSCIOUSNESS IN 1,980 AIR FORCE PERSONNEL. — School of Aviation Medicine. Aerospace Medical Center, Brooks Air Force Base, Texas. Report no. 61-6, Oct. 1960. 15 p.

Also published in Aerospace Med., 31 (12): 973-988. Dec. 1960.

To learn the incidence of loss of consciousness among members of the United States Air Force military population, four different surveys have been carried out to include 1,578 individuals on flying status and 402 Academy cadets (total, 1,980). Anonymous questionnaires indicate that loss of consciousness has occurred in 37.4 per cent of rated flying personnel. Loss of consciousness, for reasons other than all types of physical trauma, has occurred in 20.2 per cent of the flying population. A wide variety of precipitating factors was described by the individuals surveyed. The results of the surveys indicate that loss of consciousness and syncope are not infrequent events in a healthy flying population. The surveys establish that many pilots have had successful flying careers even though they have, on occasion, experienced loss of consciousness precipitated by innumerable causes. (Authors' abstract)

11842
Lindahl, L. E. H. 1960
PGR-CHANGES AND OTHER VARIABLES RELATED TO EXPERIMENTAL INDUCED MOTION-SICKNESS. — Acta psychologica (Amsterdam), 17 (2): 99-112. 1960. In English.

Fifty persons were subjected to five-minute periods of rocking and rotating on appropriate chairs while wearing inversion-spectacles, for up-down and right-left respectively. Psychogalvanic reflex recordings taken under these conditions were found to correlate at the one per cent level with intensity of mechanical plus optical stimulation. All subjects were tested with the Maudsley Personality Inventory for neuroticism and extraversion, and the Taylor Scale for Manifest Anxiety. Others were additionally tested with Hamilton's Block Sorting Test for obsessionality, and the Guilford Inventory for Factors S, T, D, C, R. Extraversion correlated negatively with the subjects susceptibility to motion sickness as deter-

mined also by a travel sickness questionnaire. It was suggested that neuroticism lowered the subjects threshold, while anxiety gave a dubious result as did obsessionality. The psychogalvanic reflex score showed gross emotional disturbances accompanying motion sickness, but these did not markedly precede other symptoms. The importance of visual components involved in motion sickness was demonstrated by showing that when an unusual visual field content is presented, motion sickness thresholds are greatly decreased. (Author's summary, modified)

11843
Lukács, S., 1959
E. Galla, T. Halm, and L. Vámos
[PROPHYLAXIS OF MOTION SICKNESS (KINETOSIS)] A mozgásbetegség (kinetózis) megelozése.—Honvédorvos (Budapest), 11 (1): 52-57. Jan.-March 1959. In Hungarian.

Various types of prophylactic medication for motion sickness are surveyed. On the basis of their own experiences the authors recommend the drug Aviamin (a dimenhydrinate preparation) for routine prophylaxis of air sickness. (From the authors' summary)

11844
Lundin, G. 1960
NITROGEN ELIMINATION FROM THE TISSUES DURING OXYGEN BREATHING AND ITS RELATIONSHIP TO THE FAT/MUSCLE RATIO AND THE LOCALIZATION OF BENDS.—Jour. Physiol. (London), 152, (1): 167-175. June 1960.

The rate of nitrogen elimination from the body during a four-hour resting period of pure oxygen breathing at a simulated altitude of 7500 m. was determined in 6 subjects by measurements of the N_2 concentration of end-tidal air. Tissues (presumably muscle) associated with the rapid component of nitrogen elimination were observed to eliminate 4.6 to 6.1% of their N_2 content per minute, with a half-time of 12 to 15 minutes. The second-phase tissues (presumably fat) eliminated 0.47 to 0.79% of their N_2 content per minute, with a half-time of 90 to 150 minutes. No relationship was observed between age and elimination rate for the slow phase. Indirect calculations of the fat and muscle weight of subjects from equations based on the assumption that the nitrogen measured was entirely from muscle and fat tissues showed fair agreement with other indirect observations. A close relationship between the nitrogen desaturation rate of fat tissue and decompression sickness is suggested.

11845
Malette, W. G., 1961
J. B. Fitzgerald, and A. T. K. Cockett
DYSBARISM: A REVIEW OF 35 CASES WITH SUGGESTIONS FOR THERAPY. —School of Aviation Medicine. Aerospace Medical Center, Brooks Air Force Base, Tex. Review no. 3-61, April 1961. 17 p.

A review is presented of 35 cases of dysbarism of which 19 patients survived, while 16 had a fatal outcome. Twenty-five of the reactions resulted from exposure to simulated altitude in decompression chambers, while 10 occurred in aircraft. Since dysbarism presents a mixture of neurologic and hypovolemic symptoms, emphasis is placed upon the high degree of clinical judgment necessary to assess the predominant lesion and direct therapy accordingly. Consideration is given to diagnostic and laboratory data of value in the management of dysbarism, and to various therapeutic procedures, including fluid therapy, overcompression and hypothermia. (26 references)

11846
Marbarger, J. P., 1958
W. E. Kemp, W. Kadetz, and J. Hansen
STUDIES IN AEROEMBOLISM.—Jour. Aviation Med. 29 (4): 291-300. April 1958.

A study was made of the effect of denitrogenation on the incidence of bends pains in three subjects exposed to an altitude of 38,000 feet for up to 30 minutes. The subjects performed a standard exercise consisting of 5 knee-bends every 3 minutes during the exposure. After direct ascent to 38,000 feet without denitrogenation, all subjects experienced bends pains in less than 30 minutes at high altitude. The incidence of bends was decreased to 47% by breathing an oxygen-rich mixture (105 mm. Hg oxygen partial pressure) at 18,000 feet or ambient air at 12,000 feet for 4 hours prior to ascent to 38,000 feet. Forty per cent of the subjects remained symptom-free for 30 minutes at high altitude after breathing 100% O_2 for 2 hours at 18,000 feet. It is indicated that maintenance of a low tissue gradient of nitrogen tension for a long duration is as effective in reducing nitrogen in the less vascularized parts of the body as a higher tension for a shorter period. The possibility is also suggested that the local release of carbon dioxide is the most important factor in decompression sickness.

11847
Marotta, S. F., 1961
J. P. Marbarger, N. Andersen, J. Hansen, and W. Kadetz
INCIDENCE OF BENDS FOLLOWING PARTIAL DENITROGENATION AT SIMULATED ALTITUDE.—Aerospace Med., 32 (4): 289-295. April 1961.

The incidence of decompression sickness was studied in 15 healthy young men who participated in a total of 96 trials in a low-pressure chamber at a simulated altitude of 38,000 feet following partial denitrogenation at 12,000 feet for 2, 4, 6, 8, 10, and 12 hours. At high altitude, each subject was required to perform a standard exercise consisting of 5 knee bends every 3 minutes for 30 minutes followed by 5 knee bends every two minutes for the succeeding 30 minutes. Of the 96 trials, only 6 were symptom-free and these occurred in 2 subjects. The remaining trials were all terminated prematurely due to decompression sickness. The data suggest that the time before the onset of bends was increased proportionally to the increase in time allotted for partial denitrogenation at 12,000 feet reaching a maximum at 8 hours. The descent altitude at which all symptoms of aviator's bends disappeared roughly paralleled the height of the incidence of bends. The knees were the principal site of aviator's bends regardless of the time-stay at 12,000 feet. They accounted for 67% of the total number of symptoms. No direct correlation was noted between percent body fat and percent of time at 38,000 feet before the onset of bends. (Authors' summary, modified)

11848
Meek, J. C., 1961
A. Graybiel, D. E. Beischer, and A. J. Riopelle
OBSERVATIONS OF CANAL SICKNESS AND ADAP-

TATION IN CHIMPANZEES AND SQUIRREL MONKEYS IN A SLOW ROTATION ROOM.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1). Report no. 59, May 18, 1961. 15 p.

Chimpanzees and squirrel monkeys, with both normal and disturbed vestibular function, were subjected to varying degrees of rotation in the Pensacola Slow Rotation Room. The normal animals showed a form of "canal sickness" similar to that observed in normal humans, and adaptation could be observed after exposure of the animals to subcritical stimulation for several days. The manifestations of canal sickness were correlated with labyrinthine function. It was found that canal sickness failed to develop in those animals which exhibited no nystagmus in bilateral caloric tests. These experiments point to the conclusion that in these animals as in man, the canal sickness experienced in a slow rotation room depends upon normal vestibular function. Thus the chimpanzee and the squirrel monkey may contribute considerably to the clarification of the etiology and final control of canal sickness. (Authors' abstract)

11849
Milch, L. J., 1959
and H. D. Stallings
MOTION SICKNESS ABOARD JET AIRCRAFT.—Texas State Jour. Med., 55 (3): 175-177. March 1959.

The environmental factors usually associated with motion sickness are discussed in relation to their effects upon passengers in jet aircraft. High ambient temperatures, which predispose to labyrinthine stimulation and emesis, are considerably lessened by the efficient air conditioning of jet aircraft. Noxious odors such as that of vomitus from other passengers are effectively inhibited by the air conditioning system, but the odor of jet-propulsion fuel is more unpleasant than that of octane fuel, and a person exposed to the odor of JP fuel prior to boarding may be more likely to become airsick aloft. Increased accelerative forces combined with accompanying vestibular stimulation resulting in nausea and vomiting are more pronounced in jet aircraft. The assumption of a nearly supine position by the passenger can minimize accelerative vestibular stimulation, however. The jet accident rate and proportion of fatal accidents make for tenseness and apprehension on the part of the passenger and result in an indictment of these mental states as underlying causes of motion sickness. Noise and vibration as factors in airsickness may be discounted in jet flying. The high operating altitudes of jets reduce rough air turbulence and accompanying accelerative forces. Speculations on the administration of various motion sickness prophylactic drugs are included in this discussion.

11850
Miller, James W., 1958
and J. E. Goodson
A NOTE CONCERNING "MOTION SICKNESS" IN THE 2-FH-2 HOVER TRAINER.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 17 01 11, Subtask 3). Report no. 1, Feb. 20, 1958. ii+19 p.

Essentially the same: MOTION SICKNESS IN A HELICOPTER SIMULATOR.—Aerospace Med., 31 (3): 204-212. March 1960.

The development of the 2-FH-2 helicopter simulator is reviewed. The problem of "motion sickness" was found to lie in one or a combination of several modes of distortion: both static and dynamic distortions in the projected scenery, errors in the perceived directional changes of motion, and dynamic errors in the perceived angular rate of motion. Suggestions are made as to how the distortion might be remedied.

11851
Odland, L. T. 1959
FATAL DECOMPRESSION ILLNESS AT AN ALTITUDE OF 22,000 FEET.—Aerospace Med., 30 (11): 840-846. Nov. 1959.

Clinical and pathological details of an incident of fatal decompression sickness in a pilot at an altitude of 22,000 feet are presented. Since obesity, or a tendency toward adiposity, is a factor in this and in nearly all fatal cases of decompression sickness, weight reduction appears to be the most practical method of prevention.

11852
Okunev, R. A. 1961
[EXPERIENCE IN THE USE OF HYPNOSIS AND SUGGESTION FOR THE PROPHYLAXIS AND TREATMENT OF MOTION SICKNESS] Opyt primeneniia gipnoza i vnusheniia dlia profilaktiki i lecheniia ukachivaniia [Abstract]. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (12): 72. Dec. 1961. In Russian.

The effectiveness of hypnotic treatment was investigated in regard to prophylaxis and treatment of motion sickness in experimental conditions (rotation in the Bárány chair) and at sea. Hypnosis reduced motion sickness considerably and increased the work capacity of individuals during rocking. The effectiveness of hypnosis is directly related to the depth of trance reached in the sessions. Reinforcement sessions twice a week were found necessary after completion of the course. On the average, the course required 30 sessions for most individuals. Tape-recorded broadcasts aboard the ship were found to be a satisfactory substitute for the hypnotist. Since 20-25% of people cannot be hypnotized satisfactorily, hypnosis for motion sickness should be combined with the administration of anti-motion sickness drugs.

11853
Parsons, V. 1958
A BRIEF REVIEW OF AVIATOR'S DECOMPRESSION SICKNESS AND THE HIGH ALTITUDE SELECTION TEST.—Jour. Royal Naval Med. Service (London), 44 (1): 2-13. Winter 1958.

Preoxygenation (by breathing 100% oxygen for four hours or more) affords protection against effects of altitude up to at least 40,000 ft. However, as this method is inconvenient, expensive, time-consuming, and difficult to fit into an operational program, the application of preliminary personnel selection methods would be preferable. A high-altitude selection test is described consisting of three exposures in a decompression chamber to 37,000 ft. within seven minutes, lasting one hour each without enforced exercise. Exposures are carried out on alternate days for one week and repeated every four years. The intensity of resulting symptoms can be categorized as "minimal or transient", "mild" (ample warning of their onset), or "severe" (the subject is rendered incapable of controlling the descent of his aircraft). The symptoms include syncope, chokes, abdominal distension, and post-decompression syncope. The importance of constant observation, during the test

and afterwards, of subjects having suffered severe symptoms is stressed. Factors influencing susceptibility are shown to be multiple, and the general impression is confirmed that subjects under 27 years of age, who are not overweight and have a normal body-fat distribution, are less susceptible than older, obese individuals. The high-altitude selection test has been shown to be of value not only for preselection, but also for purposes of indoctrination of air personnel in recognizing early symptoms of decompression sickness. Without such indoctrination, mild symptoms might be overlooked, and serious results may ensue.

11854
Pfrommer, J. R. 1959
DECOMPRESSION SICKNESS: THE STATE OF THE ART.—U. S. Armed Forces Med. Jour., 10 (11): 1292-1298. Nov. 1959.

Literature regarding investigation and case reporting of decompression sickness is reviewed. Our present knowledge concerning the etiology of symptoms of this afflication is incomplete, although it is generally agreed that body nitrogen formed during atmospheric pressure changes plays an important part. It is emphasized that a consideration of the problems involved in space flight is implicit in further investigations of decompression sickness.

11855
Phillips, P. B., 1958
and G. M. Neville
"EMOTIONAL G" IN AIRSICKNESS.—Jour. Aviation Med., 29 (8): 590-592. Aug. 1958.

Comprehensive interviews were conducted with 69 airsick student pilots referred for medical treatment during a 10-month period from a total student population of 2,893. Past history of motion sickness was determined, and an evaluation was made of anxiety towards flying and motivation for flying. The students were reassured that the airsickness was temporary, and were returned to flight training without treatment. Twenty-nine of the students did not complete primary flight training at their own request(15), because of continuing airsickness (11), or because of flight failure (3). Data from the prior interviews revealed that 28% of failing students had a past history of motion sickness, 62% showed poor motivitation, and 62% showed marked anxiety. Of the 40 students completing training, 80% had a past history of motion sickness. Anxiety was marked in only 10% of those succeeding, and motivation was moderate or strong in 98%. It is concluded that the "emotional g" of attraction to earth may be responsible for the failure of flight students. An equation is presented which indicates the relation of failure in flight training directly to anxiety and inversely to motivation.

11856
Powell, T. J., 1959
T. M. Carey, H. P. Brent, and W. J. R. Taylor
UNCONSCIOUS EPISODES IN PILOTS DURING FLIGHT (1956).—In: Medical aspects of flight safety, p. 102-115, 2 unpaged leaves. North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Eight cases of unconsciousness or diminished consciousness while flying were investigated at the Royal Canadian Air Force Institute of Aviation Medicine, Toronto, during 1956. Five of these cases satisfied the criteria for the diagnosis of "physiological unconsciousness in medically fit aircrews". The factors seem to be: (1) previous or concomitant g; (2) hypoglycemia occurring a few hours after a light carbohydrate meal; (3) hyperventilation; (4) anxiety or anger; and (5) early slow electroencephalographic activity with hyperventilation found during standard medical examination. All of these factors contribute to diminished cerebral activity and can summate to cause unconscious episodes. These episodes may be prevented by removing one or more of the factors. (Authors' summary, modified)

11857
Rait, W. L. 1959
THE ETIOLOGY OF POSTDECOMPRESSION SHOCK IN AIRCREWMEN.—U. S. Armed Forces Med. Jour., 10 (7): 790-805. July 1959.

Fifteen fatal cases of postdecompression shock occurring during a 14-year period are reviewed. Nine cases occurred after decompression-chamber runs and six after actual flight. Fat emboli resulting from exposure to low ambient pressure appeared to be the cause of all fatalities. A non-fatal, Australian case of postdecompression shock is also reported. It is noted that in both fatal and non-fatal cases of postdecompression shock the individuals did not attain altitudes much above 30,000 feet. The hypothesis is advanced that the cause of death in fatal cases and the cause of shock in non-fatal cases was embolization of liver fat to lungs and brain under changed circumstances of differential pressure applied to the liver. Fat may reach the cerebral end-arteries by arteriovenous shunts in the lungs, by a patent foramen ovale or by the vertebral venous plexus. The management of the nonfatal Australian case and research on the experimental production of fatty livers in rats subjected to decompression are briefly reviewed.

11858
Reinhardt, R. F. 1959
MOTION SICKNESS: A PSYCHOPHYSIOLOGIC GASTROINTESTINAL REACTION?—Aerospace Med., 30 (11): 802-805. Nov. 1959.

It is suggested that susceptibility to motion sickness is governed by the pattern of an individual's psychologic development, and a concept of motion sickness as a psychophysiologic reaction to stress is presented. Positional changes and anxiety can be indelibly associated through the traumatic experiences of infancy. The nonacoustic labyrinthine system is uniquely suited to retain the archaic responses, reflexes, and pathways of infancy, some of which make for poor function and faulty environmental adaptation. The labyrinth and its sensorimotor responses represent a closed system of obsolete reactions to perplexing positional changes out of the dim and consciously forgotten past. Opposed to the concept that motion sickness is due to overstimulation of the inner ear receptors from "violent head motion" is the finding that many people, while in a weightless state, develop all the symptoms of motion sickness. Motion sickness usually accompanies g force intolerance, and the latter (at least in its episodic form) was found to coincide with personality disturbances in three military aviation students.

11859
Remond, A. 1959
[OCCULT LOSS OF CONSCIOUSNESS, CAUSE OF UNEXPLAINED ACCIDENTS] Les pertes de connais-

sance occultes, causes d'accidents inexpliqués.—In: Medical aspects of flight safety, p. 116-131. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

A study of fainting episodes in persons unaware of their occurrence resulted in their classification based on central nervous system disorders. Loss of consciousness was due to the following causes: (1) abnormal sensory sensitivity (photogenic and reflex epilepsies); (2) psychomotor epilepsy resulting from stress; (3) syncope and fainting in persons with vagal excitability exposed to conditions such as hot and confined work areas, muscular discomfort, acceleration, emotional upset, etc.; (4) paroxysmal sleep; and (5) paroxysmal coma concomitant with visceral diseases. The importance is stressed of systemic diagnosis of these conditions by routine electroencephalography with minor stimulation during selection procedures of flying personnel or ground crews whose jobs implicate great responsibilities. It is recommended that all subjects involved in an accident in or out of the service and especially where head injury is involved be carefully examined in order to discover (a) a hidden cerebral cause of the accident, or (b) possible brain injuries resulting therefrom which could cause failure of the central system. Preventive measures could be facilitated by using a warning device to alert the other crew members of a dangerous functional impairement of an automatic counteraction mechanism set into motion by an abnormal electroencephalogram or electrocardiogram.

11860
Rising, J. D., 1960
and M. Delp
SUDDEN KNEE AND ABDOMINAL PAIN, DYSPNEA, NAUSEA, AND COLLAPSE OCCURRING IN AN OBESE AERIAL PHOTOGRAPHER.—Jour. Kansas Med. Soc. 61 (9): 473-477. Sept. 1960.

At a staff and student conference held at the University of Kansas Medical Center the following case report was presented: An extremely obese patient was admitted complaining of abdominal and knee pain and dyspnea seven hours after a flight in an unpressurized aircraft at an altitude of 33,000 feet. Blood pressure was unobtainable, and pulse and respiration were markedly elevated. Administration of vasopressors failed to produce a sustained increase in blood pressure, and the patient died in ventricular fibrillation. The illness is attributed to extensive air (nitrogen) embolism caused by decompression.

11861
Robie, R. R., 1960
F. W. Lovell, and F. M. Townsend
PATHOLOGICAL FINDINGS IN THREE CASES OF DECOMPRESSION SICKNESS.—Aerospace Med., 31 (11): 885-896. Nov. 1960.

Three fatal cases of decompression sickness are presented. Case 1 presents a typical history and specific pathological findings. Case 2 presents a typical history of the syndrome, but there is a paucity of pathological findings to explain the death. Case 3 is somewhat atypical in history and also presents a paucity of pathological findings. (Authors' summary, modified)

11862
Rozsahegyi, I. 1959
LATE CONSEQUENCES OF THE NEUROLOGICAL FORMS OF DECOMPRESSION SICKNESS.—British Journal Industrial Medicine (London), 16 (4): 311-317. Oct. 1959.

Various neurological forms of decompression sickness are classified and an inquiry two-and-a-half to five-and-a-half years after the acute illnesses are reported. One hundred subjects with decompression sickness of the central nervous system were examined. In more than half of the cases the clinical picture was that of chronic encephalomyelopathy, vegetative neurosis, or psychosomatic symptoms. Symptoms were found in three-quarters of the cases, and objective signs in the same proportion. Fourteen patients were unable to work two-and-a-half to five-and-a-half years after the acute illness, and only 13 of 100 patients were reported to be reasonably well. The best and only adequate treatment for decompression sickness is recompression. After recompression the prognosis for recovery is increasingly poorer with longer time, and after the first six weeks there is no hope of a perfect recovery. (Author's abstract)

11863
Rudolph, S. J., 1961
M. E. Herring, and D. A. Vavala
NEUROCIRCULATORY COLLAPSE ASSOCIATED WITH REDUCED BAROMETRIC PRESSURE: CASE REPORT.—Aerospace Med., 32 (11): 1023-1025. Nov. 1961.

A case of neurocirculatory collapse associated with reduced barometric pressure under actual flying conditions is presented. The pilot in this case experienced bends, chokes, abdominal distention, and a prickly feeling in the skin over his abdomen which disappeared upon switching the oxygen regulator to 100% oxygen. The reported disappearance of the bends upon switching the oxygen regulator to 100% oxygen is difficult to explain because the oxygen regulator he was using automatically delivers 100% oxygen beginning at 34,000 feet. The pilot either had a great psychosomatic component in his pain, or he was actually decreasing motion in his joints when passing the control of the airplane to the co-pilot before switching to 100% oxygen. (Author's discussion, modified)

11864
Steele, J. E. 1961
MOTION SICKNESS AND SPATIAL PERCEPTION: A THEORETICAL STUDY.—Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Projects no. 7210 and 7232, Tasks no. 71701 and 71789). ASD Technical Report no. 61-530, Nov. 1961. vi+23 p.

Theories of motion sickness are reviewed and compared with a new theory in which the activity of the central nervous system is more important than the intensity or modality of sensory stimulation. Concepts treated are the development and validation of an inertial reference frame, the perceptual transformation of sensory data (which reduces its content, increases its reliability and can incorporate compensations for environmental variables), and the consequences of perceptual inadequacy. (Author's abstract) (63 references)

11865
Stonehill, R. B., 1961
and P. G. Keil
SUCCESSFUL PREVENTIVE MEDICAL MEASURES AGAINST HEAT ILLNESS AT LACKLAND AIR FORCE BASE. —— Amer. Jour. Public Health, 51 (4): 586-590. April 1961.

The Preventive Medical Program initiated in 1957 and modified in 1958 incorporated techniques to develop adequate heat adaptation, including supplemental salt and water intakes, adequate clothing protection from direct sunlight, postponement of arduous activities until after the first week of training, and elimination of outdoor physical activities during the most severe heat loads. When the Wet Bulb Globe Temperature Index of Yaglou (used as an indicator of environmental heat stress) reached 88°F. or above, arduous outdoor physical activities were terminated.

11866
Taylor, W. J. R., 1960
W. H. Johnson, and E. A. Sellers
CARDIOVASCULAR CHANGES WITH VESTIBULAR STIMULATION.—Aerospace Med., 31 (8): 627-638. Aug. 1960.

Individuals susceptible to motion sickness demonstrated characteristic cardiovascular reactions in response to selected physical stimuli. The reactions differed from those in a comparable group of subjects more resistant to vestibular stimulation. One hundred randomly selected aircrew candidates, aged 17 to 27 years, were subjected to vestibular stimulation by swing or turntable while the changes in blood pressure, heart rate, and atrio-ventricular conduction time were analyzed. With vestibular stimulation by either method, both systolic and diastolic pressure rose; the heart rate initially rose and then fell. The turntable population was divided into two groups according to the degree of susceptibility to experimentally produced motion sickness. The motion-sick group showed a smaller rise in systolic blood pressure than the less susceptible group, while the diastolic pressure was more pronounced. An elevation in heart rate was initially present in the motion-sick group. Early in the period of rotation, the A-V conduction time of the susceptible group was shorter than the resting value, but became more prolonged toward the end of exposure. The findings of this study demonstrate a correlation between autonomic reactivity and susceptibility to motion sickness. (Authors' summary, modified)

11867
Unger, H. R., 1959
and L. J. Milch
THE EFFICACY OF TRILAFON IN POTENTIATING BONAMINE MOTION SICKNESS PROPHYLAXIS IN DOGS.—School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-78, June 1959. 4 p. AD 226 474

A standardized swinging procedure was utilized to induce vomiting in a group of normal mongrel dogs. The susceptible animals were randomly placed in three treatment groups—namely, placebo, Bonamine, and the combination of Bonamine with Trilafon. Adaptation to swinging motion cannot explain the significant prolongation of vomiting in Groups II and III. Likewise, no increase in susceptibility was established in the placebo group, nor in control swings of groups II and III. Prolongation of vomiting time represents an elevated threshold of vestibular stimulation along with labyrinthine-vomiting center chain. Bonamine and the combination of Bonamine with Trilafon exhibited a protective effect against swing-induced emesis. Trilafon, a potent tranquilizer, has no protective effect when used alone and in combination with Bonamine affords a degree of protection which is no greater than the effect shown by Bonamine alone. It is therefore concluded (a) that the action of Trilafon does not contribute to the protection afforded by Bonamine against swing-induced vestibular stimulation and, therefore, (b) that stimuli arising from those brain centers affected by Trilafon have not been shown to be contributing factors in the etiology of motion-induced emesis. (Authors' summary and conclusions)

11868
Unger, H. R., 1960
and W. F. Turner
RECURRENT DYSBARISM IN FLIGHT: A CASE REPORT.—Aerospace Med., 31 (12): 1010-1015. Dec. 1960.

The case of a 36-year-old senior pilot in the U.S. Air Force who experienced two separate episodes of dysbarism in flight is presented. The onset of symptoms occurred within 15 minutes on both flights at cabin altitudes of 32,000 and 31,000 feet. Severe bends, chokes, nausea, and visual symptoms occurred on the first flight. Bends of lesser intensity and chokes were observed on the second flight and also developed during a simulated flight in the low-pressure altitude chamber. Physical examinations, neurological and ophthalmological consultations and a battery of laboratory tests revealed no significant deviations from normal except for minimal obesity and a moderately elevated serum fatty acid. (Authors' summary)

11869
Valdivia, E. 1961
MOUNTAIN SICKNESS. —— Amer. Jour. Nursing, 61 (8): 77. Aug. 1961.

The symptoms of hypoxic hypoxia which may be experienced in mountain climbing are reviewed. Acclimatization by resting a few days at intermediate altitudes is recommended.

11870
Viadro, M. D., 1960
and A. S. Panfilov
[ON DECOMPRESSION DISORDERS IN FLIGHT PERSONNEL DURING FLIGHT] O dekompressionnykh rasstroistvakh u letnogo sostava v polete.—Voenno-meditsinskii zhurnal (Moskva), 1960 (1): 62-65. Jan. 1960. In Russian.
English translation in: Military Medical Journal, 1960 (1): 99-103. New York: U. S. Joint Pub. Research Serv., no. 1374-N/26, May 31, 1960. (Available from Office of Technical Services, U. S. Dept. Commerce)

Three cases of decompression sickness due to failure of the pressurized cabin during high-altitude flight are reviewed. In all three cases the first symptoms of dysbarism appeared in the right arm or shoulder. The fixation of the initial symptoms is thought to be due to heavier exertion of the right arm in the manipulation of the controls. In the first case the pilot suffered loss of vision and consciousness after descent, with general cerebral and vasodystonic sequelae. In the other two cases the patho-

logical process affected the diencephalic brain-stem area, however, without any residual symptoms. In each case the flier neglected to inform others of his condition at the appearance of the first symptoms. This indicates inadequate knowledge of the symptoms and consequences of decompression sickness among the flight crews.

11871
Whiteside, T. C. D. 1960
MOTION SICKNESS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 156, Dec. 1960. 7 p.

After a discussion of the etiology of motion sickness, it is conceded that, given sufficient stimuli, all normal individuals can become motion sick. The sickness may be of differing intensity, depending on the psychological factor and the apparent acclimatization to movement of a particular character. Clinical features of motion sickness are described, and a short literature survey of several treatments is included. In the choice of treatment, the duration of the motion should be considered, as should the duties which the individual may have to accomplish. The side effects of drowsiness, blurred vision, dizziness, and tinnitus which often accompany the use of motion-sickness drugs are incompatible with the satisfactory execution of many types of duty.

11872
Wilson, C. L., 1961
and R. H. Lang
CARDIAC ARRHYTHMIAS AND SYNCOPE DURING PRESSURE BREATHING: CASE REPORT.—Aerospace Med., 32 (11): 1026-1030. Nov. 1961.

It is vitally important for physicians and other allied medical personnel to realize that cardiac arrhythmias and syncope sometimes occur in otherwise healthy flying personnel in conjunction with positive pressure breathing and respiratory maneuvers. The individual described in this case report developed sinus arrest, syncope, and convulsions while breathing 100% oxygen with 11 mm. Hg positive pressure at a simulated altitude of 43,000 feet.

11873
Wünsche, O., 1961
and H. Hartmann
[ON THE PATHOGENESIS AND PROPHYLAXIS OF DECOMPRESSION SICKNESS OF THE HIGH ALTITUDE FLIER. IV. THE EFFECT OF CHANGES IN BLOOD VISCOSITY ON THE INTRAVASAL GAS BUBBLE FORMATION AFTER RAPID DECOMPRESSION] Zur Pathogenese und Prophylaxe der Druckfallkrankheit des Höhenfliegers. IV. Die Beeinflussung der intravasalen Gasblasenbildung nach rascher Depression durch Änderung der Blutviscosität. —Internationale Zeitschrift für angewandte Physiologie (Berlin), 18 (6): 456-459. 1961. In German.

Three groups of 15 albino rats each were pretreated with an electrolyte solution containing 0.4% $KHCO_3$, 0.2% CaI_2, and 0.2% $NHCO_3$. A fourth group received injection of 5 mg. Hygroton (1-oxo-3-(3'sulfamyl-4'-chlorphenyl)-3-hydroxyisoindolin) intravenously 48 hours before decompression. The electrolyte solution was administered orally in addition to dry food 5 days (Group I), 10 days (Group II), and 15 days (Group III) prior decompression until hyperelectrolytemia and for the fourth group an exsiccosis appeared. Decompression to 13,000-18,000 m. altitude showed significantly less intravasal gas bubble formation in the electrolyte- and Hygroton- pretreated animals as compared to controls. The responsible factors are presumed to be an increase of the osmotic pressure, blood viscosity, and exsiccosis.

c. Diseases and Injuries

11874
Ades, H. W., 1960
G. C. Tolhurst, and G. J. Harbold
FEASIBILITY STUDIES FOR HEARING CONSERVATION PROGRAM ABOARD CVA-TYPE AIRCRAFT CARRIERS.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-2005, Subtask 1). Report no. 8, Aug. 26, 1960. ii+54 p.

Studies of the feasibility of conducting a hearing conservation program aboard an operational CVA consisted in (1) systematic survey of the noise environment in critical areas using a new device for measuring the cumulative noise over six-hour periods, (2) testing of a double-walled sound-insulated room and three types of multiple and automatic individual audiometers to determine the feasibility of audiometry during various ship's operational conditions. Results show that, from all aspects, accurate audiometry can be carried out, and a hearing conservation program is feasible, given proper motivation and cooperation of all concerned. (Authors' abstract)

11875
Alzamora-Castro, V., 1961
G. Garrido-Lecca, and G. Battilana
PULMONARY EDEMA OF HIGH ALTITUDE. —Amer. Jour. Cardiol., 7 (6): 769-778. June 1961.

Acute pulmonary edema produced by exposure to altitudes of 3,000 m. or higher was observed in twenty-seven subjects with normal hearts, ranging in age from four years to fifty-three years. The disease was often observed in acclimatized subjects returning to high altitudes after short visits to places located at sea level. As a rule symptoms appeared shortly after arrival at the high elevation, either during the first trip or in one or more subsequent trips. Respiratory infections were an aggravating or precipitating factor. The recommended treatment is oxygen, or when possible, descent to lower altitudes or sea level. The mechanism responsible for high-altitude pulmonary edema is not clear, but various possible causes are discussed briefly. (20 references)

11876
Averill, K. H., 1959
R. J. Fosmoe, and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. IV. THE WOLFF-PARKINSON-WHITE SYNDROME.—In: The first international symposium on cardiology in aviation, p. 205-249. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Essentially the same published in: Amer. Jour. Cardiol., 6 (1): 108-129. July 1960.

One hundred six cases of Wolff-Parkinson-White (WPW) syndrome were found in an electro-

cardiographic survey of 67,375 supposedly healthy males (occurrence rate of 1.6 per 1000). There was an equal distribution of cases among the various age groups. The experimental production of normal excitation is discussed with particular reference to the effects of varying vagal tone at various levels of the conduction system and to the value of intravenous atropine sulfate. The vectorcardiographic characteristics are discussed and several examples are presented. The changes which may be seen in the ST segments and T waves following a routine exercise tolerance test are emphasized. The probable congenital nature of the true WPW syndrome is stressed and the usual benign clinical nature is discussed. The study casts serious doubt on the concept of an acquired WPW syndrome. (Authors' summary, in part) (89 references)

11877
Baumann, E. S., C. F. Gessert, and B. H. Senturia 1958
STUDIES OF FACTORS CONSIDERED RESPONSIBLE FOR DISEASES OF THE EXTERNAL EAR: INFLUENCE OF TEMPERATURE AND HUMIDITY ON ETHER-SOLUBLE SUBSTANCES IN EXTERNAL AUDITORY CANAL.—Washington University School of Medicine, St. Louis, Missouri; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-112. Sept. 1958. 8 p.

Measurements were made of the amounts of ether-soluble substances (ESS) in the external auditory canals of cats and rabbits kept under controlled conditions of high relative humidity and low temperature with low relative humidity. The quantity of ESS found in the ear canals of cats or rabbits did not differ significantly with differences in environmental temperature and humidity. (Authors' summary) (32 references)

11878
Bear, S. H. 1958
SINUS SYMPTOMS FROM MODERN FLIGHT.—Modern Med. 26 (20): 141-143. Oct. 15, 1958.

Aerosinusitis (or barotrauma) is produced by differences between pressure in the atmosphere and pressure inside the sinus. Predisposing factors during ascent are located basically in the sinus, ostium, or duct; during descent, the disturbance occurs in the nasal cavity or near the mouth of the duct leading into the sinus. Sharp pains over the sinus (most frequently during descent, but sometimes during ascent), nasal obstruction or pressure, blood-streaked mucus or sputum, blurred vision, lacrimation, rhinorrhea, and plugged ears are among the main symptoms. Following diagnosis through roentgenographic examination, conservative therapy consisting of vasoconstrictor sprays, prophylactic antibotics, or cocaine and ephedrine applications will alleviate most conditions. Chronic aerosinusitis will require additional surgery.

11879
Beckh, H. J. von 1961
THE INCIDENCE OF MOTION SICKNESS DURING EXPOSURES TO THE WEIGHTLESS STATE. —In: Space medical symposium. Astronautik (Stockholm), 2 (4): 217-224. 1961.

The incidence of motion sickness is approximately 30% in weightlessness experiments using fighter aircraft, where the subject is restrained. In cargo aircraft where the subject is unrestrained and able to float within the cabin, the incidence is considerably higher. Consideration is given to the fact that in all parabolic-flight experiments the subjects were exposed to accelerations of 2-3 g (even up to 6.5 g) before and after the weightless parabola. It is difficult to distinguish effects due to acceleration from those due to weightlessness per se. Vagal symptoms at the time of burnout and re-entry decrease the operator's capability to perform. However, should it be true that weightlessness per se is able to produce motion sickness, then the operator would be liable to suffer vagal symptoms of long duration, which could incapacitate him to a high degree. The applicability of the Weber-Fechner law in this respect is discussed. (Author's abstract, modified)

11880
Bertrand-Fontaine, and B. Nicolas 1959
[DIAPHRAGMATIC HERNIA IN AVIATION MEDICINE (ONE OBSERVATION)] La hernie diaphragmatique en médecine aéronautique (à propos d'une observation). —Médecine aéronautique (Paris), 14 (4): 405-410. 1959. In French, with English summary (p. 410).

A pilot complaining of spasmodic pains in the right hypochondrium during flight was found by gastric radiogram to be suffering from a diaphragmatic hernia. The patient was able to fly without incident after surgical treatment.

11881
Bierman, E. O. 1959
TRAUMA FOLLOWING EJECTION FROM JET AIRCRAFT: A CASE REPORT.—Amer. Jour. Ophthalmol., 48 (3, Part 1): 399. Sept. 1959.

A 34-yr. old male, ejected from a jet aircraft at approximately 18,000 ft. at a speed of over 600 miles per hour (0.9 the speed of sound), sustained a multiplicity of broken bones, subconjuctival hemorrhages, marked extravasation of the eyelids, and marked swelling of the face and lips. Examinations within a few hours after the accident and two months later revealed no damage to the eye itself.

11882
Caccuri, S. 1961
[OCCUPATIONAL MEDICINE] Medicina del lavoro. —xii+725 p. Napoli: V. Idelson e F°. 1961. In Italian.

This is a handbook for students and specialists in occupational medicine dealing with the disorders caused by industrial poisons, respiratory disorders caused by dust, infections and infestations, disorders caused by physical agents and work position, and the fatigue syndrome. Of special interest is the section dealing with disorders observed in aviators (p. 581-586). These are classified according to those caused by altitude (hyperventilation, tachycardia, neuropsychiatric and motor disorders, etc.), those caused by descent (cardiovascular changes, hypotension, etc.), and neuroses. Symptoms depend essentially on hypoxemia and other factors such as noise, temperature variations, vibrations, and the presence of toxic gases in the cockpit. In order to prevent these disorders, it is indispensable for the aviator to submit to special medical and psychophysical examinations, and to take adequate rest periods between long flights.

11883
Camarda, V. 1958
[ELECTRO-NYSTAGMOGRAPHIC STUDY OF MÉNIÈRE'S DISEASE BY THE METHOD OF ROTATORY DIFFERENTIATED STIMULATION] Studio elettro-nistagmografico della vertigine di Ménière con il methodo della stimolazione rotatoria differenziata.—Rivista di medicina aeronautica (Roma), 21 (2): 292-304. April-June 1958. In Italian, with English summary (p. 301).

Twelve subjects suffering from Ménière's disease underwent an electro-nystagmographic examination (E.N.G.) and a rotary differentiated stimulation test. The rotatory differentiated stimulation consisted in applying to the chair in which the patient was sitting angular accelerations from threshold values (1° per sec.^{2} or less) to greater values, in case nystagmus did not appear at threshold values. On the basis of E.N.G. recordings, the following deviations were observed: (1) absence of spontaneous nystagmus; (2) raising of the threshold to three seconds in 40% of the examined subjects, to 4°/sec.^{2} in 16%, and to 6°/sec.^{2} in only one case, equal to 8% of the subjects; and (3) greater amplitude and frequency of the nystagmic oscillations if they beat with their rapid phase towards the acoustically uninjured ear (latent directional predominance of the nystagmus). The presence in the electro-nystagmographic recordings of these deviations from the rule can be used to formulate a diagnosis of Ménière's disease without the help of further vestibular examinations. (Author's abstract, modified)

11884
Cammack, K., 1959
R. L. Rapport, J. Paul, and W. C. Baird
DECELERATION INJURIES OF THE THORACIC AORTA.—A.M.A. Arch. Surg., 79 (2): 244-251. Aug. 1959.

Eight cases of closed rupture of the thoracic aorta produced by horizontal deceleration are presented. The signs and symptoms of aortic deceleration injuries include: (1) history of deceleration; (2) shock out of proportion to obvious trauma; (3) dyspnea and chest pain; (4) hemothorax, usually left; and (5) chest X-ray indicating widened mediastinum. The forces concerned in deceleration injuries of the thoracic aorta are discussed.

11885
Caporale, R. 1961
[EAR DISORDERS CAUSED OR AGGRAVATED BY FLIGHT ACTIVITY] Affezioni dell'orecchio dipendenti o aggravate dall'attività di volo. — In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 176-207. Roma, 1961. In Italian, with English summary (p. 198).

During flight, lesions in the external ear may be caused by ear protectors or radio earphones. The middle ear is affected either by a gradual or rapid decrease of atmospheric pressure (aerotitis media, barotitis, tubal occlusion, tympanic hyperemia, vertigo, tympanic rupture), or by the pathological phenomena of recompression (barotraumatic otitis). Data are included on the incidence of these types of otopathies in flying personnel and evidence presented that in spite of the use of preventive measures (helmets, ear plugs, pressurized cabins) varying altitudes cause a high morbidity rate among fighter pilots. Regarding disorders of the inner ear, attention is drawn to vestibular and cochlear conditions which may be induced by barotrauma, and to problems relating to the course, diagnosis, and prevention of occupational deafness induced by acoustic trauma. The cochlea shows good resistance to anoxia. In severe anoxia, however, the cochlear potential notably decreases; exposure to high-intensity sound aggravates the effect of anoxia and vice versa. Mention is made of vestibular asymmetry induced by acrobatic flights in fighter pilots. (160 references)

11886
Carlson, L. D., 1960
and H. L. Thursh
COLD INJURY AND FROSTBITE: A SELECTED, ANNOTATED BIBLIOGRAPHY.—University of Washington, Seattle; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Report no. 59-20, Dec. 1960. 62 p.

This is a selected bibliography of cold injury, with detailed analyses of the individual items. (65 references)

11887
Carr, C. D., 1958
and B. H. Senturia
STUDIES OF FACTORS CONSIDERED RESPONSIBLE FOR DISEASES OF THE EXTERNAL EAR: SURVIVAL OF EXOGENOUS ORGANISMS IN THE EXTERNAL AUDITORY CANAL UNDER VARIED CONDITIONS.—Washington University School of Medicine, St. Louis, Missouri; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-111, Sept. 1958. 17 p.

The endogenous bacterial flora of the cat meatus is similar to that of the normal human ear canal. Exposure of the cat to elevated or lowered temperatures and humidities did not alter the flora nor produce any morphologic changes in the skin of the ear canal. Morphologic changes were produced in the skin of susceptible cat ears by the instillation of Pseudomonas aeruginosa under the controlled environmental conditions, and the contaminant was shown to persist in the ear for long periods, apparently independent of the concentration of bacteria instilled. Exogenous gram-negative bacilli survived for longer periods than did exogenous gram-positive bacteria. Additional factors of trauma and lipid removal did not appear to have a striking influence on the influence of survival time of instilled organisms, nor on the degree of morphologic skin changes. (Authors' abstract) (56 references)

11888
Casiello, G. 1961
[MORBIDITY QUOTIENT OF FLYING PERSONNEL IN A JET TRAINING BASE FOR THE YEARS INCLUDING 1954 TO JULY 31, 1959, AND CONSIDERATIONS ON THE VALUES OBTAINED] Quoziente di morbilità del personale aeronavigante in una base addestramento aviogetti per gli anni compresi dal 1954 al 31 luglio 1959 e considerazioni ricavati.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 308-311. Roma, 1961. In Italian.

A statistical morbidity study made on flying personnel at a jet training base between 1954 and June 31, 1959, is presented in two tables. Table I deals with the work days lost due to flight disorders and lists,

according to year, the average number of pilots on the airbase, the barotraumatic diseases, states of flight fatigue, total days lost, morbidity quotient, and flight hours per year. Table II analyzes the work days lost due to disorders of varied etiology (respiratory, gastrointestinal, traumatic factors, etc.) according to year, number of pilots on the base, various disorders, morbidity quotient, and total flight hours.

11889
Clark, C. C., 1960
and J. D. Hardy
GRAVITY PROBLEMS IN MANNED SPACE STATIONS.—Aero Space Eng., 19 (5): 36-39. May 1960.
Also issued as report: Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task no. MR005.15-0005.6, Report no. 8). Report no. NADC-MA-6033, March 29, 1961. iii+30 p.

A brief discussion is presented of the problems of weightlessness and of the problems of artificial gravity (as produced by rotation) in a manned space station, with emphasis on the following points: (1) Restraint systems both for man and for movable objects will have to be developed for use at zero g. (2) In a rotating space station, velocities of linear or angular motions of the head may have to be kept at low magnitude by using restraints and possibly eye prism devices, mirror walls, etc., to reduce the need for head motions in order to avoid disorienting illusions and nausea. (3) Normal growth of the embryo and the young, and the normal repair of adult tissues such as bone and muscle which are affected in cellular patterns by force distribution, may require artificial gravity. (4) It may be necessary to develop exercises and other procedures prior to changes of acceleration level to restore or develop tolerance to the new level in spite of acclimatization to the old level. A tabulated summary of animal and human ascents above 100,000 ft. since 1948 is also included.

11890
Cox, G. E., 1961
L. G. Nelson, C. B. Taylor, and C. B. Davis
ALTERATION OF HEALING RESPONSES IN EXPERIMENTAL WOUNDS IN ARTERIES AND OTHER TISSUES BY HYPERCHOLESTEROLEMIA.—Aerospace Med., 32 (1): 25-29. Jan. 1961.

The effects of hypercholesterolemia on the healing of necrotic areas of the aorta, skeletal muscle, liver, spleen, and kidney were studied on rabbits, with these results: When the serum cholesterol is below 250 mg. per 100 cc., the interstitial lipoproteins do not accumulate at sites of arterial injury and repair. When levels exceed 250 mg. per 100 cc., lipids accumulate in scars at sites of arterial injury. When the serum cholesterol is about 1100 mg. per 100 cc., lipids accumulate as xanthomatous lesions in experimental wounds of the liver, spleen, kidney, muscle, and skin. In hypercholesterolemic animals, lipid accumulation at sites of injury adversely affects healing of wounds. (Authors' summary, modified)

11891
De Cilla, F., 1959
and P. Italiano
[TRAUMATIC VERTEBRAL LESIONS CAUSED BY FLIGHT INCIDENTS]. Lesioni traumatiche vertebrali da incidenti di volo.—Revista di medicina aeronautica e spaziale (Roma), 22 (1): 169-179. Jan.-Mar. 1959. In Italian.

Reported cases of dorsal and lumbar vertebral fractures occurring in pilots during landing and take-off are reviewed. These lesions occur frequently and are usually non-symptomatic. The author concludes that it is the flight surgeon's responsibility to conduct systematic radiological examinations of the spine in persons who have experienced sudden flight incidents.

11892
DeLalla, O., 1958
and J. W. Gofman
RELATIONSHIP OF TRAUMATIC INJURY TO SERUM LIPOPROTEINS AND TOTAL-SERUM CHOLESTEROL.—University of California, Berkeley; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-110, Aug. 1958. 7 p.

An investigation was made of the effect of traumatic injury in the form of major fracture on serum lipoprotein and cholesterol levels in humans, both for short- and long-term post-injury periods (from less than 14 weeks to 28 years between fracture and sampling). Significant effects on low-density lipoproteins were observed, but only for the period up to 6 months after injury. No significant long-term effects on low-density lipoproteins or serum cholesterol were found. The results indicate that human atherosclerosis is not expected to be appreciably influenced by trauma in the form of fracture. (Authors' summary)

11893
Dermksian, G., 1959
and L. E. Lamb
SPONTANEOUS PNEUMOTHORAX IN APPARENTLY HEALTHY FLYING PERSONNEL.—Ann. Internal Med., 51 (1): 39-51. July 1959.

An analysis is made of 38 episodes of spontaneous pneumothorax occurring in 25 apparently healthy flying personnel. The cases were studied extensively with routine and specialized techniques, including pulmonary function studies and chest roentgenograms in the altitude chamber. In three cases, spontaneous pneumothorax occurred in flight and was disabling because of the pain and dyspnea resulting from the altered ventilatory function of the lung and the existing problem of hypoxia at altitude. The possible causes of spontaneous pneumothorax are reviewed and the following entities are considered: (1) pleural adhesions, (2) congenital pulmonary cysts, (3) scar tissue vesicles, and (4) emphysematous valve vesicles. These entities are usually bilateral. The incidence and recurrence rates in the literature are reviewed. Diagnostic techniques, operative procedures and evaluation studies are discussed from the standpoint of flight duty. Although spontaneous pneumothorax is usually considered lightly when it occurs at ground level, its occurrence in aviation may result in the abortion of a mission, a serious accident, or a major disaster. (Authors' summary and conclusions, modified)

11894
Dersh, J. 1961
DETECTION OF GLAUCOMA IN UNITED STATES AIR FORCE PERSONNEL. — Postgraduate Med., 30 (4): 326-329. Oct. 1961.

Using tonometry as a part of the annual examination of 1000 United States Air Force personnel, previously unrecognized early or borderline glaucoma was detected in 1% of the patients from the age of 35 to 64. 1.2% of the patients were sus-

pected of having glaucoma and were to be retested every 6 months. It is urged that tonometry be adopted as a standard part of the annual examination of all personnel in the United States Air Force as well as the other branches of the armed forces.

11895
Diamond, S. 1961
EARLY DETECTION OF GLAUCOMA IN AGING AIRCREW PERSONNEL.—Aerospace Med., 32 (8): 741-745. Aug. 1961.

Three cases of glaucoma in pilots over 40 years of age are presented in order to illustrate the greater vigilance which must be exercised in detecting the disease. Incipient glaucoma, if detected, can be well controlled long before visual damage occurs, and visual deterioration may be indefinitely postponed. Early warning symptoms and signs include ocular pain, headache, rainbow haloes, subnormal accommodation reflected by premature presbyopic symptoms or measurements, prolonged dark adaptation or disturbed night vision, extremely shallow anterior chamber, suspicious disc cupping or exaggerated physiological cupping, fine retinal arterial pulsation, and borderline or pathologic elevation of intraocular tension revealed by tonometry. Routine tonometry over age 40 on periodic examination may provide the ultimate answer. In the meantime, the slightest questionable symptom, sign, or positive family history should lead to tonometry, or referral for tensions and ophthalmolocial evaluation. (Author's summary, modified)

11896
Ducros, E., 1958
and J. Tosan
[PULMONARY TUBERCULOSIS IN AIR FORCE FLYING PERSONNEL] Tuberculose pulmonaire dans le personnel navigant de l'armée de l'air.—Médecine aéronautique (Paris), 13 (3): 249-263. 1958. In French, with English summary (p. 261-262).

While numerous publications have appeared on the effect of flying on pulmonary tuberculosis, very few articles are devoted to the incidence of this disease among the flying air force personnel. These persons are subject to very strict medical examinations and constitute an elite from the viewpoint of physique. We therefore must expect that tuberculosis is very rare among these selected people. Since the medical archives of the air force were at the disposal of the authors, a statistical study was made on the incidence of tuberculosis among flying personnel and the influence of flying hours upon the disease covering the period from January 1942 until December 1956. This interval of 15 years allows a long-range observation of afflicted persons. The available data were analyzed by statistical methods. For each group of flying activity the number of cases are given with radiological observations, age, and number of flight hours. It is shown that tuberculosis is rare among flying personnel and that pilots are less affected than other flying specialists. However, the number of pulmonary cavities was found higher among pilots. No correlation was found between the onset or the relapse of the disease and the number of flight hours. Twelve cases of relapse indicate the necessity of a long period of medical supervision following scar formation after the first attack.

11897
Egorov, V. A., 1961
and V. E. Potkin
[ETIOLOGY OF NEUROMYOSITIS AND LUMBOSACRAL RADICULITIS IN FLIGHT AND MAINTENANCE PERSONNEL OF HELICOPTER AIRCRAFT] Etiologiia neiromiozita i poiasnichno-kresttsovogo radikulita u letnogo i tekhnicheskogo sostava vertoletnoi aviatsii [Abstract]. — Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 84. Feb. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (2): 137-138. Washington: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

A study of the etiology, clinical aspects, and pathology of neuromyositis and lumbosacral radiculitis in helicopter personnel and maintenance workers indicated overcooling of the lumbar region due to certain dressing and working habits as the causal agent. The local application of ethyl chloride gave relief from pain faster than other treatments. Re-education and supervision on the part of the medical and administrative personnel is required to ascertain that the clothing worn by flight and maintenance personnel conforms with existing meteorological conditions.

11898
Freitag, W. 1958
[ON AERODONTALGIA AND OTHER AERODONTOPATHIES] Über die Aerodontalgie und andere Aerodontopathien.—Deutsche Versuchsanstalt für Luftfahrt, Report no. 61, April 1958. 47 p.

A sound tooth system is not injured in any way by a change of surrounding conditions (such as temperature, atmospheric pressure, radiation, lack of oxygen, and acceleration) which develop when flying. However, if the tooth system is not sound, some of the above mentioned stresses can cause pain and further morbid change. A report is given on experimental and clinical tests of these problems which is based on personal studies and a literature search.

11899
Garrido-Klinge, G., 1960
and L. Pena
[GASTRODUODENAL ULCER AT HIGH ALTITUDES (PERUVIAN ANDES)] La úlcera gastroduodenal en las grandes alturas (Andes Peruanos). — Anales de la Facultad de medicina, Universidad nacional mayor de San Marcos de Lima (Peru), 43 (2): 419-436. 1960. In Spanish.

A study of 71 cases of gastroduodenal ulcer occurring in a group of 17,500 native and resident workers in the Peruvian Andes (3,000 to 5,000 meters altitude) revealed an incidence of 0.4%, especially in persons between 21 and 30 years of age. Sixty-six per cent of the cases presented hemorrhage. There appears to exist in the Andean native a great predisposition towards gastroduodenal ulcer. At high altitude the vascular and blood factor plays a major role in the etiology and pathogenesis of gastric ulcer. A review of the literature dealing with gastroduodenal ulcer in general and at high altitude is included. (63 references)

11900
Gudbrandsen, C. O. 1961
THE EFFECT OF PHYSICAL EXERCISE ON CHOLESTEROL-INDUCED ATHEROSCLEROSIS IN RABBITS.—Univ. of Wash. School of Medicine, Seattle; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Report no. 60-2, Feb. 1961. v+85 p.

Two groups of ten 3-month-old, male, New Zealand white rabbits were fed an atherogenic diet, ad libitum. This diet contained 0.5% cholesterol and 5% fat (by weight) during the first 63 days for Group I and the first 31 days for Group II; during the last 40 days the diet contained 0.25% cholesterol and 3.5% fat. Exercise, given up to 2 hours per day in a motor-driven drum, was started simultaneously with the diet for four of the animals of Group II; it was started for four of the animals in Group I after 34 days on the atherogenic diet. The effective exercise given was estimated as being only about one-half that given the animals in the previous year's experiment. The ad libitum diet results in a much higher intake by the controls than by the exercised animals, with respect to cholesterol, fat, and total number of calories. The controls gained an average of 500 to 700 g more than the experimental rabbits. The amount of exercise was considered inadequate in relation to the cholesterol and fat consumed; no significant difference was observed between the exercised and sedentary animal with regard to the blood cholesterol levels, appearance of the serum, grossly visible aortic atherosclerosis, or microscopic quantitative evaluation. (Author's summary)

11901
Halm, T. 1959
[THE PATHOGENESIS OF AERODONTALGIA (ODONTALGIA EVOKED BY CHANGES IN THE ATMOSPHERIC PRESSURE)] Az aerodontalgia (légnyomásváltozás okozta fogfájdalom) pathomechanizmusa.—Honvédorvos (Budapest), 11 (1): 58-63. Jan.-March 1959. In Hungarian.

The pathological mechanisms responsible for aerodontalgias cannot be conclusively identified as yet. Experimental investigations implicate changes in gas volume as the basic causal factor. (From the author's summary)

11902
Harris, J. D. 1961
SALIENT POINTS IN A BROAD HEARING CONSERVATION PROGRAM.—Naval Medical Research Lab., Groton, Conn. (Project no. MR005.14-1001-2.09). Memorandum Report no. 61-11, Dec. 18, 1961. 8 p.

There must be centralized responsibility for implementation of any adequate hearing conservation program vested in top level medical personnel, who must: (1) evaluate the environment, and set damage risk criteria; (2) supervise auditory examination and disposition of the case load; (3) be responsible for fitting and distribution of ear plugs, muffs, and other protective devices; (4) oversee supplying and maintaining audiometric equipment and supplying trained audiometrists; and (5) conduct an educational program for all personnel concerned as to the medical need for complying with the provisions of the program. (Author's summary)

11903
Hassan, W. E. 1961
PULMONARY COLLAPSE OCCURRING AMONG FIGHTER AIRCREW.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 289-293. Roma, 1961.

Transient pulmonary collapse occurs in a high proportion of day fighter pilots and in a smaller proportion of all-weather fighter crew members when using undiluted oxygen during flight. The different incidence in two types of aircraft (Hunter and Javelin) showed that the condition is not totally caused by 100% oxygen. Evidence that positive g loadings play an important part in causation is provided by the unanimous opinion of affected aircrews, the different incidence between Hunter and Javelin pilots and crew, and the somewhat similar symptoms reported by subjects who rode the human centrifuge. The anti-g suit has been blamed, but one subject showed pulmonary collapse after a flight in which no anti-g suit was worn. Restriction of respiratory movements by posture, personal flying equipment, harness and straps, may be significant. An attempt to prevent occurrence of the condition by intermittent deep breathing throughout flight failed as the crews were too busy to remember the deep breathing. No correlation was found with body size, build, age, or smoking. The duration of the condition is short and X-rays must be taken as soon as possible after flight. Little evidence was found of permanent injury, although the condition provides an additional reason for the temporary grounding of aircrew with respiratory infections.

11904
Hiss, R. G., 1959
K. H. Averill, and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. III. VENTRICULAR RHYTHMS.—In: The first international symposium on cardiology in aviation, p. 183-203. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Essentially the same published in: Amer. Jour. Cardiology, 6 (1): 96-107. July 1960.

In this study of 67,375 supposedly healthy males, all known forms of ventricular rhythm were detected except ventricular flutter and fibrillation. Four hundred nineteen cases (0.6%) of premature ventricular contractions were noted. There was a twofold increase in the rate per 1000 of individuals with premature ventricular contractions in the 40-44 age group as compared to the younger age groups, and a threefold increase above 45 years of age. There were 18 cases of ventricular parasystole (0.03%) and one case of ventricular tachycardia. Four cases of idioventricular rhythm with AV dissociation are discussed; three were detected by the survey and one was known previously.

11905
Hiss, R. G., 1959
K. H. Averill, and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. VIII. NONSPECIFIC T WAVE CHANGES.—In: The first international symposium on cardiology in aviation, p. 329-346. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiology, 6 (1): 178-189. July 1960.

An analysis of 67,375 apparently healthy males revealed 581 individuals with nonspecific T wave changes on their routine electrocardiogram. Com-

plete clinical evaluation of 226 cases failed to reveal any increase or family history of heart disease over what might be expected from males of the same population with normal electrocardiograms. Comparison of the nonspecific T wave group with a series of 6000 normal electrocardiograms (1000 from each 5-year age group of the adult population) revealed that the body weights and heart rates of the abnormal group were slightly higher than in the normal value series, and the percentage of overweight individuals in each age group was markedly larger. There was an increase in the incidence of nonspecific T wave changes in the older age groups. (Authors' summary, in part)

11906
Houston, C. S. 1960
ACUTE PULMONARY EDEMA OF HIGH ALTITUDE.—New England Jour. Med., 263 (10): 478-480. Sept. 8, 1960.

A report is presented of a case of acute pulmonary edema observed in a healthy young mountain climber with a normal heart. Symptoms observed after hospital admission included moderate cyanosis, slightly elevated temperature, doubtful electrocardiographic irregularities, dyspnea, and lung rales. The patient was symptomfree 36 hours after admission. The condition is attributed to the combined stresses of cold, exertion, and anoxia (12,000 feet altitude). Several other cases suggestive of high altitude pulmonary edema are briefly reported.

11907
Hultgren, H. N., 1961
W. B. Spickard, K. Hellriegel, and C. S. Houston
HIGH ALTITUDE PULMONARY EDEMA. —— Medicine, 40 (3): 289-313. Sept. 1961.

Eighteen patients with acute pulmonary edema following exposure to an altitude of 12,200 feet to 15,300 feet were observed at the Chulec General Hospital in La Oroya, Peru, from 1950 to 1959. The symptoms consisted of cough, hemoptysis, dyspnea, and weakness. Physical examination revealed tachycardia, cyanosis, and pulmonary rales. Bed rest and oxygen administration resulted in complete clinical recovery and clearing of the pulmonary exudate in 24 to 48 hours. Fifteen of the 18 patients had been thoroughly acclimatized and developed pulmonary edema upon returning to the mountains after a one- to three-week stay at sea level. Although the most likely cause of the edema is acute left ventricular failure, x-ray studies revealed no evidence of left ventricular or left atrial enlargement. Pulmonary venous constriction, a shift of blood volume to the lungs, and a residual elevation of plasma volume from prior acclimatization are additional causative factors requiring investigation. Thirteen episodes of a similar syndrome occurring in mountaineers are described. Although such episodes have been previously considered to be instances of pneumonia, their similarity to the cases observed in Peru suggests that they also represent instances of high-altitude pulmonary edema. (From the authors' summary and conclusions) (37 references)

11908
Ivankov, E. I., 1961
N. A. Lysakov, and V. V. Smirnov
[HEALTH CAUSES OF DROPPING STUDENTS FROM FLIGHT SCHOOLS] O prichinakh otchisleniia kursantov letnykh voenno-uchebnykh zavedenii po sostoianiiu zdorova. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (3): 57-60. March 1961. In Russian.

English translation in: Military Medical Journal, 1961 (3): 87-91. Washington: U. S. Joint Pub. Research Serv., no. 9572 (1374-N/40), June 29, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Medical reasons for dropping students from flight schools were analyzed for the years from 1953 to 1959. In this group 20.6% of students were dropped for diseases not detected at the time of admission. Of these, the greatest number, 51.88%, were dropped for diseases of internal organs; 19.24%, because of central nervous system disorders; and 12.49%, because of oto-rhino-laryngological disorders. In the group dropped for diseases of internal organs, neurocirculatory asthenia accounted for 18.42% of the total attrition rate; mental and emotional stresses, respiratory infections, and premature discharge from hospitals were thought to be precipitating factors. The largest portion of central nervous system disorders were functional in nature. Refractive errors accounted for 7.18% of students dropped. Failure to detect disease at the time of admission is attributed to concealment of symptoms by the candidates and overlooking of symptoms by members of the flight medical board.

11909
Izakson, K. A., 1961
and E. IA. Drui
[EXPERIENCE FROM NEUROPSYCHIATRIC EXAMINATIONS OF FLIGHT PERSONNEL] Opyt psikhonevrologicheskogo izucheniia letnogo sostava [Abstract]. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 136-137. Feb. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (2): 136-137. Washington: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

Five years of work in the early detection and prophylaxis of neuroses in flight personnel are summarized. Most cases involved individuals between 25 and 35 years of age, with 5-15 years of flight service. In 1956, neurotic symptoms were discovered in 7.2% of flight personnel. The symptoms consisted of asthenic and hypersthenic signs. A labile pulse was frequently encountered in the orthostatic test. A periodic elevation of the systolic blood pressure to 140-150 mm. Hg was seen in 28% of the individuals with symptoms of asthenia, and autonomic and emotional instability. Lack of rest, inadequate sleep, unsatisfactory housing, excessive flight loads, and inefficient organization of the flight day were implicated as causal factors. Prophylactic measures consisted of treatment in psychiatric clinics and rest homes, and administrative adjustment of living and housing conditions, flight routine, and recreation.

11910
Jenson, R. L. 1961
DIABETES IN FLYING PERSONNEL.—Aerospace Med., 32 (12): 1127-1134. Dec. 1961.

The importance of early diagnosis of diabetes mellitus in flying personnel is presented. Over 50%

of mild diabetic patients can be diagnosed by a glucose tolerance test. A classification of the essential features of abnormal glucose tolerance tests and diagnostic criteria is presented. (Author's summary, modified)

11911
Jeż, J. 1960
[CAUSES AND MECHANISM OF INJURIES DURING PARACHUTE JUMPING] Przyczyny i mechanism urazów w czasie skoków ze spadochronem. — Lekarz wojskowy (Warszawa), 36 (10): 992-999. 1960. In Polish, with French summary (p. 999).

A statistical analysis is presented of the causes and mechanisms of injuries observed in 15,000 parachute jumps. The percentage of lesions was very small in comparison to those cited in other publications — not more than 0.4%. The number of injuries during unscheduled jumps was ten times greater than during scheduled jumps. Injuries were sustained around the ankle and knee and occurred during landing (70%). The right leg was injured more often than the left. Frequency and severity of the lesions increased with age. Adequate training of a parachutist plays a major role in the reduction of injuries. (Author's summary, modified)

11912
Johnson, R. L., 1959
K. H. Averill, and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. VI. RIGHT BUNDLE BRANCH BLOCK.—In: The first international symposium on cardiology in aviation, p. 271-288. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Essentially the same published in: Amer. Jour. Cardiol., 6 (1): 143-152. July 1960.

Complete right bundle branch block was noted in 106 individuals in a survey of 67,375 apparently healthy males. The rate per 1000 below the age of 40 was 1.5 contrasted to a rate of 2.9 per 1000 past the age of 40. Complete right bundle branch block could not be correlated with an increase in clinical factors thought to be associated with an increased incidence of coronary artery disease. The body weight, blood cholesterol, phospholipid levels, and blood pressure were similar in the normal group as compared to the individuals with complete right bundle branch block. The initial 0.08 QRS vector was more often normally oriented even in the presence of complete right bundle branch block suggesting that the initial events of ventricular excitation are relatively unaltered in the presence of uncomplicated right bundle branch block. In contradistinction to left bundle branch block, right bundle branch block is frequently seen in apparently healthy individuals and unless other evidence of heart disease is present or the individual is in the older age group with a previously normal electrocardiogram it whould not be accepted as diagnostic evidence of significant underlying heart disease. (Authors' summary, in part)

11913
Johnson, R. L., 1959
K. H. Averill, and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. VII. A-V BLOCK. —In: The first international symposium on cardiology in aviation, p. 289-328. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiol., 6 (1): 153-177. July 1960.

Observations from the electrocardiographic data of 350 cases of first degree A-V block, and from clinical studies of 139 individuals from this group are presented. First degree A-V block, in a survey of 67,375 males, occurred at a rate of 5.2 per 1000. A-V conduction time was greater than 0.24 second in 20% of this group, indicating that a precise values which separates the normal from the abnormal does not exist. Although the significance of the prolonged PR interval can be determined only by individual clinical evaluation, there is no doubt that the PR interval can be markedly prolonged in some individuals who are otherwise normal. In the present series, only 5 of 139 were found to have evidence of organic disease. The effect of atropine, standing, and exercise on the A-V conduction time was compared. In nearly all the PR interval could be reduced to normal by one or more of these procedures. Instability of the A-V conduction mechanism was often demonstrable, particularly in those with the longest PR intervals. Observations of one case of second degree A-V block, apparently due to myocarditis, and one case of complete A-V block, presumably congenital, are included. (Authors' summary, in part) (43 references)

11914
Koch, C. 1961
[VESTIBULAR LIABILITY AS A CAUSE OF UNFITNESS FOR FLYING] La labilità vestibolare come causa di inabilità al pilotaggio.—Atti delle giornate mediche delle forze armate (Torino, 6-7 giugno 1961), p. 380-381. Torino: Minerva Medica, Dec. 23, 1961. In Italian.

Vestibular examination of 414 pilot candidates showed an incidence of 14.4% of labyrinthine disease, 1.9% having organic labyrinthine disease and 12.5% functional disorders—predominantly neurovegetative dystonia. These findings were instrumental in disqualifying the candidates from flying. Prolonged labyrinthine stimulation causing fatigue of the diencephalic vegetative centers is responsible for the so-called vestibular vegetative syndrome which manifests itself by nausea, vomiting, general illness, etc. The real cause of vestibular lability in most subjects may possibly arise from a homeostatic deficiency of the sympathetic and parasympathetic systems and appear in most cases as general hyperreflexia and less frequently as vestibular hyperreflexia. The three fundamental elements of the vestibular vegetative syndrome are: (1) initial vegetative tonus of the subject; (2) sensitivity of the vestibular apparatus; and (3) intensity of vestibular stimulation.

11915
Koch, C. 1961
[STATISTICAL COMPARISON AND CORRELATIONS BETWEEN OTORHINOLARYNGOLOGICAL DISEASES AND OTHER DISEASES IN THE SELECTION OF CANDIDATES FOR THE AERONAUTICAL ACADEMY] Raffronto statistico e correlazioni tra infermità otorinolaringojatriche ed altre affezioni nella selezione dei candidati all'Academia Aeronautica.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 100-111. Roma, 1961. In Italian.

A statistical study of 414 pilot candidates is presented, dealing with the incidence of otorhinolaryn-

gological diseases and their relations to diseases of other organs and systems. Fifty-three percent of the candidates were not admitted to flight training due to dysfunction of various organs and systems. Tabulations and discussion are included on the following: the incidence of tonsil diseases and their complications (heart, kidneys, heart and kidneys); the relation between tonsil and appendix diseases; incidence of nasal diseases and imperfections; incidence of middle ear diseases; incidence of ear disease with functional damage (hearing disorders); and the incidence of labyrinthine diseases and their neurological relations.

11916
Koldovski, O., 1961
P. Novak, and F. Vorel
[THE DEVELOPMENT OF ATHEROSCLEROSIS IN JET AIRCRAFT PILOTS] O razvitii ateroskleroza u pilotov reaktivnykh samoletov. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (10): 70-72. 1961. In Russian.

The total cholesterol level was investigated in 138 jet aircraft pilots (average age, 29 years) and 142 men of the same average age in other occupations. There were no clinical or electrocardiographic abnormalities in either group. In addition, the qualitative and quantitative composition of food consumed by both groups daily was determined and periodically analyzed. The total blood cholesterol level was higher in jet pilots (237.4 mg./100 cc.) than in the control group (206.4 mg./100 cc.). These values agree with the findings of more pronounced atherosclerotic changes revealed by autopsies of pilots who died of various causes as compared with control autopsies of young men of the same age who had died of similar causes. Atherosclerosis was shown to progress with increasing age, particularly in jet pilots. On the average the degree of atherosclerosis in jet pilots is comparable to that in men fifteen years older, i.e., approximately 50 years old. Previous findings on cholesterolemia in helicopter pilots exclude aviation stress as the main responsible factor for early atherosclerosis in jet pilots. The excessive calorie count in the diet of the pilots (40% higher than energy expenditures; 40% from animal fats) which, however, did not lead to pronounced obesity, requires further investigation.

11917
Koldovsky, O., 1960
and P. Novak
TOTAL SERUM CHOLESTEROL LEVEL IN FLYING PERSONNEL.——Rivista di medicina aeronautica e spaziale (Roma), 23 (2): 203-211. April-June 1960. In English.

The total serum cholesterol level was determined in flying personnel of transport aircraft and in mechanics and administrative workers (controls). Both groups were between 23 and 24 years of age. The average total serum cholesterol level in flying personnel was 247.4 mg., and in the controls 199.3 mg. A discussion is included on the relation between the high serum cholesterol level in flying personnel and (1) obesity, (2) high food consumption (5000 calories per day, 40% approximately animal fat), and (3) the high incidence of atherosclerosis. (31 references)

11918
Kopra, L. L., 1959
D. T. Pedrini, and R. W. Fullington
RELATIVE HEARING LEVELS AND TYPES OF HEARING LOSS AMONG FOUR SELECTED GROUPS OF AIR FORCE PERSONNEL.——Univ. of Texas, Austin; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-51, April 1959. 11 p.

Pure-tone air-conduction and bone-conduction audiometric tests were administered to 125 Air Force personnel. One group consisted of 25 non-noise-exposed men. The other three groups were noise-exposed individuals: 25 Class A, 50 Class B (re AFR 160-3, 1956), and 25 Class C (500-2000 c.p.s. average of more than 15 db.). Relative hearing levels of right and left ears within and between groups are presented. Results showed: good agreement between median and mean thresholds at almost all test frequencies; no significant differences between right and left ears within groups; that the non-noise-exposed and Class A median and mean thresholds were within a few decibels of the American Standard reference normal; that the Class B group deviated from the Class A groups only at 3000, 4000, and 6000 c.p.s. that, with the exception of Class B at 4000 and 6000 c.p.s. the Class C group was significantly different from the other groups at all test frequencies; that approximately 13% of Class B and Class C groups had either conductive or mixed-type hearing loss, the remaining 87% being perceptive-type hearing loss; that 35 out of 75 individuals in Class B and Class C groups expressed a preference for an ear and of these 35 individuals, 25 chose the better ear correctly. (Authors' abstract)

11919
Kos, C. M. 1961
CLINICAL OTOSCLEROSIS: MANAGEMENT IN PILOTS.——Aerospace Med., 32 (1): 35-41. Jan. 1961.

Otosclerosis, a peculiar osteochondrodystrophy which has a predilection for the circumferences of the oval window and footplate of the stapes, is a common cause of hearing impairment in young adults. Its insidiously progressive nature eludes detection during its early stages unless hearing is periodically monitored by audiometry. The mechanical portion of the hearing impairment may be corrected in most cases by microsurgical techniques. Whether rehabilitation by such methods alters or hinders the individual's ability to meet all requirements for flying duty is unknown. Stapes-substitution procedures, which require the removal of the entire otosclerotic stapes and replacement with an elastic tissue connected to the incus by an artificial strut of polyethylene tube, steel, or tantalum wire, are currently superior to results obtained with Fenestration or Mobilization techniques. (Author's summary)

11920
Kraus, R. N. 1961
EARLY DIAGNOSIS OF HYDROPS OF THE LABYRINTH. —— School of Aviation Medicine, Aerospace Medical Center, Brooks Air Force Base, Tex. Review no. 1-61, Feb. 1961. 23 p.

The symptom complex manifested by vertigo, tinnitus, and deafness (Ménière's disease or hydrops of the labyrinth) is briefly reviewed, and its differentiation from other forms of hearing defects demonstrated. Thirteen representative cases which occurred in flying personnel are reported. Defec-

tive hearing was frequently observed before vertigo occurred. The importance of early diagnosis of Ménière's disease in aviation medicine is emphasized.

11921
Kraus, R. N. 1959
AN EVALUATION OF PATIENTS SUSPECTED OF HAVING NOISE-INDUCED HEARING LOSS.—School of Aviation Medicine, Randolph Air Force Base, Tex. Aeromedical Review no. 4-59, June 1959. 16 p.

Seventy-seven individuals referred to the Diagnostic Hearing Center of the School of Aviation Medicine were tested for pure-tone threshold air conduction and bone conduction audiograms. Of these, 29 had a conductive-type defect, 7 had a functional-type defect, and 41 had a perceptive-type defect. In only 19 instances was noise exposure considered to be a possible cause of defective hearing. It is suspected that poor hearing probably was present for many years in those individuals who affirmed that they were unaware of hearing loss. The audiometric curves obtained on many of the individuals were not of the type usually found in noise-induced hearing loss. The greatest difficulty encountered in evaluating the results was the lack of a reference audiogram.

11922
Kraus, R. N. 1960
PROGRESS IN STAPES MOBILIZATION SURGERY: AVIATION MEDICINE IMPLICATIONS.—School of Aviation Medicine, Brooks Air Force Base, Tex. Review no. 4-60, Sept. 1960. 13 p.

Otosclerosis is the most common cause of progressive hearing loss of a conductive type in adults. Stapes mobilization effected by the direct method was revived in 1953. Recent procedures involve fenestration of the footplate, the use of a vein graft, and reconstruction of the stapes with tantalum or stainless steel wire or a polyethylene prosthesis. Fenestration of the horizontal semicircular canal is ordinarily considered permanently disqualifying for flying duties and a waiver can be granted only by the Surgeon General, U. S. Air Force. An Air Force policy has not been formulated with regard to fenestration of the footplate of the stapes. Aviation medicine principles should be considered in the choice of a surgical procedure for otosclerosis performed on an aircrew member. Mobilization of the stapes achieved conservatively by manipulation of the head of the stapes or occasionally by chisels is recommended and has been demonstrated not to have adversely affected the performance of flying duties by aircrewmen. Until it has been definitely determined that the middle ear can tolerate fenestration or removal of the footplate, addition of grafts and prostheses, without compromising the integrity of the inner ear while being subjected to the inevitable, repeated bouts of severe atmospheric pressure changes encountered in military aircraft, it would seem wise to refrain from using these procedures on flying personnel. (Author's summary) (27 references)

11923
Kraus, R. N. 1958
SINUS BAROTRAUMA—TREATMENT.—School of Aviation Medicine, Randolph Air Force Base, Texas. Review no. 1-59, Oct. 1958. 11 p.
Also published as: TREATMENT OF SINUS BAROTRAUMA.—Ann. Otol. Rhinol. and Laryngol., 68 (1): 80-89. March 1959.

A regimen is presented for the treatment of chronic or acute inflammation of nasal sinuses, produced by barometric pressure differential between the air or gas inside the sinus and that of the ambient atmosphere. The condition may occur in flight during descent. The treatment includes nasal shrinkage by application of a vasoconstrictor, utilization of the Proetz displacement procedure, infraction of the middle turbinate, instrumentation (cannulation or puncture) of the sinus, administration of a systemic vasoconstrictor, systemic administration of antibiotics (and antihistaminics, when indicated), and return of patient to higher altitude or decompression in an altitude chamber, followed by slow descent in each instance. Case histories are cited as examples of sinus barotrauma caused by a retention cyst in the maxillary sinus and by an osteoma in the frontal sinus. The physiology and pathology of the inflammation are reviewed.

11924
Kraus, R. N., 1961
L. L. Elliott, and E. W. Moore
STAPES MOBILIZATION: EXPERIENCE IN THE UNITED STATES AIR FORCE.—School of Aerospace Medicine, Brooks Air Force Base, Tex. Report no. 61-88, July 1961. 11 p.

This paper reviews results of 151 stapes mobilization operations on 94 patients. For patients on whom follow-up data were available, improvement in hearing seemed to be well maintained for a 6-month period. Although it was noted that operations performed on both ears of a patient tended to have similar results, the tendency was not statistically significant. Finally, there was considerable evidence that successful operations were proportionately higher in patients requiring surgery on only one ear. A further study is being conducted to obtain additional follow-up information for the entire sample. (Authors' summary)

11925
Lamb, L. E., 1958
and K. D. Kable
ACUTE MYOCARDIAL INFARCTION IN A TWENTY-ONE-YEAR-OLD AVIATION CADET.—Jour. Aviation Med., 29 (4): 263-270. April 1958.

A case is reported of acute myocardial infarction occurring in an aviation cadet less than 21 years old. Difficulties in diagnosing the condition in young men despite the presence of classic symptoms are discussed.

11926
Lamb, L. E., 1959
K. D. Kable, and K. H. Averill
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. V. LEFT BUNDLE BRANCH BLOCK.—In: The first international symposium on cardiology in aviation, p. 251-270. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Essentially the same published in: Amer. Jour. Cardiol., 6 (1): 130-142. July 1960.

As a result of routine electrocardiograms taken on 67,375 apparently healthy males, 13 examples of complete left bundle branch block were found. The majority of the 13 individuals had a significant past history that suggested an acquired defect of the heart. This study points up the fact that complete left bundle branch block in a healthy population is a

rare finding (1 in 5000). For this reason, brief case summaries are included. The vectorcardiographic and electrocardiographic characteristics are described and examples are cited. The study presents evidence that left bundle branch block is the result of cardiac pathology and is significant evidence of cardiac disease. In certain instances the cardiac involvement may be minimal, creating no major adverse effects as may be seen following myocarditis. This report includes examples that likely belong to this group. (Authors' summary)

11927
Lavernhe, J., and E. Granotier 1960
[THE MEDICAL EVALUATION OF FLYING PERSONNEL: THE PROBLEM OF ARTERIAL HYPERTENSION] L'expertise médicale du personnel navigant: le problème des hypertensions artérielles. — Revue des Corps de santé des armées (Paris), 1 (5): 681-690. Oct. 1960. In French.

Diagnostic principles to be employed in the routine examination of airmen to detect the presence and significance of arterial hypertension are discussed. Medical examination of 3500 airmen revealed thirty-nine cases of chronic arterial hypertension, with 13 of neural origin, 9 of the essential type without complications, 12 of the essential type with evidence of moderate atherosclerosis, and 5 with organic involvement. It is indicated that flying activity should be forbidden in cases of essential hypertension with organic complication, restricted in cases without complication, and allowed in most cases of hypertension of neural origin.

11928
Lavernhe, J., C. Bousquet, and J. Jouhandou 1960
[MEDICAL EVALUATION OF FLYING PERSONNEL: GASTRODUODENAL ULCERS] L'expertise médicale du personnel navigant: les ulcères gastroduodénaux. — Revue des Corps de santé des armées (Paris), 1 (4):537-549. Aug. 1960. In French.

Fourteen cases are reported of gastroduodenal ulcers which occurred in flying personnel between 29 and 51 years of age and presented diagnostic problems. A study of the cases shows that ulcerous disease can be compatible with a career of flying under certain conditions: proper medical or surgical therapy with a sufficient period of inactivity after stabilization of the ulcer or after surgery, reclassification (temporary or definite) to a less demanding position, and submission to a rigorous medical examination at the time flight activity is to be resumed.

11929
Lederer, F. L., and B. J. Soboroff 1960
OTOLARYNGOLOGY. — In: Cyclopedia of medicine, surgery, and specialties: Review service, 1960, p. 507-515. Ed. by G. M. Piersol and E. L. Bortz. Philadelphia: F. A. Davis Company, 1960.

Various pathological conditions of the ear and larynx are reviewed. A brief discussion is given of the etiology, prognosis, and treatment of sinus barotrauma, a condition which is becoming more prevalent as travel by air increases.

11930
Leiffheidt, G. 1959
[AERODONTALGIA] Aerodontalgie. — Wehrmedizinische Mitteilungen (Darmstadt), 1959 (6): 88-89. 1959. (Supplement to Truppenpraxis, 1959 (6)) In German.

The highlights of a survey of the causes of aerodontalgia are reported, as presented during the military section meeting at the XII International Congress of the "Fédération Dentaire Internationale". The following factors were ruled out on the basis of negative experimental evidence as the causes of aerodontalgia: (1) acceleration forces, (2) aeroembolism, except under specific conditions, and (3) air pockets under a filling or a cap as a result of inadequate treatment. Research workers in Italy, Norway, France, and England are of the opinion that aerodontalgia appears typically in the living tooth, particularly in recently treated teeth. It is thought to be due to heat damage to the pulp during treatment. Research in Germany also implicates periapical infectious processes associated with avital teeth. It is suggested that flight personnel receive priority dental treatment aimed at prophylaxis.

11931
Lomonaco, T. 1961
[DISEASES OF THE MAJOR APPARATUSES AND ORGAN SYSTEMS CAUSED OR AGGRAVATED BY FLYING] Malattie dei principali apparati e sistemi organici dipendenti o aggravati dall'attività di volo. — In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 91-144. Roma, 1961. In Italian, with English summary (p. 136-138).

Aviation pathology is concerned with diseases of the respiratory tract arising from acute or severe hypoxia and including spontaneous pneumothorax, pharyngo-laryngo-tracheal and bronchopulmonary affections, and pulmonary tuberculosis. The cardiovascular system undergoes physio-pathological changes during flight as a result of anoxia or accelerations and during parachute jumps. Atherosclerotic disease and hypertension are evidenced in flying personnel along with cardiovascular failure caused by decompression sickness, hyperventilation, airsickness, etc. Personnel are also handicapped by meteorism, gastroduodenal ulcer, and gastrointestinal disorders due to long flights, by kidney disorders, and osteoarticular and muscular lesions. High altitude flight may produce polyglobulism, blood coagulation changes, and severe manifestations in persons with sickle-cell anemia. Consideration is given to the prevention of diseases caused by flight activities by means of rigid selection and control of flying personnel, and by well organized medical-aid programs. (71 references)

11932
Loyke, H. F. 1959
SICKLE CELL ANEMIA AND SICKLE CELL TRAIT IN FLYING AND NON-FLYING AIR FORCE PERSONNEL: A CLINICAL AND EXPERIMENTAL STUDY.—Aerospace Med., 30 (7): 517-523. July 1959.

In 202 Negro Air Force personnel examined at Langley Air Force Base, five were found to have abnormal hemoglobins. One was homozygous for "S" hemoglobin, and 4 were heterozygous for "A" and

"S" hemoglobin. Electrophoretic studies were the only reliable screening method for these diseases. In the "SS" sample, multipointed sickle red blood cells first appeared at 4,000 feet. In the "AS" hemoglobin, oat-shaped cells were first noted at the 6,500-foot level and continued to be seen up to 10,000 feet, when the first multi-spined sickle cell forms appeared. With return to sea level, both types of abnormal cells decreased. (Author's summary and conclusions, modified)

11933
Luykx, H. M. C., and B. L. Murray 1961
ILLNESS AMONG FLYERS: TEMPORARY REMOVALS FROM FLYING USAF RATED OFFICERS, JULY-DECEMBER, 1959.—Aerospace Med., 32 (6): 505-515. June 1961.

An analysis and tabulation of illnesses and causes of illness among fliers for the last six months of 1959 are presented. When the rates of removal, noneffective ratios, and average duration of inability to fly are figured, three diagnostic groups dominate both the temporary removals and the man-days lost from flying: respiratory conditions, digestive disorders, and injuries (including accidents, poisonings, and violence). A detailed analysis of these diagnostic categories is given: infective and parasitic diseases; neoplasms; allergic, endocrine system, metabolic, and nutritional diseases; diseases of the blood and blood-forming organs; mental, psychoneurotic, and personality disorders; diseases of the nervous system and sense organs, the circulatory system, the respiratory system, the digestive system, the genito-urinary system, the skin and cellular tissue, and of the bones and organs of movement; congenital malformations; symptoms and ill-defined conditions; accidents, poisonings, and violence; and special admissions without sickness.

11934
Malyshkin, E. T., and B. L. Gel'man 1961
[MEDICAL EXPERT EVALUATION OF FLIGHT PERSONNEL WITH CHRONIC DISEASES OF THE STOMACH AND DUODENUM] Vrachebnaia ekspertiza letnogo sostava pri khronicheskikh zabolevaniiakh zheludka i dvenadtsatiperstnoi kishki. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (7): 57-60. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (7): 92-97. Washington: U. S. Joint Pub. Research Serv., no. 10316 (1374-N), Oct. 4, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

In view of the high incidence of gastrointestinal diseases in flight personnel, an individual approach to expert evaluation of suitability for flight work is advised with pilots suffering from chronic diseases of the stomach and duodenum (peptic ulcer, chronic gastritis). This method allows salvaging flight personnel for certain types of flight work under close medical supervision. Retraining of fliers to other types of aircraft is contraindicated because of the added mental stress which may aggravate the medical condition.

11935
May, J. E., and J. A. Kaplan 1961
AORTIC COARCTATION: A NATURALLY OCCURRING STUDY ON THE EFFECT OF HYPERTENSION ON ATHEROSCLEROSIS.—Aerospace Med., 32 (7): 616-620. July 1961.

Coarctation of the aorta is a significant lesion, both clinically and experimentally. The lesion is of clinical importance because of the ease of diagnosis, the availability of satisfactory surgical corrective procedures, and the poor prognosis of undiagnosed and untreated cases. Experimentally, coarctation provides insight into the effect of physical and mechanical factors in the development of hypertension and atherosclerosis. One case history of fatal coarctation in a 46-year-old man is presented.

11936
Mercier, A., and G. Perdriel 1961
[PROTECTION OF THE EYES OF NON-FLYING PERSONNEL IN CHARGE OF FLIGHT SAFETY] La protection oculaire du personnel non navigant chargé de la sécurité aérienne. —— Revue de médecine aéronautique (Paris), 1 (1): 97-111. Sept. 1961. In French, with English summary (p. 97).

A study is presented of the visual work conditions in radar stations, airfield local controls, and meteorological stations. Visual fatigue originating in radar scope readers is explained by an analytical study carried out in electromagnetic detection stations. One subject out of two appears to be affected with visual asthenopia, which is generally due to organic failure of the ocular system. The hazards of radar emission may affect mechanical engineers in charge of aerials and emitter controls leading to lenticular lesions. Ophthalmological selection criteria of personnel in charge of flight safety are somewhat stricter at times than those required for certain categories of flying personnel. Technical improvements have been made to protect against organic and functional failure of the visual system. These include the use of ocular prostheses for scope reading, illumination engineering, etc. It is stressed that the flight surgeon be familiar with the techniques required for flight safety.

11937
Miller, J. M. 1960
PROBLEM MEDICAL REPORT.—Aerospace Med., 31 (10): 835-841. Oct. 1960.

This case history describes the downhill course of a pilot with valvular heart disease who survived for 14 years following the first detection of a heart murmur. In retrospect, it seems clear that the pilot should have been grounded at least four years earlier than he actually was, due to the danger of sudden death.

11938
Moore, J. T., and J. F. Culver 1961
PRIMARY PIGMENTARY DEGENERATION OF THE RETINA: A CASE REPORT.—Aerospace Med., 32 (9): 806-808. Sept. 1961.

A case of primary pigmentary degeneration of the retina in a U. S. Air Force command pilot, aged 49, is presented. This visual defect, which would not interfere with most activities, constitutes a serious disability in flight and during aircraft ground operations. No treatment is available which will affect the course of the disease. The process is the result of a defective gene, but the pathogenesis of the retinal degeneration is poorly understood.

11939
Moseley, H. G. 1958
AIRCRAFT ACCIDENT INJURIES IN THE U. S. AIR FORCE: A REVIEW OF 2,011 CASES IN 1953 AND 1955.—Jour. Aviation Med., 29 (4): 271-282. April 1958.

An analysis is presented of injuries sustained in major aircraft accidents in the U. S. Air Force during 1953 and 1955. Of 8,416 aircraft occupants, 18.7% sustained fatal injuries, 5.2% major injuries, and 76.1% minor injuries. The predominant cause of death was multiple traumatic injury, followed by burns and intra-cranial injury. Intra-thoracic or intra-abdominal injury, transection of the spinal cord, and hemorrhage were causes of death in a small number of cases. The predominant type of major injury sustained with survival was fracture, primarily of the vertebrae. Other frequent injuries were burns, intracranial injuries, and surface wounds. Major injuries most frequently involved the head and face. Highest survival rates were found for accidents in non-jet trainers and transport aircraft, presumably because of their relatively low velocity. There was also a negative correlation between the incidence of injury and seat retention, seat belt use, and rearward or sideward seating position.

11940
Moskovich, I. M. 1961
[THE SIGNIFICANCE OF THE EXPERIMENTAL-PSYCHOLOGICAL EXAMINATION IN THE DIAGNOSIS OF EARLY FORMS OF CEREBRAL ATHEROSCLEROSIS IN FLIGHT PERSONNEL] Znachenie eksperimental'no-psikhologicheskogo issledovaniia v diagnostike rannikh form tserebral'nogo ateroskleroza u letnogo sostava. — Voenno-meditsinskii zhurnal (Moskva), 1961 (8): 59-60. Aug. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (8): 80-82. Washington: U. S. Joint Pub. Research Serv., no. 11298 (1374-N), Nov. 30, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce.)

Differential diagnosis of early cerebral atherosclerosis and neurasthenia was attempted by clinical examination of 30 pilots referred to the hospital for functional nervous system disease. The chief complaints were headache, dizziness, fatigue, sleep disorders, mild irritability, cardiac signs, emotional liability, memory lapses, difficulties in concentration, etc. Neurological examination showed in some inertia of convergence, weakened pupillary reflex, slight anisocoria, and an increase or inequality of tendon and periosteal reflexes. Since differential diagnosis was not possible at this stage, psychological examination was undertaken with simultaneous observation of autonomic nervous system indices. Among the tests administered were proofreading tests, rote-memory tests, Schulte's number-searching tables, a modification of the preceding, addition tasks, and memorization of standard texts. Early cerebral atherosclerosis was diagnosed on the basis of relative inertia in shifting attention, memory disturbances, and below-normal scores on the psychological tests.

11941
Nareff, M. J. 1959
PASSENGER PHLEBITIS: A COMPLICATION OF LONG DISTANCE AIR TRAVEL.—Aerospace Med., 30 (11): 791-796. Nov. 1959.

Passenger phlebitis was observed in eight individuals following long flights in military transport aircraft with varying seat configurations. Varying degrees of edema can be detected after any mode of travel during which the passenger remains seated for a considerable time. In the sitting position, venous return from the feet is inhibited proportional to the distance of the vein below the level of the heart. A bending and kinking effect is imposed at the groin and knee regions. Further venous compression can result from crossing the legs, a seat proportionally too low, wearing of a constricting belt or garment, a large meal, or abdominal distention due to decreased atmospheric pressure. Immobility, compounded by drowsiness and sleep during flight, and inadequate leg room, intensify the venous stasis of the sitting position. Passengers should be briefed regarding prolonged immobility in flight, particularly where previous venous disease or thrombosis has occurred.

11942
Nelms, J. D., and J. L. Waddell 1961
A TEMPERATURE: SENSATION SCALE FOR THE FIELD TREATMENT OF FROSTBITTEN EXTREMITIES BY RAPID THAWING.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.), Report no. FPRC 1185, Oct. 1961. ii+27 p.

A brief review of the literature indicates that rapid thawing in water between 42° C. and 45° C. provides the best prognosis for frostbitten limbs. The use of this method by men surviving in cold environments and the need for accurate temperature measurement is discussed. A temperature:sensation scale for the normal hand was derived, tested, and modified in laboratory and field conditions. The scale finally selected permits the preparation of water of the correct temperature for frostbite treatment by the majority of subjects without access to a thermometer. The maximum observed inaccuracy was 1.2° C. outside the preferred range but was well within the safe range for treatment. (Authors' abstract)

11943
Onesti, R., E. D'Elia, and S. Marini 1961
[IDIOPATHIC SPONTANEOUS PNEUMOTHORAX ARISING IN FLIGHT] Pneumotorace spontaneo idiopatico insorto in volo.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 294-299. Roma, 1961. In Italian.

A case is reported of a 29-year-old pilot with five years of flying experience who developed idiopathic spontaneous pneumothorax during flight. The first sign of the disorder appeared during a rapid descent from 30,000 ft. to 18,000 ft. The pilot tolerated the pneumothorax for six days and continued normal flight activity before reporting to the infirmary. It is postulated that the positive accelerations to which the pilot was subjected during the rapid descent could have caused the pneumothorax. Following hospitalization, the pilot returned to normal flight activity without further illness.

11944
Palmer, E. D. 1961
ACUTE ULCER AND SPACE SAFETY: A SUMMARY OF OPINIONS. — Military Med., 126 (3): 204-206. March 1961.

Features of space travel which may be conducive to the development of ulcers include newness, insecurity, aloneness, loneliness, boredom, and restraint. Opinions on the validity of supposing that acute gastroduodenal ulcer may be a space threat were solicited by questionnaire from 70 recognized gastroenterologists. Included were queries on the extent of susceptibility to acute stress ulcer among the human population, the possibility of eliminating susceptibles by selection, the methods of such selection, the value of preflight conditioning, and other practical prophylactic measures. The author comments on the lack of a basis for military or industrial recognition of susceptibles, for planning prophylactic moves, or even for deciding if there is a problem, despite the high incidence of ulcer in modern society.

11945
Perdriel, G., 1961
and G. Raynaud
[CENTRAL ANGIOSPASTIC RETINOPATHY IN THE AVIATOR] La rétinopathie centrale angiospastique chez l'aviateur.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 362-365. Roma, 1961. In French.

Central angiospastic retinopathy is very prevalent in flying personnel, and especially in pilots. By means of the ophthalmoscope two forms, acute and cicatricial, of macular chorioretinitis may be distinguished. The etiology of the conditions may be attributed to either vaso-neurotic or neuro-psychiatric causes. Medical therapy includes vasodilatation, antispasmodics, and vitamin C administration. Psychotherapy, with or without neuro-sedatives, assures a cure without sequelae and return to flight duty after several weeks.

11946
Phillips, P. B., 1959
and J. J. Zarriello
CENTRAL NERVOUS SYSTEM INJURY FROM HIGH RADIAL G FORCE.—Aerospace, Med., 30 (11): 847-851. Nov. 1959.

The details are presented of a young flight student who apparently suffered a central nervous system injury, possibly an alteration in blood flow and subsequent edema, while under a positive 9-g stress in an airplane during an emergency. The clinical findings cleared without specific treatment. He was returned to flight status, where his efficiency and ability are reportedly above average.

11947
Phillips, P. B., 1959
and J. J. Zarriello
EPILEPTIFORM SEIZURE AND LOW G TOLERANCE: A CASE REPORT.—Jour. Aviation Med., 30 (1): 35-37. Jan. 1959.

A case report is presented of a 23-year-old aviation officer candidate who became unconscious at less than 2 g. It was determined that the individual was subject to a form of idiopathic epilepsy.

11948
Picard, D., 1959
A. Appaix, and P. Nourrit
[HISTOLOGICAL LESIONS OF THE INTERNAL EAR FOLLOWING EXPERIMENTAL BAROTRAUMA IN THE GUINEA PIG] Lésions histologiques de l'oreille interne consécutives à des barotraumatismes expérimentaux chez le Cobaye.—Comptes rendus de la Société de biologie (Paris), 153 (7): 1230-1232. July 1959. In French.

A histological study of the guinea pig subjected to different types of barotrauma demonstrated the effects of decompression on the fragile structures of the middle ear, and especially on the internal ear. Damage was manifested as vascular rupture and hemorrhage, peri- and endolymphatic pressure changes capable of inducing changes in the organ of Corti, and disintegration of the membrana tectoria observed in the apical part of the chochlea in two cases of rapid decompression.

11949
Polizzi di Sorrentino, A. 1959
[ISTHMIC AORTIC STENOSIS] Stenosi istmica dell' aorta.—Rivista di medicina aeronautica e spaziale (Roma), 22 (2): 105-110. April-June 1959. In Italian.

The medico-legal aspects and clinical manifestations of a non-symptomatic case of coarctation of the aortic isthmus in a flier, not detected during selection tests prior to military induction and erroneously diagnosed as bronchial asthma during subsequent hospitalization, are discussed.

11950
Raboutet, J., 1959
C. Bousquet, E. Granotier, J. Lavernhe, and R. Portos
[MEDICAL EXAMINATION OF FLYING PERSONNEL: THE PROBLEM OF GLYCOSURIA] L'expertise médicale du personnel navigant; le problème des glycosuries.—Médecine aéronautique (Paris), 14 (4): 385-403. 1959. In French, with English summary (p. 403).
Also published in: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 117-135. Roma, 1961. In French.

Twenty-one cases of glycosuria observed during the regular medical examination of about 3,500 flying personnel are described. Diabetics and paradiabetics were in most cases removed from flying service, while pilots suffering from a lowering of the renal glucose threshold were, with proper precautions, returned to flying duty.

11951
Rigal, R. D., 1959
F. W. Lovell, and F. M. Townsend
PATHOLOGIC FINDINGS IN THE CARDIOVASCULAR SYSTEMS OF MILITARY FLYING PERSONNEL.—In: The first international sysposium on cardiology in aviation, p. 65-76. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiol., 6 (1): 19-25. July 1960.

In a group of supposedly healthy young fliers, there is a significant percentage who have moderate or marked atherosclerosis of the coronary arteries. However, in these individuals there is very little arteriosclerosis in the aorta, renal arcuate arteries, and small arteries of the periadrenal fat and the pancreas. The same observations are true of a similar group of non-flying military personnel. Fliers and non-fliers in the present study were not basically comparable because of age and other differences. However, the incidence of moderate and marked coronary artery sclerosis was approximately equal

in both groups, regardless of age. In implicating marked coronary artery disease as a causative factor in an otherwise unexplained aircraft accident, extreme caution must be used. The finding of severe narrowing of the lumen of the coronary arteries must be considered in the light of information gained from the investigation of mechanical factors and from reports of the details in the accident. (Authors's conclusions and summary)

11952
Robion, J., 1958
F. Montagard, M. Petrique, and J. Sepetjian
[CHRONIC INTESTINAL AMEBIASIS AMONG FRENCH AIR FORCE FLYING PERSONNEL IN MOROCCO: CLINICAL AND THERAPEUTICAL NOTES; EFFECTS ON PHYSICAL FITNESS] Amibiase intestinale chronique du personnel navigant de l'Armée de l'Air au Maroc: Notes cliniques et thérapeutiques; incidence sur l'aptitude.—Médecine aéronautique (Paris), 13 (1): 65-71. 1958. In French, with English summary (p. 73).

Although early diagnosis and the use of new drugs check the development and improve the prognosis of chronic intestinal amebiasis, still too many instances of "disguised" clinical forms of this condition have been observed. Recent changes in the symptoms and course of the disease have been noted. Symptoms characteristic of the "disguised" form include intestinal disorders (mainly constipation), feelings of tiredness, and neuro-vegetative disturbances. An analysis of the effects of these symptoms on the physical fitness and aptitude of flying personnel is presented, based on observation of eleven officers, one suffering from constipation, four from fatigue, and six from neuro-vegetative disturbances. Medical-inquiry techniques and quick examination procedures are summarized and outlined in tabulated form. In conclusion, the methods of treatment are discussed and prescriptions listed.

11953
Rotondo, G. 1961
[MEDICO-LEGAL PROBLEMS OF OCCUPATIONAL PATHOLOGY OF ABDOMINAL ORGANS AND WALLS IN AVIATORS] Problemi medico-legali della patologia professionale degli organi e pareti addominali negli aviatori. —Rivista di medicina aeronautica e spaziale (Roma), 24 (4): 621-642. Oct.-Dec. 1961. In Italian, with English summary (p. 640).

The physiopathological effects of high-altitude flight on the abdominal organs and wall of aviators are discussed. These include transposition of one or more organs with subsequent functional disorder, visceral disorders, rectal and anal disorders, visceral hernia, and kidney disease. Consideration is given to gastrointestinal disorders induced or aggravated by flight, with special reference to ulcers, the typical disease in flying personnel. Following various etiopathogenic theories, the medico-legal problems connected with disabilities incurred, their evaluation and treatment are presented.

11954
Rusanov, V. N. 1961
[THE EARLY DIAGNOSIS OF ATHEROSCLEROTIC CARDIAC SCLEROSIS FLIERS] O rannei diagnostike aterosklerotícheskogo kardioskleroza u letchikov. —Voenno-meditsinskii zhurnal (Moskva), 1961 (8): 56-59. Aug. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (8): 76-79. Washington: U. S. Joint Pub. Research Serv., no. 11298 (1374-N), Nov. 30, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

A study was made of the findings in 35 fliers with diagnosed atherosclerotic cardiac sclerosis. Of these 11 patients were in the 35 to 40-year age range, and 24 in the 40 to 45-year age range. The duration of arteriosclerosis was less than two years in 17 patients; two to four years in 18 patients. The majority complained of fatigue, general weakness, and headaches. Autonomic hyperreactivity was found in 18, signs of cerebrovascular sclerosis in 3, a neurasthenic syndrome in 3. Only five patients showed normal electroencephalograms. Twenty-eight patients had abnormal changes in the electrocardiogram. Cardiovascular symptoms noted in many were pain in the cardiac region, tachycardia, deviation to the left, dilatation and thickening of the aortic shadow in the X-ray picture. Increase in liver size was noted in 21; first stage of essential hypertension in 9; excess weight in 21 patients. A reduction in the lecithin-cholesterol ratio was seen in more than half of the patients. Flying may be continued by individuals with preclinical forms of the disease provided they have a good functional capacity with symptoms of the vasomotor or metabolic type only.

11955
Sandegard, K. E. 1960
[AEROMEDICAL CASE REPORTS: BACK INJURIES AT F14 DURING 1958-59 AFTER EJECTION BY CATAPULT FROM THE A32 LANSEN] Flygmedicinsk kasuistik: ryggskador vid F14 under 1958-59 efter utskjutning med katapultstol fran A32 Lansen. —Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 9 (1): 14-15. 1960. In Swedish.

In four ejection incidents, two fliers were ejected at a height of 450 meters, following engine failure, and sustained no injuries. Two others were ejected at a height of 400 meters following a collision. The latter two released their ejecting mechanisms during a spin without first removing the top of the cockpit; their parachutes opened at a height of approximately 75 meters. The pilot, sitting with his back pressed against the back of the seat when releasing the mechanism, suffered only a minor fracture. The navigator, who was leaning forward as far as his straps permitted, exhibited fractures of most disks between the third thoracic and third lumbar vertebrae. He was confined to bed for five days, moved around freely after four weeks, and returned to flying duty after about two and one-half months.

11956
Sawyer, C. H., 1961
and L. E. Lamb
MITRAL VALVULAR DISEASE: CASE REPORT.—Aerospace Med., 32 (10): 958-963. Oct. 1961.

This report presents a case of a pilot with progressive "pure" mitral regurgitation with a 12-year asymptomatic follow-up. The auscultatory findings include diastolic murmurs and rumbles, and the presence of a third heart sound. Mitral regurgitation, occurring in the absence of pulmonary hypertension or left heart failure, involves primarily a compromise of cardiac output, for which considerable compensation is available in the earliest stages.

Positive acceleration, because of the orientation of the mitral valve and position of the left atrium above the left ventricle, would increase emptying of the left atrium and decrease mitral regurgitation. Negative acceleration is seldom encountered in conventional or jet aircraft. Hypoxia can produce a need for increased cardiac output. Sudden need for increased right heart output is known to be capable of precipitating acute right heart failure in the presence of significant disease. It is considered highly unlikely that a mitral regurgitant lesion of this severity would occur in a person on flying status.

11957
Scano, A. 1961
[PATHOLOGICAL OCULAR MANIFESTATIONS CAUSED OR AGGRAVATED BY FLIGHT] Manifestazioni patologiche oculari causate od aggravate dal volo. — In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 208-227. Roma, 1961. In Italian, with English summary (p. 224).

Pathological changes of the eye caused by flight may be the result of altitude, consisting essentially of injury to the chorioretinal vessels and the crystalline lens. High accelerations may lead to retinal detachment and hemorrhage and subconjunctival hemorrhage. Other factors such as cold (corneoconjunctival freezing), solar radiation, wind, lubricants and hydraulic fluids occasionally present in cockpit, and prolonged piloting may also have pathological effects. Retinal hemorrhage and detachment are contraindications for flying. Protective measures for flying personnel include the use of oxygen and cabin pressurization to counteract the effects of altitude, integral protection from atmospheric agents by a closed cabin, use of protective eyeglasses and infrared brown visor, provision of good cabin illumination and visibility to reduce ocular fatigue, prescription of adequate vitamins and diet to prevent disorders, prohibition of the abuse of alcohol and tobacco, and instruction on the ocular effects of flying and means for protection. (46 references)

11958
Senturia, B. H., 1961
C. F. Gessert, C. D. Carr, and E. S. Baumann
AEROTITIS MEDIA: A COMPARISON OF BAROTRAUMATIC EFFUSIONS WITH MIDDLE EAR FLUIDS OF NONBAROTRAUMATIC ORIGIN. — Arch. Otolaryngol., 74 (2): 141-149. Aug. 1961.

Aerotitis media effusions are compared with serous, purulent, and muco-purulent effusions of the middle ear. It appears that the serous type of effusion most closely resembles that of aerotitis media because of the similarity in content of desoxyribonucleic acid, protein-bound carbohydrate, mucus, and cellular remains. The conclusion is drawn that aerotitis media effusions originate in the blood serum, and they may be symptoms of early or mild forms of inflammation. Descent from altitude is thought to produce vascular changes which allow blood components to enter the tympanic cavity. A review of the literature is included. (40 references)

11959
Senturia, B. H., 1960
C. F. Gessert, C. D. Carr, and E. S. Baumann
BIOCHEMISTRY AND CYTOLOGY OF EFFUSIONS IN AEROTITIS MEDIA: A COMPARISON WITH FINDINGS FOR FLUIDS OF NONBAROTRAUMATIC ORIGINS. — Washington Univ. School of Med., Department of Otolaryngology and Pharmacology, St. Louis, Mo.; issued by School of Aviation Med. Aerospace Medical Center, Brooks Air Force Base, Texas. Report no. 61-4, Nov. 1960. 10 p.

Aerotitis media specimens were examined for cytologic and certain biochemical constituents. The findings were compared with various categories of middle ear effusions of nonbarotraumatic origin and with blood serum. The chemical, physical, and microscopic properties of aerotitis media effusions most closely resemble the serous category of middle ear effusions. It was concluded that aerotitis media effusions probably have their origin in blood serum and that the negative pressure which occurs in the middle ear upon descent from altitude causes vascular changes sufficient to allow various blood components to enter the tympanic cavity. No evidence of inflammation was found. (Authors' abstract) (40 references)

11960
Severskii, A. I. 1959
[AEROMEDICAL BOARD TEST IN INITIAL STAGES OF HYPTERTENSIVE DISEASE] Vrachebnaia ekspertiza letnogo sostava pri nachal'nykh formakh gipertonicheskoi bolezni.—Voenno-meditsinskii zhurnal (Moskva), 1959 (9): 63-65. Sept. 1959. In Russian.
English translation in: Military Medical Journal, 9: 105-109. New York: U. S. Joint Pub. Research Service, No. 2061-N, Dec. 28, 1959. (Available at Office of Technical Services, U. S. Dept. Commerce)

A group of 198 fliers suffering from incipient hypertension were tested in regard to fitness for further flight duty. All the subjects suffered from elevated blood pressure in combination with other cardiovascular and nervous symptoms. On the basis of this and other extensive studies of the initial stages of the hypertensive disease, fliers with blood pressures of 150/90 mm. may be permitted to fly provided there are no subjective symptoms or objective organic or neuropsychiatric changes. Therapeutic-prophylactic measures for alleviating hypertension are described.

11961
Shannon, I. L. 1958
SALIVARY SODIUM, POTASSIUM, AND CHLORIDE LEVELS IN SUBJECTS CLASSIFIED AS TO DENTAL CARIES EXPERIENCE.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-74, April 1958. 6 p.

Without the use of exogenous salivary stimuli, saliva samples were collected from 537 males, each of whom had been placed by clinical and roentgenographic examination into one of three oral status categories (carious, resistant, or restored). After the analysis, the following results were evident: (1) No significant differences in volume (ml./5 min.) levels were noted between the three groups of subjects. (2) The mean potassium levels were not significantly different for the three categories. (3) The mean sodium level for the resistant group was sig-

nificantly lower than that for the other two groups. (4) The chloride mean value for the resistant group was significantly lower than the mean level for the carious subjects; a similar but even more significant difference was found between the chloride means of the resistant and restored subjects. (5) Salivary sodium and chloride levels were not significantly different between the carious and restored groups. (6) The findings indicate that the predictability of an individual's dental status based upon salivary volume and sodium, potassium, and chloride findings would be, at best, extremely low. (From the author's summary)

11962
Smith, George B., 1959
and L. E. Lamb
ELECTROCARDIOGRAPHIC FINDINGS IN 67,375 ASYMPTOMATIC INDIVIDUALS. IX. MYOCARDIAL INFARCTION.—In: The first international symposium on cardiology in aviation, p. 347-361. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiology, 6 (1): 190-199. July 1960.

From a survey of 67,375 males, abnormal electrocardiograms led to the detailed clinical evaluation of 51 individuals to determine whether they had previously suffered an infarction. Of these 51, 34 were found to be normal, but the remaining 17 demonstrated clinical findings that could not be considered normal and they had probably had a previous myocardial infarction. Experience with this series of patients confirms two opinions which have been previously expressed in the literature: that arteriosclerosis occurs in young people, often to a degree which impairs coronary circulation and may produce a myocardial infarction: and that a significant portion (usually estimated at 25 to 30%) of all infarctions occur without symptoms or with vague symptoms that are not related to the heart. (Authors' summary, in part)

11963
Solomon, R. J., 1958
Edward P. Smith, and P. G. Keil
UNUSUAL PULMONARY LESIONS IN FLYING PERSONNEL.—Jour. Aviation Med., 29 (5): 371-374. May 1958.

Ten cases of pulmonary lesions occurring in flying personnel are reported. Diagnoses were made of lung, bronchial, and pericardial cysts, coccidioidomycosis, cancer, pulmonary infarction, and pectus excavatum. Procedures used in the diagnosis of pulmonary disease are also outlined.

11964
Spiegel, F. S. 1959
SIGNIFICANT CAUSES FOR PHYSICAL DISQUALIFICATION FOR FLYING IN U.S. AIR FORCE OFFICERS, 1956-1957.—Aerospace Med., 30 (7): 476-480. July 1959.

During the years 1956 and 1957, 1685 cases of serious illness or injury were reviewed. Of 45 possible diagnostic categories, six groups accounted for approximately one-half the total disqualifications: psychoneurosis, encephalopathy (including syncope), eye conditions (excluding malignancies), peptic ulcer and gastric surgery, malignant neoplasm, and myocardial infarction and arteriosclerotic heart disease.

11965
Strumza, M. V. 1958
[VENOUS THROMBOSIS AND FLIGHT] Phlébothrombose et aviation.—Médecine aéronautique (Paris), 13 (4): 339-342. 1958. In French.

A hematological study was carried out on chloralosed dogs under hypoxic conditions. Arterial pressure and breathing were recorded, and the proportions of oxygen and carbon dioxide in the blood were determined. After recalcification, clotting time was determined at 37° C. on citrated plasma diluted ten times. Under severe but not rapidly lethal hypoxic conditions (at a simulated altitude of 43,000 ft.), the animals showed a decrease in clotting time; on the other hand, animals subjected to hypoxia at a simulated altitude of 9,850 ft. or exposed to sudden anoxia showed a slight hypocoagulability. It seems, therefore, that thromboembolic conditions appearing during air travel are not caused by hypercoagulability produced by hypoxia. The importance of the fact that venous stasis may be induced in the lower limbs in persons seated and motionless for long periods of time is emphasized. A slackening of the return flow of blood with an increase of blood volume in the feet was observed in persons keeping this position for one hour. This phenomenon may be intensified by hypoxia. Avoidance of immobility seems to indicate a possible means of prophylaxis as suggested by these findings. (Author's summary, modified)

11966
Stýblova, V. 1961
[CLASSIFICATION OF NEUROLOGICAL CHANGES DUE TO VIBRATION DISEASE] Klasifikace neurologickych změn u onemocnění z vibrace. —Československá neurologie (Praha), 24 (1): 62-70. Jan. 1961. In Czech, with English summary (p. 69).

A survey of 350 workers exposed to vibration showed slight changes in 65%, and serious signs of nervous system involvement in 9%. These changes are apparently caused directly by vibration, although other factors contribute. The importance of neurological changes is usually underestimated in the case history, and the findings are variously evaluated. Three categories for classification are proposed: (1) the syndrome of neuritis or polyneuritis, with signs of organic change of the nervous system (lighter or more serious forms); (2) a more or less pronounced syndrome of amyotrophic lateral sclerosis (involvement of the peripheral and central motor neurons); and (3) functional changes with the polyfuniculoneuralgic syndrome of Vitek, (a) neuralgic form, and (b) vegetative form with signs of spasmophilic neuropathy. Vasospastic crises are considered a sign of vasoneurosis and included under the vegetative neurological changes. (Author's summary, modified)

11967
Sullivan, B. J., 1961
and W. J. Fimian
THE EFFECT OF INOSITOL AND RAPID REWARMING UPON ACUTE COLD INJURY IN THE RABBIT. I. ELECTROPHORETIC STUDIES OF SERUM AND EDEMA FLUID.—Boston Coll., Mass.; issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8240-1). Technical Report no. 61-29, Oct. 1961. 16 p.

Rabbits were subjected to local acute cold injury by freezing one leg for ten minutes. The experiment was divided into five parts, with a separate group of rabbits being tested under each of the following series: (1) cold injury and gradual rewarming, (2) cold injury and rapid rewarming, (3) inositol treatment, cold injury, and gradual rewarming, (4) inositol treatment, cold injury, and rapid rewarming, (5) inositol treatment alone. Observations indicated that the two groups treated with inositol prior to cold injury developed less edema than the two comparable groups subjected to cold injury without inositol. Electrophoretic studies of serum protein distribution were performed; the two groups not treated with inositol, and the group treated with inositol alone, showed no significant changes in serum protein distribution subsequent to the experimental conditions. Serum protein distributions in the two groups which had received inositol prior to cold injury revealed a significant decrease in serum albumin in both groups, with an increase in either alpha, beta or gamma globulin. It is suggested that inositol may affect the capillary walls so that they are less permeable to alpha, beta and gamma globulins under the conditions of cold injury. (Authors' abstract)

11968
Sullivan, B. J., 1961
and W. J. Fimian
THE EFFECT OF INOSITOL AND RAPID REWARMING UPON ACUTE COLD INJURY IN THE RABBIT. II. RADIOACTIVE TRACER STUDIES OF CIRCULATORY RETURN.—Boston Coll. Biology Dept., Mass. issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8240-1). Technical Report no. 61-30, Oct. 1961. 17 p.

Acute local cold injury was experimentally produced in rabbits, and the rate of circulatory return was studied by measurements of a radioactive tracer ($Cr^{51}Cl_3$) which previously had been introduced intravenously. Four groups of animals were compared: (1) cold injury and gradual rewarming (control group); (2) inositol treatment, cold injury, and gradual rewarming; (3) cold injury and rapid rewarming (dry heat); (4) inositol treatment, cold injury and rapid rewarming (dry heat). No significant differences in the time required for maximum circulation to return were found between the four groups. However, the rates of circulatory return were found to be significantly faster in the three experimental groups as compared to the control group. In addition each of the two groups treated with inositol demonstrated less swelling and bleb formation than either of the two groups not so treated. (Authors' abstract) (24 references)

11969
Taylor, E. R. 1958
MIGRAINE IN ITS AEROMEDICAL ASPECTS.—School of Aviation Medicine, Randolph Air Force Base, Tex. Review no. 8-58, July 1958. 22 p.

The migraine syndrome is discussed as to its natural history, the individual attack, the patterns of recurrence, the pathologic physiology, related syndromes, detection, diagnostic criteria, therapy, prognosis, and aeromedical considerations in regard to disposition. Three case summaries are presented to demonstrate the concepts currently employed at the School of Aviation Medicine Aeromedical Consultant Service. (Author's summary)

11970
Tillisch, J. H., 1961
and E. T. Carter
CLINICAL PROBLEMS IN AVIATION MEDICINE: CASE REPORT NUMBER 1.—Aerospace Med., 32 (9): 859-862. Sept. 1961.

A case history of a 29-year-old pilot with psychomotor or temporal lobe epilepsy is presented. The condition is incompatible with flight duty.

11971
Tillisch, J. H., 1961
and E. T. Carter
CLINICAL PROBLEMS IN AVIATION MEDICINE: CASE REPORT NUMBER 2.—Aerospace Med., 32 (10): 964-965. Oct. 1961.

A common problem encountered by the aviation medical examiner is an asymptomatic elevation of blood pressure in a pilot. This case history of a 33-year-old commercial airline pilot emphasizes the necessity for prompt and proper study of a given case of hypertensive disease.

11972
Tillisch, J. H., 1961
and E. T. Carter
CLINICAL PROBLEMS IN AVIATION MEDICINE: CASE REPORT NUMBER 3.—Aerospace Med., 32 (11): 1068-1069. Nov. 1961.

A 31-year-old pilot continued to feel severe thoracic symptoms after ordinary duties several months after a left spontaneous pneumothorax. Pulmonary function and other tests confirmed the impression that significant pulmonary impairment did not exist. The problem seemed to be somatization of an anxiety reaction or pure malingering. There was not adequate cause to relieve the pilot from flying duties for reasons of disease disability.

11973
Ueno, H., 1959
and K. Toyonari
[DISTURBANCES IN THE EAR, NOSE AND LARYNX OF MAINTENANCE CREWS AT A JET AIR BASE] Bō jetto kichi seibiin no chōki narabini biintō shōgai.—Japanese Defense Forces Med. Jour. (Tokyo), 6 (12): 1-7. Dec. 1959. In Japanese, with English abstract (p. 7).

Noise measurements at a T-33 jet air base were made along with a survey on findings in the ear, nose, and larynx of 100 maintenance crews, and the following results were obtained: Noise around the aircraft body registered 111 phons at 5 meters diagonally in front of the intake at the start of jet engine, and 130 phons or more at the main wing base and the tail end of the fuselage at 100% output of the engine. Audiometry indicated disturbances in 46.0%, particularly in these with more than three months on the same duty. Objective abnormal findings in ears were noted in 51.0%, the majority being opacity (36.0%) and drawing (18.5%) with few cases of atrophy, loss of light reflex, and hyperemia of the malleus handle. Abnormal findings in the nose and larynx were found in 55.0%, including chronic tonsillitis (20.0%) and upper respiratory infections (46.0%). Subjective symptoms in the ears were present in 65.0%, in the nose and larynx in 36.0%. Disturbances were found most frequently among personnel of the Engine Test Section and A B Line where noise was intense and the personnel could easily be affected by the exhaust gas of jet engines and the dust. Some 60 to 80% of the

personnel from both groups, however, recovered from the conditions after performance of their duties.

11974
Varvarin, V. P., and A. S. Panfilov 1959
[ABNORMALITIES OF THYROID FUNCTION IN THE ETIOLOGY OF VEGETATIVE-VASCULAR DISORDERS] Disfunktsiia shchitevidnoi zhelezy v etiologii sosudisto-vegetativnykh narushenii.—Voenno-meditsinskii zhurnal (Moskva), 1959 (9): 66-68. Sept. 1959. In Russian.
English translation in: Military Medical Journal, 9: 110-113. New York: U. S. Joint Pub. Research Service, No. 2061-N, Dec. 28, 1959. (Available at Office of Technical Services, U. S. Dept. Commerce)

The possibility of abnormal thyroid function was investigated in 72 fliers with vegetative-vascular disorders between the ages 20-35 years. The absorption of radioactive iodine (I^{131}) by the thyroid was normal in 50 individuals and elevated in 22 individuals with the most pronounced vegetative disturbances. Reexamination of 11 individuals after 8 to 12 months showed normal I^{131} absorption in seven, unchanged conditions in two, and increased absorption in two. The vascular-vegetative symptoms had improved correspondingly in the seven. The clinical picture in the two subjects with increased I^{131} absorption corresponded to moderate thyrotoxicosis with enlargement of the thyroid. It is concluded that abnormalities of thyroid functions are present in approximately one-third of the cases of vascular-vegetative instability. Examination of the thyroid by the radioactive iodine method has been recommended to the aeromedical examination board in cases of vascular-vegetative instability.

11975
Verhoeven, A. F. P. M. 1958
[WHOOPING COUGH TREATMENT THROUGH DECOMPRESSION: A HISTORICAL AND CRITICAL SURVEY] Kinkhoestbehandeling door onderdruk: historisch en critisch overzicht.—Aeromedica acta (Soesterberg, Netherlands), 5 (1956-57): 211-238. [1958]. In Dutch, with English summary (p. 236).

A historical and critical survey is given of the effects of decompression and flight treatment on whooping cough. There has been a reduction and marked improvement in about 60% of untreated, uncomplicated cases. The best results are obtained between the third and eight week of the spasmodic stage. It has been found that the results are not influenced by the seriousness of uncomplicated whooping cough, by repetition of the treatment, by the social environment of the patient, or by his age. Results of decompression and flight treatment have been found to be equivalent. There is evidence that exposure to a simulated height of 3000 m. for 45-60 seconds is sufficient to obtain successful results. From an economic standpoint, the decompression chamber is preferred. In regard to the mechanisms involved, it may be assumed that this treatment causes a stress reaction in the neurovegatative system. (Author's summary, modified)

11976
Waldron, D. L. 1959
A PRELIMINARY STUDY OF THE EFFICIENCY OF LIMITED FREQUENCY MONITORING AUDIOMETRY IN THE AIR FORCE HEARING CONSERVATION PROGRAM.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 58-59, Aug. 1959. 4 p.

The Rudmose audiograms of 879 aircraft and engine maintenance men were examined in such a way as to answer two questions: (1) the poorest threshold level of hearing would have been identified in what percentage of this sample if tested only at 4000 c.p.s.? (2) What percentage of those with a 15 db. or higher hearing level, at any of the frequencies from 500 c.p.s. through 4000 c.p.s. would have been picked up for more extensive testing if they had been screened at 15 db. for 4000 c.p.s. only? Approximately 35% were found to have recorded their poorest threshold level at 4000 c.p.s. Of those with a 15 db. or higher hearing level at some frequency (or frequencies) below 4000 c.p.s. 97.7% would have been identified by 4000 c.p.s. screening at 15 db. above audiometric zero. (Author's abstract)

11977
Watson, W. L. 1961
THE VALSALVA MANEUVER: ITS RELATIONSHIP TO CHRONIC RECURRENT AEROTITIS MEDIA.—School of Aerospace Medicine, Brooks Air Force Base, Tex. Review no. 5-61, June 1961. 8 p.

The usefulness of the Valsalva maneuver as an Air Force screening procedure is re-examined. A group of 100 pilots (assumed to be free of chronic, recurrent aerotitis media) with many flying hours in conventional aircraft were required to inflate their middle ear by the Valsalva maneuver in a pressure chamber during high-altitude indoctrination. The finding that 95 of the 100 experienced pilots performed the Valsalva maneuver successfully in both ears supports the proposition that ability to Valsalva is a desirable screening requirement. Inability to inflate the middle ear is presumably related to predisposition to aerotitis media.

11978
Yamasaki, M. 1959
[ON AEROTITIS MEDIA AND THE FUNCTION OF THE EUSTACHIAN TUBE DURING FLIGHT] Kōkūji no jikankinō oyobi kōkū chūjien ni tsuite. [Abstract] —Nihon kōkū igaku shinri-gakkai kiroku [Proceedings of the Japanese Society of Aviation Medicine and Psychology] (Tokyo), No. 7: 4-5. May 1959. In Japanese.

A year's survey was made in 1958-1959 of the incidence, etiology, and progress of aerotitis media in 600 students during flight training. During this time, 16 cases of aerotitis media were observed, and 38 cases of tubal occlusion. Most of the subjects were afflicted in the months of December and January; no cases were observed in July and August. The relationship between peroral diseases and otitis media was not found to be directly proportional. A proportional relationship could be established, however, between occurrences of otitis media and tubal obstruction. In 7/16 of the aerotitis media cases, peroral diseases were not observed. Diagnoses of septal abnormalities should be considered irrelevant, since deformities of the septum are very common; in fact, very few septa are normal. Catheterization of the Eustachian tube in the presence of inflammation, may or may not give relief. An abnormal development of the mastoid is frequently revealed by X-rays in individuals recovered from aerotitis.

11979
Zarriello, J. J., and J. J. Acker 1958
SPONTANEOUS PNEUMOTHORAX IN FLIGHT: A CASE REPORT AND A BRIEF REVIEW OF THE LITERATURE.—U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 19 01 11, Subtask 1). Report no. 3, July 17, 1958. ii+9 p.

Also published in: Aerospace Med., 30(6): 418-423. June 1959.

The purpose of this case report of spontaneous pneumothorax occurring in flight and the review of the literature is to emphasize the problem of spontaneous pneumothorax as it involves the pilot and his career. The incidence of spontaneous pneumothorax reveals that it is a fairly common occurrence. Only 5 cases have been reported in the previous literature as occurring during aerial flight. It is quite uncommon for spontaneous pneumothorax to occur in individuals exposed to reduced pressures such as they occur routinely in low pressure chambers used for indoctrination of flight personnel. (Authors' summary, modified)

d. Pharmacology

11980
Berry, C. A. 1961
MAN, DRUGS, AND SPACE FLIGHT. — Annals Otol. Rhinol. Laryngol., 70 (2): 418-427. June 1961.

The use of drugs to extend the performance and capability of astronauts is cautioned against. The use of a specific drug should meet two basic requirements, namely, (1) the action of the drug in space conditions as well as in earth conditions should be known and (2) the drug should be pretested on each individual to use it. Various drugs to be used for the treatment of a loss or deficit, for prophylaxis of anticipated deficits, and for enhancing natural capabilities are discussed in conjunction with the different jobs to be done by the astronauts. It is concluded that astronauts would perform better without being under the influence of drugs.

11981
Cappone, M. K. 1961
THE EFFECT OF ANALGESIC DOSAGES OF ACETYLSALICYLIC ACID UPON PSYCHOLOGICAL REACTION TIME.—Jour. Psychol., 52 (2): 327-331. Oct. 1961.

In order to determine the effect of analgesic dosages of aspirin upon the psychological reaction time of six female college students, the simple reaction time response to a white light was used with readings being taken every fifteen seconds for one consecutive hour. Each subject served eight hours, two each with 10 "gr." [apparently grains] of aspirin, 5 "gr.", placebos, and no dosage. The indications of the mean scores of reaction time and the results of the analyses of variance were that there was no alteration in reaction time for any of the six subjects during any of the designated time segments nor for the total sixty-minute period while under the influence of the four experimental conditions. (Author's summary and conclusion)

11982
Donaldson, W. N. S. 1961
TRIFLUOPERAZINE (STELAZINE) IN THE TREATMENT OF SEASICKNESS. — Jour. Royal Naval Med. Service (London), 47 (3): 100-103. 1961.

Four hundred and five patients with seasickness were treated with trifluoperazine (Stelazine) capsules in a troopship at sea under varying weather conditions. Two hundred and eighty showed a good response, and were relieved of all symptoms, 115 responded but had some residual nausea or headache, and 10 failed to respond at all to the drug. On the whole, this drug appears to be valuable in the treatment of seasickness.

11983
Ercoles, A. M. 1961
ON THE INFLUENCE OF HOMATROPINE ON THE ADAPTATIONAL PROCESSES OF THE PERIPHERAL RETINA.—Atti della Fondazione Giorgio Ronchi (Firenze), 16 (2): 130-131. March-April 1961.

The peripheral visual fading time of a small target was measured after instilling two drops of the mydriatic drug, homatropine, into the conjunctival sac. The fading time decreased soon after instillation but recovered slowly.

11984
Evrard, E. 1961
[CONTRAINDICATIONS OF CERTAIN DRUGS FOR AIRCRAFT PILOTS AND AUTOMOBILE DRIVERS] Contre-indications de certain médicaments pour les pilotes d'avions et les conducteurs de véhicules automobiles. — Bruxelles-médical (Bruxelles), 40 (7): 215-221. Feb. 14, 1961. In French, with English summary (p. 221).

Drugs which cause changes in the nervous system and in psychomotor responses are sources of danger for flight safety. Certain antihistaminics, nasal decongestants, anti-malarials, atropine-scopolamine preparations, antibiotics, sulfonamides, stimulants (benzedrine, caffeine, etc.), and tranquilizing agents are contraindicated for use by pilots or are to be used with caution.

11985
Fleischhauer, O. 1961
["ONLY" A COLD] "Nur" ein Schnupfen. — Aero-Sport (Berlin), 10 (10): 21. Oct. 1961. In German.

Reasons for flight restrictions in case of a common cold are explained briefly, emphasizing the anatomical and physical aspects of the passage of air through the sinuses and the Eustachian tube in the normal state and while having a cold. Rapid changes in barometric pressure without capacity for instantaneous pressure equalization may lead to complications, such as sinus aches, detachment of the mucosal lining in the sinuses and nasal passages, rupture of the eardrum, etc. The pilots are advised not to disregard a cold but to consult a physician before flying.

11986
INVALIDS BY AIR. — Lancet (London), 1961, v. 1 (7179): 705-706. April 1, 1961.

The American Aerospace Medical Association and the British Overseas Airways Corporation concur in establishing safeguards for the protection of

passengers aboard commercial aircraft. Invalids may be refused passage for aesthetic reasons deemed distressful to normal passengers, for administrative reasons which take account of facilities in the air, along the route, or at the destination, or because of clinical or pathological conditions including advanced pregnancy, impaired cardiac function, pneumothorax, recent operation on a hollow viscus, and severe colds or other infectious diseases.

11987
Johnson, J. C. 1959
DRUGS AND THE FLYER.—Soc. Exper. Test Pilots Quart. Review, 3 (3): 38-40. Spring 1959.

A few of the more common drugs used frequently in self-medication and the reasons they can be dangerous to the flyer are discussed. Antihistaminics, commonly contained in "cold pills", may decrease depth perception and depress the vestibular apparatus, thus interfering with equilibrium. Other common cold preparations, some airsickness pills, and even some nose drops can interfere with normal vision. Among the antibiotics, indiscriminate use of streptomycin and dihydrostreptomycin may lead to vestigular damage and hearing loss. Preparations containing acetanilid, phenacetin, or bromides, and proprietary medications such as Bromo-Seltzer and Alka-Seltzer, may cause the formation of abnormal hemoglobin in the blood and thus make the individual more susceptible to hypoxia. Alcohol significantly lowers a pilot's altitude tolerance, increases his susceptibility to fatigue, and decreases his alertness and reflexes. Caffeine usually produces some nervousness and restlessness. The use of Dexedrine should be reserved for maximum-effort missions, and strict supervision by trained medical personnel is necessary in some cases. Barbiturates are definitely contraindicated to the flyer, and flyers on tranquilizers must be grounded for a period of 30 days following the last dose.

11988
Jongkees, L. B. W. 1961
THE INFLUENCE OF SOME DRUGS UPON THE FUNCTION OF THE LABYRINTH. — Acta otolaryngologica (Stockholm), 53 (2-3): 281-286. March-April 1961. In English.

Simple techniques are described by which the efficacy of anti-seasickness drugs as depressors of vestibular function can be investigated by judging the effect on the recording of eye movements by electronystagmography. Cinnarzine, Largactil, hyoscine, and Nembutal had no effect on the corneo-retinal potentials of the rabbit's eye during rotation. Of all the seasickness drugs, only the antihistaminic (Cinnarzine) has a significant effect. Largactil did not affect or slow the vestibular phase of nystagmus; only the quick central phase was distinctly suppressed. Hyoscine had no depressing effect. Nembutal suppressed nystagmus only as a partial effect of deep anesthesia. These drugs administered to rabbits submitted to sinusoidal movement of the parallel swing produced the same results as in rotatory tests.

11989
Jongkees, L. B. W., and A. J. Philipszoon 1960
SOME NYSTAGMOGRAPHICAL METHODS FOR THE INVESTIGATION OF THE EFFECT OF DRUGS UPON THE LABYRINTH: THE INFLUENCE OF CINNARAZINE, HYOSCINE, LARGACTIL AND NEMBUTAL ON THE VESTIBULAR SYSTEM. — Acta physiologica et pharmacologica neerlandica (Amsterdam), 9 (2): 240-275. July 1960. In English.

The suppressive effects of various drugs on the labyrinthine responses to angular and linear accelerations were studied in rabbits and humans. Angular acceleration and subsequent stimulation of the semi-circular canals was obtained in rabbits with the rotary platform; cupulometric techniques were used for humans. Linear acceleration and subsequent stimulation of the otoliths was obtained in both rabbits and humans on the parallel swing. The eye movements caused by these vestibular stimuli were quantitatively recorded on the electronystagmograph. The anti-motion sickness drug, Cinnarazine (N-benzhydryl-N-transcinnamylpiperazine), appeared to have a strongly significant suppressive effect on both rabbit and human labyrinths. Hyoscine (scopolamine) failed to suppress labyrinthine eye reflexes, and, on the contrary, seemed to increase excitability. Chlorpromazine (Largactil) only affected the central phase of the nystagmus and influenced neither the slow vestibular phase of nystagmus (cupulometric test) nor the compensatory eye movements in the parallel swing tests. Nembutal suppressed vestibular excitability only as a partial effect of deep anesthesia. The effects of these drugs on the corneo-retinal potential (C.R.P.), and the alterations of the nystagmogram as a possible expression of a change in the C.R.P., are discussed.

11990
Langdon, D. E., and G. E. Reynolds 1961
POSTFLIGHT RESPIRATORY SYMPTOMS ASSOCIATED WITH 100 PER CENT OXYGEN AND G-FORCES.—Aerospace Med., 32 (8): 713-718. Aug. 1961.

High g-forces coupled with increased oxygen concentrations produced inflight changes in basal lung segments with resulting postflight signs and symptoms. Although the incidence in this series was 20%, such symptoms have not caused inflight problems in U. S. Air Force tactical fighter aircraft. The nature of the pulmonary findings is unknown, but is probably atelectasis, edema, or both. The changes are completely reversible, occurring in pilots whose pulmonary systems do not overtly differ from normal. There appear to be different degrees of individual susceptibility. During flight, utilization of the "normal" oxygen setting is preventive. Postflight symptoms from breathing 100% oxygen resolve rapidly with forced deep breathing of air. The signs and symptoms closely resemble those reported in toxicity from prolonged breathing of oxygen. Apparently, oxygen and g-forces act synergistically to produce the changes since neither alone in the short mission time results in measurable defects. (Authors' summary)

11991
Laurell, L. 1959
[MEDICAL ASPECTS OF RESCUE BY MEANS OF CATAPULT SEATS IN THE SWEDISH AIR FORCE] Medicinska synpunkter på räddning med katapultstol vid svenska flygvapnet. — Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 8 (2): 1-6. 1959. In Swedish.

An analysis is made of the causes of back injuries received in 249 escapes by catapults of various design during 1952-1959. It is shown that ejection during uncontrolled flight (e.g. spin) increases the danger of disk fracture, as personnel under such conditions are unable to assume the correct posture prior to ejection. The average shape of the fractures suggest that they are the product of a jolt and a simultaneous forward bend in the longitudinal plane of the spinal column. The use of tight straps, different ejection directions, etc., to reduce injurious effects are discussed inconclusively.

11992
Lederer, L. G., 1958
and L. E. Putnam
COMPARISON OF DROWSINESS INDUCED BY BONAMINE AND MAREZINE.—Jour. Aviation Med., 29 (12): 885-890. Dec. 1958.

A study was made of the effects of two motion sickness drugs on the nervous system. One hundred medical students were administered either 50 mg. of Marezine, 25 or 50 mg. of Bonamine, or a placebo on each of 4 days, and were asked to report the effects of the drugs by body system. Twelve subjects reported no symptoms, while the remainder reported lethargy, drowsiness, or sleepiness as a result of treatment with one or more of the drugs. A significant difference was found in the amount of drowsiness produced by Bonamine and the placebo, and a less marked difference between the effects of Marezine and the placebo. It is concluded that Marezine may be administered without danger of significant severe drowsiness.

11993
Maccagno Ferrero, V. 1960
[GASTRODUODENAL ULCER AT ALTITUDE] Ulcera gastro-duodenal en la altura. — Revista de la Asociación médica de la provincia de Yauli (La Oroya), 5 (1-4): 74-100. Jan.-Dec. 1960. In Spanish.

Sixty-four cases are presented of gastroduodenal ulcer observed in persons at La Oroya (3,800 meters above sea level). The disease appears to predominate in males, especially between 31 and 40 yrs. of age. No relation was found between the localization of the ulcer in terms of either gastric or duodenal, and altitudes over 3,000 meters. Therapy was both medical and surgical. It was noted that patients at altitude did not tolerate major blood transfusions and present post-transfusional manifestations of both reversible and irreversible hepatorenal insufficiency. (35 references)

11994
McDonald, J. C., 1958
J. S. Wilson, W. B. Thorburn, W. W. Holland, and B. E. Andrews
ACUTE RESPIRATORY DISEASE IN THE R.A.F., 1955-57.—British Med. Jour. (London), no. 5098: 721-724. Sept. 20, 1958.

In surveys of acute respiratory illness in 25 selected R.A.F. stations in England and Wales in 1955-57 it was found that the incidence of sickness requiring admission to sick-quarters was far higher in recruit units than in operational stations. Adenovirus infection was probably responsible for at least half the respiratory disease admissions in recruit units during the periods of highest prevalence in 1956, but was completely absent from the same units in 1957; it was responsible for very few admissions in other types of unit. Influenza virus A was an important cause of illness among recruits in both winters, and accounted for at least 12% of respiratory admissions in other units in 1955-56 and for outbreaks at several stations in 1956-57. More than half those invalided from the R.A.F. in 1953 or 1954 with a respiratory disease, other than tuberculosis or cancer, were discharged as a result of an acute respiratory illness contract during their recruit training. (Authors' abstract)

11995
McDonald, J. C. 1960
SURVEYS OF ACUTE RESPIRATORY DISEASE IN THE ROYAL AIR FORCE. — Jour. Hygiene Epidemiol. Microbiol. and Immunol. (Prague), 4 (4): 440-446. 1960. In English.

Surveys of acute respiratory disease in the Royal Air Force between 1954-1959 show that the incidence varies with season, age, and type of unit. Recruits had the highest rate of infection, caused mostly by adenoviruses. In a recent survey, infections with Coe or para-influenza viruses were found in many patients. Illness associated with adeno-, Coe, or para-influenza viruses differ clinically from each other and from influenza. Successful clinical trials of influenza and adenovirus vaccines are reported.

11996
Melikian, L. 1961
THE EFFECT OF MEPROBAMATE ON THE PERFORMANCE OF NORMAL SUBJECTS ON SELECTED PSYCHOLOGICAL TASKS. — Jour. Gen. Psychol., 65 (1): 33-38. July 1961.

The present study compared the effect of meprobamate, placebo, and water on the function and performance of seven psychological tasks of 30 normal subjects. The following tasks were included: the Maudsley Personality Inventory, Visual Threshold, Auditory Threshold, Digit Span, Draw-A-Person Test, Digit Symbol, and Speed of Speech. Because of technical difficulties the results of the Speed Test were discarded. No significant differences in the effect of these variables on the tasks concerned appeared during the first testing, half an hour after the drug, and one week after. This indicates that the use of meprobamate of the same dosage used in the experiment does not impair performance on the selected tasks. (Author's summary)

11997
Milch, L. J., 1958
H. D. Frankl, and A. A. Renzi
THE EFFECTIVENESS OF DRUGS AGAINST MOTION SICKNESS—PERPHENAZINE AND SYSTRAL.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 59-20, Dec. 1958. 3 p.

The observation that a drug will inhibit apomorphine-induced emesis in dogs frequently leads to the suggestion that such a compound may be useful in the prophylaxis of motion sickness. Accordingly, Trilafon (perphenazine), a drug with high activity against apomorphine-induced vomiting in dogs, and Systral, an antiemetic analog of benadryl with little or no activity against apomorphine-induced vomiting in dogs, were tested for anti-motion sickness activity in 410 humans

aboard aircraft. Neither drug offered any protection against airsickness under the conditions of the study and with the dosages employed (Trilafon 4 and 8 mg. and Systral 30 mg). The incidence of side effects and their severity and type were indistinguishable between drug and placebo groups.

11998
Niess, O. K. 1961
PHYSICAL CONDITIONING IN THE U. S. AIR FORCE. — Oklahoma Jour. Public Health, 5 (2): 9-11. Oct. 1961.

An outline is given of the U. S. Air Force Physical Conditioning Program which is to develop physical fitness, encourage regular exercise, and to foster team spirit and individual confidence. The specific programming is formulated by individual commanders depending on conditions and types of personnel. Suggestions for controlled exercise and physical activity are made. The roles of the medical department and the base commander in the program are briefly discussed.

11999
Penzi, A. A., and L. J. Milch 1958
EFFECTIVENESS OF PROCYCLIDINE HYDROCHLORIDE (KEMADRIN) AND CYCRIMINE HYDROCHLORIDE (PAGITANE) IN THE PREVENTION OF AIRSICKNESS.—Jour. Aviation Med., 29 (8): 587-589. Aug. 1958.

The incidence of vomiting during one hour of simulated turbulence in a C-54 type aircraft was determined in subjects treated one hour before flight with the anti-Parkinson drugs procyclidine hydrochloride, cycrimine hydrochloride, or diphenhydramine hydrochloride. Administration of 5 mg. of either procyclidine hydrochloride or cycrimine hydrochloride resulted in a decrease in incidence of vomiting similar to that produced by 50 mg. of diphenhydramine hydrochloride. No side effects of the drugs were observed.

12000
Ritter, R. M., S. B. Sells, and J. C. Mebane 1958
MEASUREMENT OF BEHAVIORAL EFFECTS ATTRIBUTED TO CERTAIN ATARACTIC AND ANALEPTIC DRUGS.—Jour. Aviation Med., 29 (11): 821-826. Nov. 1958.

An experiment was conducted to determine the effect of the ataractic drug meprobamate and the analeptic drugs pipradol and methylphenidylacetate on affective disposition and efficiency. Eight written tests designed to measure affect, and 4 written tests of efficiency were administered to 225 airman basic trainees before and after treatment with one of the drugs, a placebo, or no drug. Subjects treated with methylphenidylacetate showed a significant improvement over untreated subjects on a tranquil adjective scale, and a trend of improvement on four other affect tests. Similar response tendencies were noted in subjects administered the other drugs or a placebo, suggesting an effect of treatment independent of drug action. Marked situational influences were noted in all groups on successive affect tests. No effect of treatment was observed on measures of efficiency.

12001
Rubinstein, E. H. 1961
VASCULAR RESPONSES TO ADRENALINE, NORADRENALINE AND ANGIOTENSIN IN HYPOTHERMIC DOGS. — Acta physiologica latino-americana (Buenos Aires), 11 (1): 30-37. 1961. In English.

Three substances with pressor action, adrenaline, noradrenaline, and angiotensin (valoctapeptide-amide) were injected in hypothermic dogs, and vascular reactivity was determined. Hypothermia was associated with a diminished pressor activity of all three drugs when tested in single rapid injections. When the drugs were injected continuously, the pressor effect in hypothermia was higher than in normothermia. Blood-pressure regulating mechanisms may be involved in the observed hypothermic potentiation since vagotomy and ganglionic blockage diminished or abolished the pressor effect. (Author's summary, modified)

12002
Rupérez Pérez, E. 1958
[DRUGS THE USE OF WHICH IS CONTRAINDICATED IN FLIGHT PERSONNEL] Medicamentos cuyo empleo está contra-indicado en el personal de vuelo. —Ciencia aeronaútica (Caracas), 5 (49): 29-34. Dec. 1958. In Spanish.

Drugs frequently used by flight personnel during duty hours to combat minor ailments or distress have been investigated with regard to possible side-effects detrimental to safe performance of flight duty. Resistance to anoxia may be curtailed by drugs under whose influence oxyhemoglobin is converted to methemoglobin (a large number of sulfa drugs and analgesics belong to this category), by drugs elevating oxygen consumption such as thyroid extracts or dinitrophenol, and by drugs modifying neurovegetative functions (sympathomimetics). A second group of drugs is identified by its detrimental effects on resistance to atmospheric decompression; among these, atropine and its dereivatives, antacids and other medications inducing gas formation in the intestinal tract, as well as numerous vasoconstrictors, are the most conspicuous. A third group, particularly the vasodilators and alcoholic beverages, affect low-temperature tolerance. Acceleration tolerance is curtailed by the central depressors, by drugs affecting the autonomic nervous system, and by those diminishing unstriated-muscle tonus. Mental and sensory faculties are harmfully affected by opiates, antihistaminics, cocaine, quinine, and amphetamine and its derivatives. And, finally, over-all stress tolerance is diminished by such drugs as emetine, trivalent or pentavalent arsenicals, sodium salicylate, penicillin and other antibiotics, and alcohol. It is of paramount importance that all flying personnel be informed about the safety hazards involved in the use and administration of these drugs.

12003
Schmidt, C. F. 1961
PHARMACOLOGY AND AVIATION.—Aerospace Med., 32 (7): 577-582. July 1961.

During World War II, extensive attempts were made to discover or create pills, capsules, or injections to improve man's ability to withstand the unprecedented stresses imposed on him by piston-driven aircraft. The attempts were not conspicuously successful. Several ways in which morphine and other central nervous system depressant drugs affected two of the problems of war-time aviation are reviewed: unconsciousness when oxygen inhalation is begun, and hyperventilation during the use of pressure breathing devices. The same type of search for pills, capsules,

or other means of helping man solve the problems of man in space is under way at present.

12004
Strollo, M., 1959
E. Molinari, and M. Castrioto
[PERFORMANCE OF PERCEPTIVE AND MOTOR TESTS BY SUBJECTS TREATED WITH TRANQUILIZERS: AN EXPERIMENTAL CONTRIBUTION] Rendimento in tests percettivo-motori di soggetti trattati con tranquillanti: contributo sperimentale. —Rivista di medicina aeronautica e spaziale (Roma), 22 (3): 46-57. July-Sept. 1959. In Italian, with English summary (p. 56).

Perceptive and motor tests were given to twelve subjects to determine the effects of the tranquilizers Atarax, Beatilina, Largactil, and Perequil. The detrimental effects noted point to the need for caution concerning the use of tranquilizers in aerospace medicine.

12005
Suzuki, I. 1961
EFFECT OF THIOCTIC ACID ADMINISTRATION ON SOME BLOOD ORGANIC CONSTITUENTS OF YOUNG MEN ENGAGED IN MENTAL WORK. —Jour. Sci. and Labour (Tokyo), 37 (3): 100-108. March 1961. In Japanese, with English summary (p. 100).

The effect of thioctic acid (administered either orally or intravenously) on the biochemical responses to mental work was studied in 6 young men performing a vigilance task on one digit addition work for 3 hours in the morning and 2.5 hours in the afternoon for 9 days. The total serum cholesterol level rose gradually during the initial period owing to the high fat diet, and decreased noticeably during the work period in the drug-treated group; it continued to rise in the control group. The serum cholesterol ester ratio decreased during the work period; further decrease was prevented by the drug administration. Serum ascorbic acid content rose remarkably at the beginning of the experiment due to an ascorbic acid-rich diet. The control group showed a decrease which was probably due to an alarm reaction caused by stress. Thioctic acid administration caused a gradual increase of serum ascorbic acid in the work period which suggested that it stimulated the resistance to mental stress. (Author's summary, modified) (31 references)

12006
Tillisch, J. H., 1961
and E. T. Carter
CLINICAL PROBLEMS IN AVIATION MEDICINE: CASE REPORT NUMBER 4.—Aerospace Med., 32 (12): 1151-1152. Dec. 1961.

A 32-year-old airline pilot experienced blurring of vision five days after receiving chloramphenicol for three days for an upper respiratory infection. Examination disclosed small, nearly central scotomata and a visual acuity of 20/60 in one eye and 14/35 in the other. Because of the visual impairment, he was prevented from carrying on his occupation for at least six months. This case and three other cases of optic neuritis associated with the administration of chloramphenicol suggest that the drug should be prescribed only when other antibiotics are unsuitable. When the use of chloramphenicol is mandatory, frequent funduscopic examinations are indicated. (Authors' summary)

12007
Wamsley, J. R., 1961
and D. E. Flinn
TOXIC PSYCHOSIS: A CASE REPORT.—Aerospace Med., 32 (12): 1148-1150. Dec. 1961.

One case of delirium, or toxic psychosis, apparently caused by large doses of analgesic and sedative drugs, is presented. The fact that such a disorder implies no underlying psychopathology and has a good prognosis does not preclude the necessity for a careful evaluation before the individual is returned to flying status. The possibility of a basic psychologic disturbance as well as residua from the delirium must be excluded. Careful documentation of the events during the disturbed state is important if the differentiation between an organic and a functional disorder is to be made. The presence of a functional psychotic disorder is disqualifying for flying duty, while a relatively mild psychotic disorder associated with reversible organic impairment of short duration constitutes an exception to the rule. (Authors' summary, modified)

12008
Warshaw, L. J. 1961
CARDIOVASCULAR EFFECTS OF TOXIC OCCUPATIONAL EXPOSURES. —New York State Jour. Med., 61 (13): 2283-2290. July 1, 1961.

A discussion is given of the toxic effects on the cardiovascular apparatus resulting from: (1) physical agents such as abnormal barometric pressure and extremes of temperature and humidity; (2) biologic agents, including infectious and parasitic diseases, venoms and animal toxins, and allergens; and (3) chemical agents which may be inhaled, directly absorbed through the skin, or ingested. The increase in number and complexity of materials and processes with toxic propensities which may be encountered by cardiac patients makes imperative the implementation of a modern occupational health program featuring routine preplacement, periodic, and return-from-illness examinations for the early detection of heart disease.

12009
Waters, R. O. 1960
OTOTOXIC DRUGS.—School of Aviation Medicine, Brooks Air Force Base, Tex. Review no. 5-60, Oct. 1960. 9 p.

The specific toxicity of the drugs quinine, streptomycin, dihydrostreptomycin, neomycin, and kanamycin to the ear, and specifically in inducing loss of hearing, is presented. The hearing loss may be partial or total, transitory or permanent, and may occur after a relatively small dose has been given.

12010
Wheeler, W. L., 1959
J. M. Howland, W. Smith, and J. E. Corso
THE USE OF PROCHLORPERAZINE IN SEASICKNESS.—Industrial Med. and Surg., 28 (9): 405-406. Sept. 1959.

During a ten-month period beginning in January 1958, 122 passengers (30 male, 92 female) who developed symptoms of motion sickness on regularly scheduled voyages were treated with prochlorperazine, a compound containing both phenothiazine and piperazine structures. Patients ranged in age from 10 to 85 years. Prochlorperazine was effective in controlling the nausea and vomiting associated with seasickness once they had occurred.

12011
Womack, G. J. 1961
EFFECT OF SMALL DOSES OF QUININE ON THE TEMPORARY THRESHOLD SHIFT OF HEARING INDUCED BY HIGH-INTENSITY NOISE EXPOSURE. —School of Aerospace Medicine, Brooks Air Force Base, Tex. Report no. 61-70, May 1961. 10 p.

The temporary threshold shift of hearing at 4000 c.p.s. after marginally hazardous white noise exposure was examined in 14 male subjects of normal hearing. Seven subjects took quinine sulfate, 300 mg. daily for 3 days, and 7 took a placebo for 3 days. There was no significant difference in threshold shift between the experimental group and control group at 2 minutes, 6 minutes, and 24 hours after noise exposure. (Author's abstract)

e. Transportation and Hospitalization of Patients

12012
Aerospace Medical Association
MEDICAL CRITERIA FOR PASSENGER FLYING. —Arch. Environmental Health, 2 (2): 124-138. Feb. 1961.
Also published in: Aerospace Med., 32 (5): 369-382. May 1961.

Judgments of the advisability of commercial air travel for medical patients should be based on: (1) the ability of the patient to travel by any means, (2) the desirability of air travel for both the patient and other passengers, and (3) the stability of the patient's condition. In estimating the ability of patients to travel by air, knowledge of conditions of cabin pressurization, oxygen supply, emergency equipment, and training of cabin attendants is necessary, as well as the speed and duration of flight. Conditions associated with flight which may affect passengers when a clinical disturbance is present include changes in atmospheric pressure (causing dysbarism, barotitis media, barosinusitis, aeroembolism, aerodontalgia, expansion of gases in hollow viscera, hypoxia), acceleration, noise and vibration, turbulence, and prolonged immobilization. Conditions contraindicating air transportation include cardiovascular disease, bronchopulmonary disturbance, gastrointestinal disturbance, and neuropsychiatric illness. Special precautions are often necessary in cases of severe anemia, sickle-cell disease, certain ophthalmic conditions, pregnancy, diabetes mellitus, poliomyelitis, and communicable diseases.

12013
Berest, N. L. 1958
[AIR TRAVEL AND CARDIOVASCULAR DISEASES] Voyages aériens et affections cardio-vasculaires.—Médecine aéronautique (Paris), 13 (3): 215-248. 1958. In French, with English summary (p. 248).

The increasing use of air travel makes it unavoidable that an ever larger number of persons suffering from cardiovascular disorders wish to avail themselves of this type of transportation. In judging the potential dangers of flying we have also to take into account the great disadvantages of long land or sea travel, especially the fatigue of the patient. In discussing the many pros and cons, the author analyzes potential effects of reduced oxygen supply in higher altitudes and the general depression of atmospheric pressure. While the velocity of the flight has no influence, the accelerations and decelerations involved are not to be underestimated. In this way all types of cardiovascular disorders are analyzed for their relation to flight fitness, especially hypertension, arteriosclerosis, coronary diseases, arrhythmias such as tachycardia, pregnancies of cardiovascular sufferers, and acquired and inherited heart disorders. While each patient constitutes a special case, the author tries, nevertheless, to establish a few general rules for the permissibility of air travel for cardiovascular sufferers: A. Air travel is advisable, if the cardiopath carries out a normal or subnormal social activity. B. Air travel is inadvisable, if the cardiopath is totally or almost totally confined to bed. C. Air travel is admissible, if the patient is only temporarily confined to bed or has to observe intermittent rest periods. In many cases inhalation of 40 to 60% oxygen is indicated during the travel.

12014
Berry, C. A. 1958
MEDICAL PROBLEMS OF AIR RESCUE.—Jour. Aviation Med., 29 (4): 316-324. April 1958.

Medical air rescues conducted by the Air Force in the Caribbean area from 1952 to 1954 are reviewed. Forty-one missions ranging in length from 49 to 1,060 miles were flown in unpressurized aircraft. Eighty per cent of the evacuations were of civilians or foreign nationals, and 11 missions involved water landings. Problems encountered included the physical disadvantages of aircraft not equipped especially for medical evacuation, difficulties of terrain, communication difficulties due to the size of the area covered, selection of missions on the basis of urgency and crew safety, immigration problems caused by the transportation of patients across national boundaries to the Canal Zone or Panama City, and the necessity for a diversity of special medical equipment because of the range of diagnoses and situations. Two representative missions are described to demonstrate the difficulties encountered in air rescue.

12015
Binet, J. L. 1960
[THOUGHTS ON AIR EVACUATION OF CASUALTIES] Réflexions concernant le transport primaire des blessés par voie aérienne.—Revue des Corps de santé des armées (Paris), 1 (3): 413-421. June 1960. In French.

Medical aspects of the introduction of medium and heavy helicopters for evacuation of casualties from battle sites to centers of initial medical treatment are discussed. It is suggested that the advantages afforded by medical care en route and by reduction of transportation time support the advisability of air evacuation from a medical viewpoint. Various methods of traumatic shock treatment necessitated by the conditions of flight are discussed, including venous catheterization, the use of plastic infusion containers, and the determination of blood pressure by an apparatus (such as Yacoël's) which is unaffected by noise and vibration.

12016
Bukhman, A. I., and S. M. Shilovitskiĭ 1961
[A CASE OF SPONTANEOUS PNEUMOTHORAX IN FLIGHT] Sluchaĭ spontannogo pnevmotoraksa v

polete [Abstract]. —— Voenno-meditsinskiĭ zhurnal (Moskva), 1961 (2): 83. Feb. 1961. In Russian.

A case of spontaneous pneumothorax at 4200 m. altitude is described. The patient was a previously-healthy, 36-year-old transport pilot. The symptoms were a sharp shooting pain in the right side of the chest, breathing difficulties, and clouding of consciousness. X-rays revealed a calcified lesion (Ghon's lesion) in the subpleura which had thinned the pleura. There was no evidence of active tuberculosis. Changes of barometric pressure contributed to the rupture of the weakened pleura.

12017
Dössing, J. 1959
[AIR TRANSPORTATION OF PATIENTS] Patienter of flyvning.—Meddelanden från flyg- och naval-medicinska nämnden (Stockholm), 8 (1): 1-8. 1959. In Swedish.

In flight, as passenger or as patient, the individual may be subjected to decreased atmospheric pressure, lowered oxygen partial pressure, air deficiency, or nervousness. This paper discusses the complications that these unfavorable conditions may induce in patients with pneumothorax, lung abscesses, abdominal perforations, tuberculosis, cranial lesions, and other clinical conditions in which there is insufficient alveolar ventilation, lowered minute volume, or lowered oxygen carrying capacity. Categories of patients who should never travel by air, or who should travel only under limited conditions, are indicated. Air-travel hazards encountered by women in late stages of pregnancy and by newly-born infants are mentioned. The chemotherapeutic approach to the treatment and prevention of motion sickness (i.e., depression of central nervous system activity with barbiturates, depression of parasympathetic activity with scopolamine derivatives, and the use of antihistaminics) is discussed. The author concludes that, altogether, there are very few cases in which flying is absolutely contraindicated.

12018
Downie, D. 1958
"FLYING HOSPITAL" LICKS REMOTE AREA PROBLEM.—Skyways, 17, (12): 16. Dec. 1958.

A "flying hospital" designed primarily for respiratory-disease patients is now in operation in Argentina to handle emergency cases in remote areas. The converted DC-3 is equipped with a complete surgery table, two portable iron lungs, two rotary pumps, four resuscitators, two portable respirators, two 12- and two 24-volt portable batteries, eight litters, and an auxiliary power unit. The complete medical equipment totals 1600 lbs.

12019
Edwards, A. G. 1958
HELICOPTER RESCUE SERVICE.—Lancet (London), 1958 (7018): 470-472. March 1, 1958.

A discussion is presented of the rescue and medical equipment carried by Royal Air Force helicopters for the rescue and transport of patients. Procedures for lifting patients into the aircraft are briefly described.

12020
Giffen, M. B. 1960
AIR EVACUATION OF THE PSYCHIATRIC PATIENT. —Aerospace Med., 31 (5): 372-378. May 1960.

The movement of psychiatric patients by air should be planned with the same thoughtful care that goes into any medical or therapeutic procedure. To facilitate handling, the individuals are classified into: Class 1A, severe locked-ward psychiatric patients requiring restraint; Class 1B, locked-ward patients not normally requiring restraint; and Class 1C, open-ward cooperative individuals. According to regulations, the individual who requires restraint must be sedated, yet he should not be put into a stupor or coma which could endanger his life. The use and dosage of the tranquilizers promazine, chlorpromazine, and prochlorperazine are discussed briefly.

12021
Gordon, B. L., 1960
R. H. L. Wilson, R. B. Stonehill, and C. Morsey
AIR TRANSPORT OF PATIENTS WITH RESPIRATORY DISEASE: PANEL DISCUSSION.—Diseases of the Chest, 38 (1): 20-29. July 1960.

Collaborative efforts in areas of pulmonary physiology, engineering, and clinical medicine have developed various elements of safety and comfort for the air transport of patients suffering from respiratory disease. These efforts have succeeded in minimizing the incidence of air sickness, hypoxia, anxiety states, and fatigue. The need still remains, however, for the thoughtful evaluation of cases with actual or potential coronary insufficiency, hypertension, and cor pulmonale in emphysema, especially in aging persons. (From the authors' summary)

12022
Haan 1958
[ARRANGEMENT OF AN IMMOBILIZATION LITTER TO BE HOISTED INTO A HELICOPTER IN STATIONARY FLIGHT] Aménagement d'un cadre d'immobilisation destiné à être hissé par treuil dans un hélicoptère en vol stationnaire.—Médecine aéronautique (Paris), 13 (3): 285-289. 1958. In French.

Experience has shown that certain evacuations by helicopter are difficult due to the nature of the terrain. In these cases it is proposed to fasten the casualty securely into an immobilization litter and have it picked up by the helicopter during a very short stationary flight. The article describes in detail the equipment devised for this evacuation service and shows in four photos the operation of the pick-up device. The wounded are gently elevated into the helicopter hovering above and remain there immobilized on a stretcher until arrival at the place of treatment.

12023
Jayangananda, S. 1960
AEROMEDICAL EVACUATION. —— Royal Thai Air Force Med. Gaz. (Bangkok), 9 (1): 45-62. Feb. 1960. In Thai.

A general discussion is presented on the selection of patients for air travel, and on their care and treatment by medical personnel during flight. Special consideration is given to the air transport of surgical patients, those with cranial injuries, and patients suffering from gastrointestinal, cardiovascular, thoracic, pulmonary, ocular, and respiratory diseases. Mention is made of the problems encountered during flight which may affect these patients, such as decreased atmospheric pressure and temperature, hypoxia, hyperventilation, and airsickness.

12024
Kaeppelin, T. 1960
[AERIAL EVACUATION OF THE SICK AND WOUNDED IN ALGERIA] L'évacuation sanitaire aérienne en A.F.N.—Forces aériennes françaises (Paris), 14 (157): 463-474. March 1960. In French.

The success of the program of evacuation of wounded in Algeria is attributed to the network of local centers of evacuation, the use of aerial transportation, and the development of techniques for the care of patients in flight. The centrally controlled system of evacuation, types of aircraft used, and types of wounded carried, are discussed.

12025
Kimball, F. N. 1960
A GUIDE FOR PHYSICIANS REGARDING TRANSPORTATION OF THE INCAPACITATED BY AIRCRAFT.—Internat. Record Med., 173 (1): 20-30. Jan. 1960.

Hypoxia, decompression, airsickness, and other problems encountered in flight, which in medical patients might produce adverse effects, are discussed. Particular reference is made to the cardiac patient, for whom most potential danger exists. Suggestions are also given for the treatment of patients with many other specific ailments. It is suggested that in commercial transportation, arrangements for the care of medical patients may best be made through the airlines.

12026
Lamb, L. E. 1960
THE ELECTROCARDIOGRAM IDENTIFICATION CARD.—Aerospace Med., 31 (10): 856-858. Oct. 1960.

An electrocardiogram identification card is described which may be carried on the person and utilized as a baseline electrocardiogram. On the back of the card, medications that the individual is taking can be listed, medications which are contraindicated can be noted, and other medical information, such as blood type, may be indicated if the physician so desires. The family physician's name and telephone number should be listed in the event of an emergency. The simple device provides a means of improving good medical care for patients who travel frequently and extensively. (Author's summary)

12027
Langdon, D. E. 1961
AIR EVACUATION OF PATIENTS WITH HEAD INJURIES. — School of Aerospace Medicine, Brooks Air Force Base, Tex. Report no. 61-91, Aug. 1961. 8 p.

Physicians from the School of Aerospace Medicine observed results of air evacuation by modern pressurized aircraft of 47 patients with varied head injuries. Problems related to flying were minimal. Motion sickness, manifested by vomiting, occurred in only one patient. Many patients were critically ill and required complex in-flight nursing care. In selection of patients for air evacuation, the hazards of transporting patients with pneumocephalus and pneumothorax must be considered. It may be necessary, also, to perform tracheotomy in preparing the comatose patient for flight. Pressurized aircraft have minimized the effects of changing ambient pressure on trapped air collections and the problems of hypoxia and motion sickness. For many patients studied in this series, air evacuation was a lifesaving measure which brought the neurosurgeon within a few hours of the general physician's doorstep. (Author's summary)

12028
Leeds, M. F. 1959
MEDICAL ASPECTS OF COMMERCIAL JET AIR TRAVEL.—California Med., 90 (4): 273-274. April 1959.

Jet aircraft will enhance the medically safe and comfortable transportation of ill or injured persons by reducing flight time (approx. 50%), and by providing a smoother, less noisy, vibration-free environment in the aircraft cabin. A potential medical problem pertaining to passengers, which is inherent in jet air transportation, is a possible loss of pressurization while at cruising altitudes. Emphasis is being placed on design features and testing of jet aircraft to prevent this loss in flight, and several of the more important features related to this problem are cited. Relative to the comfort of fellow passengers and to the non-medical environment of commercial airliners, certain persons should not be carried on commercial jet aircraft. These may be categorized as follows: patients whose illness is objectionable because of odor or appearance, patients with contagious diseases, those who cannot take care of their needs, those with emotional disturbances, those unable to withstand mild respiratory stress, those with illnesses associated with trapped gases (such as pneumothorax), and cases of advanced cardiac decompensation, cyanosis, vital capacity of 50% of normal or less, severe anemia, status asthmaticus, mandibular fixation by wiring, poorly controlled epilepsy, and myocardial infarction within six weeks of onset. Infants less than 14 days old should not be taken aloft because of instability of the respiratory mechanisms.

12029
Macarthur, R. J. 1961
NOTES ON A POSSIBLE METHOD OF ESTABLISHMENT OF AN AERIAL AMBULANCE.—Med. Jour. Australia (Sydney), 1 (7): 260-261. Feb. 18, 1961.

Since no universally satisfactory solution has so far evolved to the problem of transportation of patients from the scene of an accident in the country to the clinic, an aerial ambulance carrying a medical attendant, blood, drugs, and resuscitative equipment is proposed. Characteristics for a suitable aircraft and airfields are listed. A plan for building an accident center and staffing it with medical personnel is proposed.

12030
Mancusi Caputi, B. 1961
[STATISTICAL AND CRITICAL CONTRIBUTION TO THE PROBLEMS OF TRAFFIC MEDICINE] Contributo statistico e critico ai problemi della medicina del traffico. — Rivista di medicina aeronautica e spaziale (Roma), 24 (3): 424-428. July-Sept. 1961. In Italian, with English summarv (p. 428).

A brief survey is presented of the activity during the last four years of the Aeromedical Military Infirmary at the international airport of Ciampino Ovest. Other than the general medical assistance to air traffic and military and civilian field personnel, it performs a regular road first air service for the area between Albano and Rome. (Author's summary, modified)

12031
Newsom, J. 1959
[PROBLEMS OF CASUALTY TRANSPORTATION. II. AIR TRANSPORTATION OF THE WOUNDED IN KOREA] Probleme des Verwundetentransportes. II. Der Lufttransport von Verwundeten in Korea.—Wehrmedizinsche Mitteilungen (Darmstadt), 1959 (7): 107-109. July 1959. (Supplement of Truppenpraxis, 1959 (7)). In German.

In the course of a discussion of transportation problems on the battle field the use of helicopters for the evacuation of heavily wounded soldiers during the Korean War is described as an example of the advantages which this form of air transportation offers in virtually inaccessible terrain. Forty heavily wounded soldiers required immediate evacuation as, in each case, life-saving operations were necessary. In spite of enemy fire, several helicopters landed safely in daylight, and 16 injured soldiers were immediately evacuated and received blood transfusions in flight. The rest of the injured were evacuated with a second transport and all lives were saved.

12032
Newsom, S. J. 1959
DIVISIONAL HELICOPTER MEDICAL EVACUATION POLICIES.—Military Med., 124 (6): 437-446. June 1959.

The development and utilization of policies concerning Seventh U. S. Infantry Division air evacuation techniques in Korea are discussed. General guidance policies established for assigning wound priorities for medical evacuation by helicopter at forward levels are listed. Two specific evacuations of Korean casualties are described.

12033
Rohrs, L. C., 1958
T. M. O'Connor, and J. A. Addison
HELI-MEDICAL SUPPORT: IN A MASS CASUALTY EXERCISE.—U. S. Armed Forces Med. Jour., 9 (2): 241-254. Feb. 1958.

A report is given of a medical field training exercise conducted in order to test and develop techniques for the management of casualties in amphibious warfare. The exercise involved transportation of a medical company clearing section and supplies by helicopter, realistic processing of simulated casualties through the company, seaward evacuation of casualties by helicopter, and realistic treatment aboard ship. During the exercise, a total of 234 casualties and 46,000 pounds of cargo were carried by helicopter.

12034
Rudolf, W. 1961
[MAY I FLY, DOCTOR?] Darf ich fliegen, Herr Doctor? — Medizinische Klinik (München), 56 (5): 199-201. Feb. 3, 1961. In German.

The main factors detrimental to well-being in flight are: (1) airsickness, (2) differences of barometric pressure, (3) lowered oxygen partial pressure, and (4) fear. Guidelines are offered to the general practitioner on advising patients on travel by air, particularly in jet aircraft. Flight is contraindicated in cases of acute coronary thrombosis, or less than six weeks after a healed coronary thrombosis, angina pectoris, hypertension with blood pressure exceeding 200/100, severe asthma, active or cavernous tuberculosis, pneumothorax, pulmonary carcinoma, pulmonary tumors, extensive pulmonary fibrosis, blood dyscrasias (with erythrocyte count below three million, or hemoglobin values below 60%), leukemia, after blood transfusion, after colostomy, urine incontinence, unrepaired hernia, acute cholecystopathy, severe psychoses, and during pregnancy near term.

12035
Salvagniac, A. 1960
[CURRENT STATUS OF MEDICAL AVIATION IN FRANCE] Situation actuelle de l'aviation sanitaire en France. — Médecin de reserve (Paris), 56 (4): 99-106. July-Aug. 1960. In French.

Current air evacuation methods used by the French Armed Forces insure a safe flight by either airplane or helicopter, even for patients with respiratory or circulatory insufficiency. It is recommended that aircraft with pressurized cabins be used, that adequate medication and auxiliary equipment be aboard the plane, along with qualified personnel trained in aviation medicine.

12036
Scano, A. 1961
[AIR RESCUE SERVICE IN ITALY] Il servizio di soccorso aereo in Italia. — Rivista di medicina aeronautica e spaziale (Roma), 24 (1): 71-81. Jan.-March 1961. In Italian, with English summary (p. 80).

The organization and activities of the Italian Air Rescue Service are described. Its chief mission is to transport and rescue wounded and sick patients and persons involved in aircraft accidents and other types of disaster. Amphibious aircraft and helicopters are used.

12037
Simon, S. W. 1958
THE EFFECT OF ALTITUDE ON ASTHMA: A QUESTIONNAIRE STUDY.—Jour. Aviation Med., 29 (6): 422-427. June 1958.

A questionnaire survey was made of 1700 flight surgeons and 860 allergists to obtain information on the ability of asthma patients to fly safely. Of 960 flight surgeons and 280 allergists replying, most said that bronchial asthmatic patients may fly in unpressurized commercial aircraft, and almost all said that pressurized aircraft were safe. A large majority felt that pollen asthmatics should be able to fly during the pollen season, and that chronic or asthmatic bronchitis, bronchiectasis, and wheezing were not contraindications to flying. Pulmonary emphysema, dyspnea at rest on the ground, lowered vital capacity, and cyanosis were said to be contraindications to flying by most of those surveyed. Most felt that a vital capacity for height of 50% or 75% was necessary for safe air travel. Drugs thought to be most valuable in an asthmatic attack at altitude were epinephrine and oxygen. It is concluded that most asthmatics may fly in pressurized planes, preferably with prophylactic treatment prior to flight, and medication prescribed by the patient's physician if required during flight.

12038
Tabusse, L., 1959
and A. Salvagniac
[RESPIRATORY RESUSCITATION AND AIR TRANSPORT] Réanimation respiratoire et transports aériens.—Médecine aéronautique (Paris), 14 (1):

61-75. 1959. In French, with English summary (p. 75).

Air transport of patients afflicted with severe respiratory illnesses has hitherto been contraindicated by the injurious effects of hypoxia and gas expansion at altitude, by airsickness and possible asphyxia, and by cold air with a possible irritation of already weak respiratory organs. The development and improvement of mobile apparatus and techniques for respiratory resuscitation and the advances in nursing care now render this type of travel not only feasible but preferred in many respiratory cases to ambulance travel. Air transportation of poliomyelitis patients has been particularly successful (as evidenced by hundreds of cited cases) in the United States, Argentina, Norway, Sweden, North Africa, and France. It is felt that, after a thorough clinical examination and conscientious effort to alleviate or correct the diagnosed condition, the use of presently available resuscitation equipment by trained and experienced personnel will provide good artificial ventilation for those patients with severe respiratory illnesses.

12039
Tinsman, C. A. 1961
PREVENTIVE MEDICINE ASPECTS OF AIR TRAVEL. — Pennsylvania Med. Jour., 64 (1): 63-67. Jan. 1961.

The physical conditions or illnesses which determine who should travel by air, and some of the public health ramifications of such methods of travel are discussed. Generally, air travel limitations are imposed by such conditions as heart diseases, severe respiratory disturbances, severe anemia, and gas confined in body cavities, conditions that are most easily affected by changes in altitude and barometric pressure. Other contraindications include sickle cell anemia, acute stages of infectious diseases, a moribund state, wired jaws, acute alcoholism and psychoses without sedation or restraint. Other aspects of aviation discussed as being within the realm of preventive medicine are: air rescue and evacuation of the wounded; transport of drugs, sera, and antidotes by aircraft; the rapid dissemination of communicable or exotic diseases; the selection and physical maintenance of aircrews; and the human engineering aspects of air frame manufacture (spacing and facing of seats, the amount of pressurization, the availability of oxygen, the arrangement and lighting of the cockpit, and the noise level). The improvements which are realized in all phases of air safety are cited as contributions of preventive medicine. The medical problems and preventive medicine aspects of space travel are briefly defined as being extensions of the problems of air travel, with shifts in emphasis on specific problems.

12040
Wilson, H. T. 1958
AIR TRANSPORTATION OF PATIENTS WITH POLIOMYELITIS: EXPERIENCE WITH 193 RESPIRATOR CASES.—Jour. Aviation Med., 29 (1): 27-32. Jan. 1958.

Observations are reported of in-flight and post-flight complications produced by air transportation in 193 patients with respiratory insufficiency caused by poliomyelitis. Increases in pulse rate, blood pressure, and body temperature, and decreases in tidal air during flight, and fever, atelectasis, and pneumonia after flight occurred in a significant number of patients. Constant observation and treatment were necessary to deal with in-flight tracheal obstruction and inadequate ventilation. The observation of frequent post-flight complications indicates that the test of successful air evacuation is not the presence of in-flight fatalities, but the occurrence of ill effects as a result of the flight.

12041
Wilson, R. H. L., 1960
R. B. Stonehill, F. D. T. Bowen, D. W. Gressly, and J. A. Mathis
AIR TRAVEL IN CARDIORESPIRATORY DISEASE. —Diseases of the Chest, 37 (5): 579-588. May 1960.

A proposal is made for a classification for planned air travel of patients with cardiorespiratory disease to be developed at a series of limiting altitudes ranging in 2,000 ft. decrements from 10,000 ft. to 2,000 ft. in the cabin. A method is given for considering various aircraft from the pulmonary physiologic point of view, together with some of the performance characteristics of certain aircraft in this regard. It is shown that respiratory acidosis and ventilatory restriction are perhaps the most important limiting factors, with alveolar-capillary block as a less common consideration. It is felt that the average physician is in a position to classify patients, and such a classification, moreover, could be useful to airlines accepting patients with cardiorespiratory disorders for air travel. (From the authors' summary)

f. Physical and Neuropsychiatric Examination

12042
Bartlett, R. G., 1961
N. E. Phillips, and E. J. Wolski
MAXIMUM BREATHING CAPACITY PREDICTION FROM THE VELOCITY-VOLUME LOOP.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 2, Jan. 3, 1961. 24 p.

Since the usefulness of the maximum breathing capacity (MBC) test as a diagnostic tool is somewhat compromised by its strenuous nature, an attempt was made to predict the MBC from a maximum velocity-volume (V-V) loop. From the limited data obtained from subjects, the reliability of prediction appears good.

12043
Beliaev, I. S. 1960
[CHECKUP OF PILOTS FOR FITNESS—AN IMPORTANT CONDITION FOR INSURING FLIGHT SAFETY] Kontrol' za rabotosposobnost'iu letchika—vazhnoe uslovie obespecheniia bezopasnosti poletov. — Voenno-meditsinskii zhurnal (Moskva), 1960 (4): 70-72. April 1960. In Russian.

The importance of a thorough preflight medical checkup is emphasized. In addition to the appearance and behavior of the pilot, the appearance of the mucosae and skin, and the pulse rate should be checked and entered in a preflight log. These procedures help to uncover the beginning of an illness and the associated reduction in fitness. Mild physical indisposition or emotional problems are frequently not reported by the pilot to avoid being grounded. Medical officers participate in assigning pilots to flight duty or to rest homes.

12044
Bellet, S., 1961
S. Deliyiannis, and M. Eliakim
THE ELECTROCARDIOGRAM DURING EXERCISE AS RECORDED BY RADIOELECTROCARDIOGRAPHY: COMPARISON WITH THE POSTEXERCISE ELECTROCARDIOGRAM (MASTER TWO-STEP TEST). —— Amer. Jour. Cardiol., 8 (3): 385-400. Sept. 1961.

A system based on the principle of broadcasting the electrocardiogram during physical exercise was able to obtain steady baselines in a study of 296 subjects. It appears that electrocardiograms taken during the exercise period have a distinct advantage in detecting abnormalities that are never revealed or only inadequately revealed during the postexercise period. (33 references)

12045
Berry, C. A., 1958
and A. H. King
THE ROLE OF THE ALTITUDE CHAMBER IN THE DIAGNOSIS AND DISPOSITION OF PROBLEM AEROMEDICAL CASES.—School of Aviation Medicine, Randolph Air Force Base, Texas. Aeromedical Reviews, no. 7-58, Nov. 1958. 20 p.
Essentially the same: USE OF ALTITUDE CHAMBER IN THE DIAGNOSIS AND DISPOSITION OF PROBLEM AEROMEDICAL CASES.—Jour. Aviation Med., 30 (4): 258-267. April 1959.

The use of the altitude (low-pressure) chamber as a diagnostic tool in problem aeromedical cases is discussed. Each "flight" is tailored to the individual case and closely simulates the actual conditions surrounding the referral incident. Twelve case histories are presented which deal with problems of the ear, nose, and throat; the heart; the lungs; the head; hyperventilation; and hypoxia.

12046
Buianov, P. V. 1959
[DOSAGED PHYSICAL EXERCISE AS A METHOD OF TESTING THE FUNCTIONAL STATE OF THE CARDIO-VASCULAR SYSTEM IN HYPERTENSIVE DISEASE] Dozirovannaia fizicheskaia nagruzka kak metod otsenki funktsional'nogo sostoianiia serdechno-sosudistoi sistemy pri gipertonicheskoi bolezni.—Voenno-meditsinskii zhurnal (Moskva), 1959 (9): 29-34. Sept. 1959. In Russian.
English translation in: Military Medical Journal, 9: 46-55. New York: U. S. Joint Pub. Research Service, No. 2061-N, Dec. 28, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

The application of a dynamic physical exercise test (30 deep knee bends in 60 sec.) to test the functional adequacy of the cardiovascular system was experimentally investigated in 55 fliers with known stages of hypertension and in a control group of healthy subjects. The following hemodynamic indices were recorded: diastolic, mean, lateral, terminal, stroke, and pulse pressure, pulse rate, systolic index, stroke and minute volume of the blood, the actual and the effective specific peripheral resistance, and the speed of the pulse wave. The indices were recorded in the morning on a fasting stomach before the exercise, directly after the exercise, and five minutes later. Five main types of hypertensive cardiovascular reactions are discussed in detail. Adequate functional evaluation of the myocardium and of the cardiovascular system by the physical stress test is possible only when based on the total picture of hemodynamic changes evoked, on the clinical picture, and on demonstrated roentgenological changes.

12047
Buianov, P. V. 1958
[EXAMINATION OF THE FUNCTIONAL STATE OF THE CARDIO-VASCULAR SYSTEM OF FLIGHT PERSONNEL WITH HYPERTENSION BY THE METHOD OF MECHANOCARDIOGRAPHY] Otsenka funktsional'nogo sostoianiia serdechno-sosudistoi sistemy metodom mekhano-kardiografii pri gipertenzivnykh sostoianiiakh u letnogo sostava.—Voenno-meditsinskii zhurnal (Moskva), 1958 (10): 38-43. Oct. 1958. In Russian.
English translation in: Military Medical Journal, 10: 55-62. New York: U. S. Joint Pub. Research Serv., No. 1166-N, Jan. 28, 1959. (Available at Office of Technical Services, U. S. Dept. Commerce)

Hemodynamic changes were studied in 84 hypertensive fliers with the aid of mechanocardiographic method developed by N. N. Savitskiĭ, employing the pulse-pressure principle. The method allows a complete evaluation of the physical aspects of hemodynamic disturbances under hypertensive conditions and of the stage to which hypertension has advanced, as well as the dynamics of the hypertensive process and the pathogenesis of the hemodynamic disturbances in the individual. The author concludes that mechanocardiography may be used in military aviation medicine practice for evaluation of the capacity for flying in pilots with cardiovascular disturbances.

12048
Busis, S. N. 1960
LABYRINTHINE VESTIBULAR FUNCTION AND TESTING METHODS.—A. M. A. Arch. Otolaryngol., 72 (1): 2-10. July 1960.

The function of the vestibular labyrinth in helping man to maintain proper balance and posture during angular and linear accelerations and gravitational changes, or while swimming under water or diving, is discussed. The various techniques for evaluating the vestibular apparatus are listed as follows: (1) caloric stimulation, (2) rotation tests, (3) fistula test, (4) galvanic stimulation, (5) optokinetic nystagmus, and (6) postural tests. Each technique is described and evaluated in terms of its usefulness in specific clinical and experimental situations.

12049
Byford, G. H. 1961
A SIMPLE TECHNIQUE FOR RECORDING SMALL EYE MOVEMENTS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 162, Sept. 1961. ii+17 p.

A contact lens photoelectric eye movement recording system is described. The transducer is carried on a dental bite and the subject is permitted freedom of movement within limits; reasonable ambient illumination is permissible. Sensitivities of the order of 40 sec. arc per cm. of trace deflexion are readily obtainable with a dynamic range in excess of 50 db. Although primarily designed as a device for measuring the movements of eyes, the technique has been used for other purposes, where displacement recording is required without the necessity for loading the moving member. (Author's summary)

12050
Carhart, R., 1959
and J. F. Jerger
A PREFERRED METHOD FOR CLINICAL DETERMINATION OF PURE-TONE THRESHOLDS.—Northwestern Univ. Audiology Lab., Evanston, Ill.; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 59-91, Sept. 1959. 14 p.

The Hughson-Westlake method for obtaining pure-tone thresholds uses a series of tonal ascents. The method encourages stability of reactions by eliciting on-effect responses. It yields a measure of unadapted level of acuity. Moreover, since moment-to-moment fluctuation in acuity is small for most listeners, theory predicts that the Hughson-Westlake method will yield thresholds which are clinically equivalent to those obtained by patterning similar tonal presentations in descending or in "threshold crossing" sequences. Experimental exploration with 36 normal-hearing subjects confirms this expectation. Hence, the Hughson-Westlake method is recommended for clinical use. (Authors' abstract) (29 references)

12051
Danilov, V. E. 1961
[EVALUATION OF CARDIAC RHYTHM DISTURBANCES IN FLIGHT PERSONNEL IN THE PHYSICAL EXAMINATION FOR AVIATORS] Otsenka narushenii serdechnogo ritma u letnogo sostava pri vrachebno-letnoi ekspertize [Abstract]. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 82. Feb. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (2): 133-134. New York: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

The principal types of disturbance of cardiac rhythm encountered in flight-medical evaluations are discussed. Functional sinus bradycardia without circulatory disturbances or pathology does not affect altitude tolerance; therefore flight duty is not precluded. Sinus tachycardia is suggestive of thyrotoxicosis and calls for an investigation of thyroid functions. Inconstant sinus tachycardia and sinus arrhythmia without pathology are considered unimportant. The presence of extrasystoles calls for evaluation after hypoxia tolerance tests together with ECG in an altitude chamber. Disappearance or reduction of extrasystoles is considered a positive sign. Diagnosis of paroxysmal tachycardia disqualifies the individual from flight in all cases. The appearance of atrioventricular rhythm on the ECG demands evaluation in conjunction with a clinical examination.

12052
Dimond, E. G., 1959
A. Benchimol, and D. Waxman
PHONOCARDIOGRAPHY.—In: The first international symposium on cardiology in aviation, p. 19-36. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].

A brief analysis of the recent advances in auscultation and phonocardiography is made. The importance of the second heart sound in congenital heart disease and pulmonary hypertension is emphasized. The systolic murmur in patients with intracardiac shunt decreases as pulmonary hypertension develops and may eventually disappear completely as the pulmonary pressure reaches systemic level. Emphasis is placed on the importance of reference tracings in phonocardiography. The carotid pulse, venous pulse, and apex-cardiogram were found to be especially useful. (Authors' summary) (41 references)

12053
Enderle, P., 1959
G. Kettenmeyer, R. Rillaert, and E. Evrard
[TWO CASES OF LATENT CORONARITIS LESIONS IN PILOTS OF 25 AND 23 YEARS OF AGE] Deux cas de lésions muettes de coronarite chez des pilotes de 25 et 23 ans.—Médicine aéronautique (Paris), 14 (1): 51-59. 1959. In French, with English summary (p. 59).

Coronary sclerosis was discovered during autopsy of two fighter pilots aged 23 and 25, respectively, who were killed in air accidents. Fitness examinations during original selection of flying personnel, and routine physical checkups gave no indication of the disease. The possible role of coronary disease in the genesis of air accidents is discussed. Based on a study of the two cases reported the author concludes that: (1) electrocardiography after hard work should be included in the medical examination of every fighter pilot in order to detect beginning lesions of coronaritis, and (2) in unexplained air accidents the presence of coronary lesions in young pilots, diagnosed or undiagnosed during clinical examination, does not furnish a sufficient explanation as to the cause of the accident.

12054
Evrard, E. 1959
USE AND VALUE OF THE STEP TEST IN MILITARY PILOT SELECTION.—U. S. Armed Forces Med. Jour., 10 (6): 659-674. June 1959.

The step test has been administered over a nine-year period to 3,329 subjects, age range 17-27 years, including applicants, student pilots, and fighter pilots in the Belgian Air Force. The final evaluation of statistical and clinical data led to the conclusion that the use of the step test is justified as an elimination test at the initial medical examination of a candidate pilot, since the test sets the minimum threshold of cardiac tolerance required of candidate military pilots at that time. An index value of 70 attests to an acceptable degree of cardiac tolerance in subjects who are otherwise medically qualified. The attrition rate due to elimination for medical reasons and fatal accidents during training was higher in subjects whose index fell between 65 and 69. An index below 65 should lead to immediate elimination. An index between 65 and 69 should indicate at least temporary unfitness until the subject can reach a score of 70 or more. Electrocardiograms recorded immediately after the step test only rarely showed some slight transitory signs of cardiac insufficiency. The step test enables the medical examiner to follow variations in cardiac tolerance to physical exertion during various phases of flight training. Since the step-test index has no relationship to the specific aptitudes for flying, it has no value in predicting success or failure in pilot training and is not to be regarded as a classification test.

12055
García Villalobos, L. A. 1960
[FLIGHT SAFETY AND ENCEPHALOGRAPHY] Seguridad de vuelo y encefalografía. —— Aviación (Lima), 24 (381): 36-41. July 1960. In Spanish.

Electroencephalographic examination of pilots and flying personnel is of value in detecting cerebral lesions, thereby minimizing the risk of aircraft accidents. The electroencephalogram is also capable of detecting changes in cerebral activity caused by hyperventilation, hypoglycemia, hypnotic and other drugs, intense sensory stimuli, anxiety, fear, increased carbon dioxide tension, and flight fatigue. It is recommended that the EEG be incorporated in the medical examinations for pilot selection and in the periodic medical screening of personnel for the appearance of latent conditions.

12056
Gastaut, H., and C. Gibson 1960
ELECTROGRAPHIC STUDY OF SYNCOPAL PREDISPOSITION. —Aerospace Med., 31 (7): 531-542. July 1960.

Physicians concerned with the selection and health of aircrew should find the ocular compression test, carotid sinus compression test, and Valsalva test of great value in assessing the syncopal predisposition of individuals. While younger subjects are more susceptible to ocular compression and older subjects react more to both carotid sinus compression and Valsalva tests, the only safe procedure in the practice of aviation medicine is to carry out all three tests on each subject. All three tests should be applied to the sitting subject with simultaneous and continuous electroencephalographic, electrocardiographic, and blood pressure recording. The tests should be mandatory for all aircrew following head injury, since post-traumatic syncope is a well-established entity which cannot be predicted by a routine resting EEG test. (Authors' conclusions, modified)

12057
Gol'din, N. A., and P. V. Kniazev 1959
[ELECTROCARDIOGRAPHIC EXAMINATIONS IN CHRONIC DISEASES OF THE HEART MUSCLE IN FLIGHT PERSONNEL] Elektrokardiograficheskie issledovaniia pri khronicheskikh zabolevaniiakh serdechnoi myshtsy u letnogo sostava.—Voenno-meditsinskii zhurnal (Moskva), 1959 (1): 64-69. Jan. 1959. In Russian.
English translation in: Military Medical Journal, 1959 (1): 96-104. New York: U. S. Joint Pub. Research Serv., no. 1555-N, May 14, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce.)

The changes of various components of the electrocardiogram were studied in 73 patients (flight personnel) with chronic diseases of the cardiac muscle during rest and in stress. The functional stress tests used were: modified step-test, inhalation of an anoxic gas mixture (10% O2 and 90% N2), physical exercise (15 squats), and a test with a U-shaped manometer. The most frequently encountered electrocardiographic changes in chronic diseases of the cardiac muscle are: a reduced voltage of the waves, smoothing out, diphasicity and flattening of the T wave in the standard as well as in the chest leads, increased systolic index, and a deviation of the cardiac axis to the left. If the electrocardiogram is normal in the resting state in presence of symptoms indicating a latent form of coronary insufficiency, the decision of the flight medical board should be based on changes observed during the anoxic test. An individualized, cautious approach is emphasized in the use of stress tests with individuals suspected of latent coronary insufficiency.

12058
Gol'din, N. A. 1959
[AEROMEDICAL BOARD TESTS OF FLIGHT PERSONNEL SUFFERING FROM DISTURBANCES IN THE AUTONOMOUS FUNCTIONS, EXCITABILITY, AND CONDUCTION OF THE HEART] Vrachebnaia ekspertiza letnogo sostava pri narusheniiakh funktsii avtomatizma, vozbudimosti i provodimosti serdtsa.—Voenno-meditsinskii zhurnal (Moskva), 1959 (9): 56-63. Sept. 1959. In Russian.
English translation in: Military Medical Journal, 9: 94-104. New York: U. S. Joint Pub. Research Service, No. 2061-N, Dec. 28, 1959. (Available at Office of Technical Services, U. S. Dept. Commerce)

A detailed discussion is presented of various abnormalities of heart function. Diagnostic procedures are described to differentiate between functional and organic origin, and aeromedical board flight fitness tests are outlined.

12059
Hamburger, R. J., and G. J. Puister 1958
[VASCULAR DISEASE AND THE OXIDATION-REDUCTION POTENTIAL IN THE SALIVA] Vaataandoeningen en het verloop van oxydoreductie potentialen in het speeksel.—Aeromedica acta (Soesterberg, Netherlands), 5 (1956-57): 403-411. [1958]. In Dutch, with English summary (p. 410-411).

The oxidation-reduction potential of the saliva of a group of healthy men was determined with the object of looking for changes which might give an indication of a certain proneness to degenerative vascular diseases. The procedure may furnish a quick and easy field method for determining physical fitness in aviators with regard to the cardiovascular system. A striking difference was observed in the course of changes during the first 5 minutes after the saliva had been taken from subjects age 20-30, 30-40, and 40-50 years. In the two younger groups, the rate of change during this time was 18 and 19 millivolts respectively, but in the oldest age group it was 52. For the time lapse from 5-30 minutes no such difference was found. These findings may give support to the idea that the change in oxidation-reduction potential of the saliva as a function of the time elapsed after taking the sample may be connected with metabolic processes which are also operative in the process of vascular degeneration. (Authors' summary, modified)

12060
Harbold, G. J., and J. W. Greene 1961
AN OPERATIONAL EVALUATION OF AN AUDIOMETRIC TEST ROOM AND THREE AUDIOMETERS ABOARD THE USS SARATOGA.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-2005, Subtask 1). Report no. 12, June 29, 1961. ii+19 p.

The study investigated the adequacy of an audiometric test room and the relative effectiveness of three audiometers aboard the USS SARATOGA. Ambient noise measures in the

test room and audiometric data were obtained during three operational conditions of the carrier. The results showed the double-walled test room to be adequate and no clinically significant differences among the three audiometers nor among the three operational test conditions. (Authors' abstract)

12061
Hoogenboom, W. P. H., 1958
and M. P. Lansberg
FUNCTIONAL MIDDLE- AND INNER-EAR SCAR PROGNOSIS IN FLYING PERSONNEL.—Aeromedica acta (Soesterberg, Netherlands), 5 (1956-57): 241-249. [1958]. In English.

A five-year follow-up survey is presented of threshold audiograms of pilot candidates and flying personnel of commercial airlines. The study was intended to make a contribution to our knowledge of hearing-loss prognosis in flying personnel. The test subjects constituted a preselected group since nearly all major defects, such as active lesions or clearly progressive anomalies, had been reasons for rejection at the pre-enlistment medical examination. This restriction, instead of invalidating the conclusions, can be considered an asset to a purely pragmatic problem, which might be termed "aeronautical vulnerability of scarred ears", the word "aeronautical" indicating both a possible conditioning factor to further damage and occupational hearing requirements. The term "scarred ears" is to be understood as applying to the functional middle ear and to the inner ear with VIIIth nerve impairment inflicted by infection, trauma, allergy or otherwise. The results of the study lend no support to the supposition of critical or even increased vunerability of "scarred ears". (Authors' summary, modified)

12062
Jerger, J. F., 1960
and T. Tillman
A NEW METHOD FOR THE CLINICAL DETERMINATION OF SENSORI-NEURAL ACUITY LEVEL.—Northwestern Univ., Evanston, Illinois; issued by School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-31, Jan. 1960. 6 p.

A new method for the clinical determination of sensori-neural hearing loss is proposed. Thermal noise of fixed intensity is presented to the skull through a standard bone-conduction oscillator mounted at the center of the forehead. The amount by which this noise shifts the pure-tone air-conduction threshold in a particular ear is subtracted from the shift produced by the same noise level in normal ears. The resulting number is called sensori-neural acuity level (SAL) in decibels. (Authors' abstract)

12063
Johnson, W. H., 1960
J. Brydon Smith, and J. A. Sullivan
ACCELERATION AS A MEANS OF DETERMINING THE SENSITIVITY OF THE COMPONENTS OF THE NON-AUDITORY MEMBRANOUS LABYRINTH.—Annals Otol. Rhinol. and Laryngol., 69 (2): 610-621. June 1960.

A procedure is described for comparing the responses of normal and diseased labyrinths to controlled accelerations. The comparisons are facilitated by a newly-devised apparatus which enables humans to be exposed to various magnitudes and types of motion, thereby making it possible selectively to stimulate otoliths and semicircular canals. By simultaneously exposing the head to angular motion in any of two planes of space at right angles to each other, a resultant acceleration is produced in the third remaining orthogonal plane. Proper orientation of the head under these conditions allows determination of the threshold of excitation to angular motion of the various semicircular canals individually. Furthermore, by the proper positioning of the subject with the head fixed relative to the trunk, rotation of the body at various speeds enables a determination of the threshold of excitation of the otolith to be made. In both of these arrangements, both subjective and objective vestibular responses can be accurately recorded during rotation, the latter by means of a closed-circuit television which enables all types of eye responses to be recorded with relative ease. (From the authors' summary)

12064
Kidera, G. J. 1960
FLYING IS A VISUAL SKILL.—Optometric Weekly (50th Anniversary Edition): 134-136. March 3, 1960.

Periodic eye examination of United Airlines pilots and other personnel have greatly contributed to the safety record and efficiency of the organization. The visual requirements for pilots are outlined, and eye examination methods and occasional pathological findings are briefly described.

12065
Krasno, L. R., 1960
and G. J. Kidera
THE BALLISTOCARDIOGRAPHIC AND PLETHYSMOGRAPHIC RESPONSE OF "NORMAL" AND CARDIAC PATIENTS TO NITROGLYCERIN.—Aerospace Med., 31 (11): 925-932. Nov. 1960.

A technique for physiologically identifying the possible presence of an early arteriosclerotic process based on relative changes occurring in the ballistocardiogram and plethysmogram following the hemodynamic response to nitroglycerin is described for 354 normal individuals (free of cardiovascular disease) and 64 individuals with some form of heart disease.

12066
Kuznetsov, S. V. 1961
[EVALUATION OF THE EFFECTIVENESS OF EXPERIMENTAL PSYCHOLOGICAL TESTING METHODS ON FLIGHT PERSONNEL DURING HOSPITAL EXAMINATION] Otsenka effectivnosti metodov eksperimental'no-psikhologicheskogo issledovaniia letnogo sostava pri gospital'nom obsledovanii.—Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 44-47. Feb. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (2): 65-70. Washington: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

A battery of psychological tests was administered to 38 fliers admitted to a hospital for medical board evaluation. The group included (a) 8 individuals with neurasthenia, one with hysteria, three with traumatic cerebrasthenia, and two with neurocirculatory asthenia of the hypertensive type; (b) individuals with somatic disorders; (c) personnel referred for poor flight performance; and (d) healthy individuals. Most pronounced deviations

were observed in the neurasthenic individuals and in subjects over 40 years of age suffering from neurocirculatory asthenia of the hypertensive type. The best discriminating procedures were stability and range and distribution of attention tests; studies of the nature of elaboration and revision of conditioned reflexes; and studies of the stability of attention by the correction method. Representative cases are discussed in some detail.

12067
Lalli, G., 1961
and G. Venditti
[NORMAL VALUES, CORRELATIONS WITH AGE, RECIPROCAL CORRELATIONS BETWEEN TOTAL CHOLESTEROL, TOTAL LIPIDS, KUNKEL TEST WITH PHENOL, LIPOPROTEIN ON THE BASIS OF DATA FROM SUBJECTS IN THE ITALIAN AIR FORCE: PROPOSED LIMITS COMPATIBLE WITH FLYING FITNESS] Valori normali, correlazioni con la età, correlazioni reciproche tra colesterolo totale, lipidi totali, test di Kunkel al fenolo, lipoproteine sulla scorta dei risultati conseguiti in soggetti appartenenti all'aeronautica militare italiana: Proposta di limiti compatibili con l'idoneità al pilotaggio.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 366-398. Roma, 1961. In Italian.

Normal values were determined and tabulated for the serological tests used in the diagnosis of arteriosclerosis (total cholesterol, total lipids, Kunkel's phenol test, β/α lipoprotein ratio) and correlated with age in 543 Italian Air Force personnel between 18 and 60 years of age. Accuracy of the limits which are compatible with flying is discussed. The values determined for the tests led to the differentiation of three categories which may be used in aviation medicine: (1) zone of values most probably normal, (2) zone of values definitely pathological, and (3) zone of values most probably pathological. The normal limits for flight fitness should not exceed the following values: around 260 mg./100 cc. for cholesterol; 30 U.S.B. for Kunkel's phenol reaction; and around 4.2 for the β/α lipoprotein ratio. It is advisable to exclude from flying the 5% of pilots with ages above 40 years. The tests may be repeated annually during control examinations for subjects who presented values above the prescribed values in order to determine flight fitness.

12068
Laval, P., 1961
F. Bostem, J. L. Ardisson, and J. Feliciano
ON THE USE OF ELECTROENCEPHALOGRAPHY DURING TESTS OF RESPIRATORY FUNCTION.—In: Cerebral anoxia and the electroencephalogram, p. 391-397. Springfield, Illinois: Charles C Thomas, 1961.

A review is presented of the accuracy and safety offered by the electroencephalogram (EEG) during respiratory function tests because of the precision of the changes in the EEG records, the regularity of its responses during variations of oxygen hemoglobin saturation in controlled hypoxia tests and its usefulness in prognosis by the use of estimated "cerebral recovery" during oxygen resaturation. It is reported that hypoxia is the determining factor for the observed EEG modifications rather than the accompanying alkalosis or kaliemia. (Authors' conclusion, modified)

12069
Lomonaco, T.
[PSYCHO-PHYSICAL SELECTION CRITERIA FOR AVIATION PERSONNEL] Criteri per una moderna selezione psico-fisica de personal aeronavigante.—Rivista di medicina aeronautica e spaziale (Roma), 22 (2): 7-30. April-June 1959. In Italian, with English summary (p. 24).

Essentially the same: [CRITERIA FOR CURRENT PSYCHOPHYSICAL SELECTION OF FLYING PERSONNEL IN ITALY] Criteria per la selezione psicofisica attuale del personale aeronavigante in Italia.—In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 3-12. Roma, 1961. In Italian, with English summary (p. 11).

Selection procedures recommended for aviation personnel combine old and well-established methods with new concepts of psychological and physiological testing. The principal methods of examining the sense organs, the respiratory and cardiovascular systems, and neuropsychiatric fitness of pilot candidates are briefly outlined. The multiplicity of these methods demands judicious evaluation and interrelation of results on the part of the examiner. On the other hand, it offers greater flexibility in terms of selecting candidates for highly specialized physical and mental tasks. However, in view of the high rate of aviation accidents caused by pilot error, only the most rigid standards should apply. Space flight has introduced entirely new selection criteria, such as subgravity, confinement, and extreme temperature tolerances.

12070
Manning, G. W. 1959
ROYAL CANADIAN AIR FORCE EXPERIENCES IN ELECTROCARDIOGRAPHIC EVALUATION.—In: The first international symposium on cardiology in aviation, p. 121-128. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].

Essentially the same: AN ELECTROCARDIOGRAPHIC STUDY OF 17,000 FIT, YOUNG ROYAL CANADIAN AIR FORCE AIRCREW APPLICANTS.—Amer. Jour. Cardiol., 6 (1): 70-75. July 1960.

The electrocardiograms of 17,000 fit Royal Canadian Air Force aircrew applicants were reviewed. In 954 instances abnormalities of varying degrees were observed, and repeat electrocardiographic and clinical studies were conducted. Eighty-six applicants were classed as unfit for pilot training on the basis of abnormal electrocardiographic findings which could not be explained on a physiologic or environmental basis. Several of these were found to have organic heart disease. A larger number were found to have questionable findings either in the history or on clinical examination (cardiac murmurs, elevated blood pressure, questionable roentgenographic findings, history of tachycardia, syncope, trauma to the chest, infectious diseases, etc.) which may or may not have contributed to the electrocardiographic findings. (From the author's summary)

12071
Moravek, M. 1961
THE STUDIES OF THE SUPERIOR NERVOUS ACTIVITY IN THE SELECTION THEORY AND PRAXIS.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 90-93. Roma, 1961.

A brief review is presented of methods used to study higher nervous activity. Mentioned are association experiments modified to study a subject's internal inhibition. The subject responds to the association impulses and simultaneously undergoes an examination consisting of speech reinforcement or he carries out a simple motor activity. This method aids in the diagnosis of minute neurotic symptoms. Whether it can be of prognostic value in pilot selection and training is questionable.

12072
Nober, E. H. 1958
AN INVESTIGATION OF THE MAGNITUDES OF GALVANIC SKIN RESISTANCE RESPONSES THAT OCCUR WITH DIFFERENT INTENSITY LEVELS OF SHOCK, CONDITIONED TONE AND EXTINCTION TONE.—Ohio State University Research Foundation, Columbus, Ohio (Contract N60NR22525); issued by U.S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 18 02 99, Subtask 1). Report no. 75, Feb. 15, 1958. ii+34 p.

Experiments were performed to establish and extinguish a conditioned galvanic skin resistance reflex, using electric shock as unconditioned and sound as conditioned stimulus. The magnitude of the skin reflex was studied as a function of (1) the intensities of shock, the conditioned tone, and the extinction tone; and (2) the four response criteria measures. The experiment involved 170 subjects and was divided into five parts; each part treated a different aspect of conditioning and extinction of the responses. The magnitude of the reinforcement responses varied as a function of the intensity of the shock while the extinction responses varied as a function of the intensity of the extinction tone; the magnitude of responses also varied as a function of the criterion measures used to quantify the responses. Stimulus intensity dynamism was repeatedly, although not consistently, observed among the means. It is concluded that the resistance response values elicited during the galvanic skin reflex hearing test are not all-or-none in magnitude but grossly reflect the intensity of the tone stimuli. (Author's summary)

12073
O'Connell, M. H. 1958
HEARING ACUITY OF AIR FORCE RECRUITS.—School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-70, April 1958. 4 p.

The hearing testing facility for all Air Force recruits beginning training at Lackland Air Force Base is described, including the demountable sound-treated test booths, Rudmose automatic audiometers, and general testing schedules and procedures. A sample of duplicate automatic audiometer tracings was taken; a total day's run was taken once each third day for a 30-day period which included May and June 1957. The total number of audiograms duplicated was 5,170. They were graded and threshold values assigned. Hearing "norms" were established for age groups between 17 and 29 years. The audiograms will serve as reference audiograms and will be the basis for individual studies of Air Force environments on hearing acuity over a period of years. (Author's summary, in part)

12074
O'Connell, M. H., and P. M. Baccaro 1959
MEASUREMENT OF AUDITORY THRESHOLD BY MANUAL AND SAM AUTOMATIC AUDIOMETRY.—School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 58-131, March 1959. 10 p.

Threshold data were obtained on two groups of unskilled listeners—one group with "normal" hearing and the other with "subnormal" hearing. No significant differences were found between the single descent and triple descent audiometric technics when averaged over the two groups; test-retest reliability coefficients were .84 and .96 for the normal and subnormal groups, respectively. The School of Aviation Medicine Model 57-1 automatic audiometer provided test results which were significantly different from the average of single and triple descent audiometry. Test results showed significantly poorer thresholds at 500, 1000, and 6000 c.p.s., a significantly better threshold at 4000 c.p.s., and no significant difference at 2000 c.p.s. for the normal group. The subjects in the subnormal group showed significantly poorer thresholds at 500, 1000, 2000, and 6000 c.p.s., significantly better thresholds at 4000 c.p.s. and no significant difference at 3000 c.p.s. Although the results showed statistically significant differences between manual and automatic audiometry, the three test methods yielded mean threshold scores which were highly similar. (Authors' abstract)

12075
O'Connell, M. H., and H. Hamlyn 1959
SERIAL AUDIOGRAMS MEASURED BY BEKESY-TYPE AUDIOMETRY.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 59-97, Sept. 1959. 7 p.

In an attempt to study the variability of serial audiograms, 42 young Lackland airmen were given binaural audiograms on nine different days at the test frequencies provided on the Rudmose ARJ-3 Békésy-type audiometer; 71% of the subjects tested showed a range of threshold scores of 20 db. or more at least once, and several subjects showed this range of scores more than once at a different or the same frequency. Subjects who showed the greatest variability were not those with the greatest hearing impairment. The variability appeared to be erratic and unpredictable, and probably occurs with most people at one time or another. No immediate explanation of this phenomenon is forthcoming at the present time. (Authors' abstract)

12076
Polistena, S. 1961
[STRATIGRAPHY OF THE PULMONARY APICES IN THE SELECTION OF FLYING PERSONNEL] La stratigrafia degli apici polmonari nella selezione del personale aeronavigante.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 136-140. Roma, 1961. In Italian.

Stratigraphy of the respiratory apparatus is of great value in the selection of flying personnel and in the periodic control examinations as it facilitates dissociation of pulmonary images and clearly demonstrates small pulmonary lesions or those barely perceptible on conventional thoracic radiograms. When pleural or pulmonary parenchymal lesions are evident on radiograms, stratigraphy aids in giving a precise diagnosis. It is of particular value in illuminating lesions of the pulmonary apices. Included are standard radiograms and stratigraphy of cases with pulmonary lesions to illustrate the diagnostic importance of stratigraphy. It is recommended that

this technique be adapted by flight surgeons for use during routine control examinations of the lung apices.

12077
Reed, G. F. 1961
AUDIOMETRIC RESPONSE CONSISTENCY, AUDITORY FATIGUE AND PERSONALITY. —— Perceptual and Motor Skills, 12 (2): 126. April 1961.

The suggestion was investigated that, in prolonged sessions of audiometric tests, hysteric subjects will build up reactive inhibition more rapidly than anxious subjects and therefore show progressively more inconsistency and decline in response accuracy. Thirty schoolchildren (15 predominantly hysteric and 15 predominantly anxious) were each subjected to a 15-minute session limited to high-frequency tones after a routine binaural pure-tone audiometric test. The hysteric group tended to be less consistent than the anxious group, and the majority showed elevation of threshold as the task was prolonged. These findings may be relevant to considerations of auditory fatigue.

12078
Robert, A., 1958
and M. B. Dell
[ELECTROENCEPHALOGRAPHY AS A ROUTINE MEDICAL EXAMINATION OF FLIGHT PERSONNEL: PRELIMINARY STUDY COVERING 1056 CASES] L'électroencéphalogramme systématique du personnel navigant: étude préliminaire portant sur 1056 cas.—Médecine aéronautique (Paris), 13 (1): 33-47. 1958. In French, with English summary (p. 47).

Routine EEG examinations were performed for selection purposes on 1056 healthy candidates for staff service in the "Air France" as well as on the regular flight staff. Three types of EEG records were obtained: "normal", "borderline", and "disturbed". Relationships were established between EEG records and personal histories. Light-flash and metrazol stimulation was applied to subjects who standard EEG records were grossly disturbed without any apparent cause. Only those subjects whose convulsion threshold was lowered after metrazol injection were eliminated. This procedure permitted the rehabilitation of a number of cases whose EEG was unfavorable. Only 2.6% of the pilot candidates, 2.1% of the stewards, and 2.3% of the stewardesses had to be rejected.

12079
Robert, P., 1958
and J. Vertut
[SOME CONSIDERATIONS REGARDING BROKEN AUDIOMETRIC CURVES OF PILOTS] Quelques considerations sur les courbes audiometriques en lysis chez l'aviateur.—Médecine aéronautique (Paris), 13 (4): 393-395. 1958.

On the basis of observations and experimental studies involving numerous cases of pathological conditions of the ear, it is asserted that audiometric curves can be used to reveal the etiological situation. A sudden break in the curve may indicate one of three possibilities: (1) following extensive flying time, the patient has had a short, severe, traumatic episode leading to permanent cochlear damage; (2) he has suffered acoustical trauma of which there may be partial future improvement (treatment with placental extracts or vitamins A and B_1 is recommended); or (3) he has suffered acoustical trauma acting on an already weakened cochlea by some acute, subacute, or chronic disease, causing progressive deafness after several days of flying and requiring several weeks of diligent care to cure. If the break in the curve is gradual it can usually be assumed that progressive tympanic sclerosis in the patient has set in, inducing ankylosis of the ossicles. In this case, treatment can only ease the condition rather than bring about complete recovery.

12080
Scano, A., 1961
and F. Rossanigo
[METHODS USED AND DATA OBTAINED IN THE EXPERIMENTAL STAGE FOR THE EVALUATION OF RESPIRATORY AND CARDIOVASCULAR FUNCTIONS] Metodi impiegati e dati ottenuti in fase sperimentale per la valutazione delle funzioni respiratoria e cardio-vascolare. —— In: II congresso mondiale e IV europeo di medicina aeronautica e spaziale, Vol. I, p. 13-54, 10 unpaged leaves. Roma, 1961. In Italian, with English summary (p. 49-51).

A survey is presented of respiratory and cardiovascular function tests and their requirements as applied to the selection of flying personnel. These include the methods of testing respiratory processes, gas diffusion through the alveolar wall, cardiovascular activities, Flack test, Schneider test, and other physical exercise tests. A discussion is presented of the Nisida 1958-1959 and Rome 1959 experiments undertaken to integrate the data of functional and psychological selection in fitness tests given to pilot candidates.

12081
Scano, A. 1961
[EXPERIMENTAL RESULTS AND PRACTICAL CONSIDERATIONS CONCERNING THE USE OF RESPIRATORY AND CARDIOVASCULAR FUNCTION TESTS] Risultati sperimentali e considerazioni pratiche intorno all'applicazione delle prove funzionali respiratorie e cardio-circolatorie in aeronautica. —— Rivista di medicina aeronautica e spaziale (Roma), 24 (4): 533-551. Oct.-Dec. 1961. In Italian, with English summary (p. 550).

Various experiments (Nisida I-V, 1958-1961; Roma I-IV, 1959-1961) with respiratory and cardiovascular function tests of military pilot trainees and students at the Italian school of aviation medicine are reviewed and the results tabulated. The methods used were pulmonary volume determinations and ergometric studies in closed circuit and during barometric decompression. A comparison of functional, clinical, and laboratory data confirm the value of these tests subject to their uniform and accurate performance and objective evaluation criteria. These tests are of value in the selection and periodic evaluation of flying personnel.

12082
Schwichtenberg, A. H., 1961
D. D. Flickinger, and W. R. Lovelace
MEDICAL MACHINE RECORD CARDS: THEIR DEVELOPMENT AND USE IN THE ASTRONAUT SELECTION PROGRAM.—In: Bio-assay techniques for human centrifuges and physiological effects of acceleration, p. 147-173. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

Under the auspices of the U.S.A.F. Air Research and Development Command, special mark sense type

Machine Record Cards were developed at the Lovelace Foundation to record complete medical history, special aviation history, physical examination and various specialists examinations, radiological and laboratory tests, as well as physiological data. In order to similarly record the results of stress tests, cards were developed for recording heat tolerance, tolerance to g forces on the centrifuge, altitude tolerance in a partial pressure suit, tilt table test, cold pressor test, and tracking under high noise levels. Cards were also developed to record complete anthropological data and various psychological variables. All data on the astronaut candidates were recorded in this manner. This approach to data recording in the life sciences opens a way to the use of computers and other modern data processing equipment. (Authors' summary)

12083
Smith, George B. 1959
and L. E. Lamb
VECTORCARDIOGRAPHY IN AEROSPACE FLIGHT: APPLICATIONS AND RATIONALE.—In: The first international symposium on cardiology in aviation, p. 37-50. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiol., 6 (1): 62-69. July 1960.

The vectorcardiogram offers three distinct advantages over the conventional electrocardiogram: (1) It enables relatively undistorted representation of the electrical forces of the heart; thus the true magnitude and direction of the spatial vectors are available. (2) The loop or spatial pathway described by the vectorcardiogram provides a measurement that is not available in the routine electrocardiogram; this may be plotted along a time base as in the linear vectorcardiogram. (3) The use of a cathode-ray oscilloscope rather than a direct writing instrument allows greater accuracy in presentation of rapid or minute changes in electrical forces. Vectorcardiography has an important application in assessing the pilot's cardiovascular system and in monitoring cardiovascular functions during flight. (From the authors' summary)

12084
Stonehill, R. B., 1960
N. Schalet, W. Y. Fong, H. Saltzman, and H. B. Houser
PULMONARY VENTILATION FUNCTION IN MILITARY RECRUITS DURING HEALTH AND ACUTE VIRAL RESPIRATORY DISEASE, INCLUDING PNEUMONIA.—Amer. Rev. Respiratory Diseases, 81 (3): 315-320. March 1960.

The pulmonary ventilatory function tests of maximal breathing capacity, vital capacity, and one-second and three-second vital capacities were performed serially at two- to three-week intervals for eleven weeks in a group of 60 Air Force recruits. Moderately severe acute respiratory disease occurred in 34 men, 14 of whom also had evidence of pulmonary infiltration of mild degree by roentgenographic examination. The remaining 26 men remained free of respiratory infection by the criteria established. The only test that showed significant change at any of the periods of observation was the vital capacity. Although a significant decrease in vital capacity occurred on one occasion in the group without respiratory disease, those patients with pulmonary infiltration showed a more marked decrease during the time of their illness. The reproducibility of the tests, even in the presence of respiratory disease without pneumonia, indicates that considerable confidence can be had that significant variation in the results will not occur in multiple tests in an individual because of technical reasons. (Authors' summary)

12085
Stonehill, R. B., 1959
J. E. Reed, and G. W. Parker
ROENTGENOLOGIC EVALUATION OF FLYING PERSONNEL AT SIMULATED ALTITUDE BY USE OF PORTABLE EQUIPMENT.—Aerospace Med., 30 (10): 751-754. Oct. 1959.

Using portable X-ray equipment, it is possible to obtain roentgenograms of diagnostic quality on ascent to simulated altitude. The procedure is described, and its application to pulmonary problems is discussed in terms of eight individuals.

12086
Stream, R. W., 1961
and F. McConnell
A COMPARISON OF TWO METHODS OF ADMINISTRATION IN BEKESY-TYPE AUDIOMETRY. — Jour. Auditory Research, 1 (4): 263-271. July 1961.

The present study was undertaken to evaluate the effect exerted on the hearing threshold by two methods for the adjustment of a pure tone by the listener when using automatic audiometry. At the same time an attempt was made to assess the relative interplay that two rates of intensity change plus listener sophistication had upon the threshold. The data resulting from the tracing thresholds of the 42 subjects, each of whom was tested for 90 seconds under each of 12 different conditions, were subjected to statistical analysis to determine the significance of the effects of the several variables upon hearing thresholds of the two groups of listeners. The results clearly indicated a significant difference in such thresholds for 42 normal hearing individuals, with the tone to inaudibility method yielding the superior hearing levels. This finding appeared to be independent of the amount of previous experience the listener had had in the area of audiometry. (Authors' summary)

12087
Tabusse, L., 1960
and P. Finetti
[TESTS OF PULMONARY FUNCTION FOR THE SELECTION OF FLYING PERSONNEL] Sélection fonctionnelle pulmonaire du personnel navigant de l'aviation. — Revue des Corps de santé des armées (Paris), 1 (5): 653-679. Oct. 1960. In French.

The examination of the respiratory functions and the lungs in candidates for flight training in France includes: (1) a superficial examination to detect thoracic deformations and to determine respiratory frequency, thoracic expansion, and the ratio of inspiratory to expiratory time; (2) a radiological examination to detect pleural anomalies and to study the costo-diaphragmatic action, changes in pulmonary transparency, and changes in the mediastinum during respiration; and (3) spirometric tests to determine vital capacity, maximum second expiratory volume, and maximum respiratory capacity. Symptoms useful in the diagnosis of asthma, pulmonary emphysema, bronchial dilatation, and silicosis are also detected in the examination and by

analysis of the medical history. Examination of 52 candidates for pilot training revealed an average vital capacity of 5 liters, an average ratio of maximum second expiratory volume to vital capacity of 79.3%, and an average maximum breathing capacity of 137 liters per minute.

12088
Trusov, M. S. 1958
[APPARATUS FOR THE INVESTIGATION OF THE FUNCTIONS OF THE OCULAR MUSCLES.] Apparat dlia issledovaniia funktsii glaznykh myshts. — Voenno-meditsinskii zhurnal (Moskva), 1958 (11): 72-75. Nov. 1958. In Russian.

English translation in: Military Medical Journal, 1958 (11): 115-119. New York: U. S. Joint Pub. Research Serv., No. 1249-N, Feb. 19, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

A portable apparatus is described, which may be used for rapid examinations of the functions of external and internal muscles of the eye to determine the dominant eye, binocular vision, near point of clear vision (absolute and relative accommodation), latent strabismus for close distance, definite strabismus to 15°, and the gamma angle (angle enclosed between the optic axis and the visual axis).

12089
Tverdokhlebov, S. P. 1960
[ORGANIZATION OF PREFLIGHT MEDICAL CHECKUP OF AIRPLANE CREWS] Ob organizatsii predpoletnogo meditsinskogo kontrola letnogo sostava. — Voenno-meditsinskii zhurnal (Moskva), 1960 (4): 72-73. April 1960. In Russian.

Individual preflight checkups were instituted after it was recognized that pilots are reluctant to reveal information about their health that might ground them. The preflight checkup begins with observation of the pilot's appetite and behavior in the mess hall. Then the flight surgeon examines each pilot individually in a specially equipped room in regard to his emotional state, outward appearance of skin and mucosae, and pulse rate. A general examination in the Romberg position is included. The findings are entered in a pre-flight log and compared with the post-flight examination. Assignment to the next flight is based on the results. The author reports that 0.8% of pilots were grounded on the basis of a pre-flight checkup for health reasons or infraction of pre-flight regulations.

12090
Ungerleider, H. E. 1959
THE PROGNOSTIC IMPLICATIONS OF THE ELECTROCARDIOGRAM.—In: The first international symposium on cardiology in aviation, p. 129-140. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].

Essentially the same published in: Amer. Jour. Cardiology, 6 (1): 35-44. July 1960.

The role of the electrocardiogram in evaluating such cardiovascular disorders as coronary artery occlusion, myocardial infarction, bundle branch block, cardiac hypertrophy, and arrhythmia is indicated. A table of mortality ratios (actual/expected) in coronary disease is included.

12091
Vacca, C., 1961
F. Sparvieri, and L. Comignani
[OBSERVATIONS ON A RESPIRATORY AND CARDIOVASCULAR FUNCTION TEST BASED ON MAXIMUM VOLUNTARY WORK PERFORMED ON A CYCLOERGOMETER] Osservazioni su di un "test" di funzionalità respiratoria e cardio-circolatoria fondato sul massimo lavoro volontario eseguito al cicloergometro. — Rivista di medicina aeronautica e spaziale (Roma), 24 (2): 178-188. April-June 1961. In Italian, with English summary (p. 186).

The relationships were studied between percent increase per minute of muscular work performed on a cycloergometer, percent increase of oxygen uptake, and percent increase of pulmonary ventilation in the phase of adaptation. These parameters, together with other elements of a cardio-respiratory function test (Cal/liter, duration of work, cardiac frequency, arterial pressure, etc.), may be used to determine the sensitivity of central cardio-respiratory regulating mechanisms under conditions of maximum voluntary muscular work, especially as related to the type of work performed by pilots and flying personnel.

12092
Vasil'eva, V. V., 1960
E. B. Kossovskaia, V. P. Pravosudov, and I. N. Sal'chenko
[INVESTIGATION OF RESPIRATORY EXCHANGE, BLOOD OXYGENATION, AND THE RATE OF CARDIAC CONTRACTION DURING INTENSIVE WORK UNDER LABORATORY CONDITIONS] Issledovanie gazoobmena, oksigenatsii krovi i chastoty serdechnykh sokrashchenii pri intensivnoi rabote v laboratornykh usloviiakh. — Fiziologicheskii zhurnal SSSR (Leningrad), 46 (7): 842-850. July 1960. In Russian.

English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 46 (7): 978-988. Dec. 1960.

A study was made of the mechanism available for increasing circulatory supply of O_2 to tissues during muscular activity. Respiratory exchange indices, oxygen saturation of blood, and rate of cardiac contractions were determined in 3 athletes and 3 untrained subjects at rest, during a 5-min. stationary run, and during a 20-min. recovery period. There were greater changes in respiratory exchange of athletes, reflected in higher performance. The greater increase in "oxygen pulse" (oxygen consumption in ml./min./no. of cardiac contractions per min.), its slower return to normal and lesser reduction in blood oxygenation, characteristic of the athlete, indicated a better correlation between respiration and circulation in physical work. Adaptation to physical work was accomplished by either of two routes, depending upon the individual: (a) a higher increase of pulmonary ventilation, or (2) a higher increase of heart rate in comparison to other factors.

12093
Vastine, R. J. 1958
PREVENTIVE AND AVIATION MEDICINE IN PRIVATE PRACTICE.—Jour. Amer. Med. Assoc., 168 (9): 1185-1187. Nov. 1, 1958.

It is suggested that an annual health examination of pilots be made a standard requirement. It should be preceded by a thorough review of recent complaints

and of the personal and family histories. The physical examination should include: (1) pure-tone audiometry, (2) sigmoidoscopy, (3) an eye examination, (4) a urinalysis, (5) a blood cell count, (6) determination of sedimentation rate and of nonfasting blood sugar, of blood urea nitrogen and blood cholesterol levels, (7) a serologic examination, (8) blood typing, (9) microscopic examination of prostatic secretions, (10) an electrocardiogram, and (11) a two-meter postero-anterior chest X-ray. All defects, no matter how slight, should be recorded. It is further suggested that the physician should be consulted in matters pertaining to aircraft comfort, cockpit engineering, cabin ventilation, availability of oxygen equipment, and on aircraft safety in general.

12094
Waldron, D. E. 1958
CENTRAL REPOSITORY FOR HEARING CONSERVATION DATA: AN EXAMINATION OF THE FIRST YEAR'S REPORTING.—School of Aviation Medicine, Randolph Air Force Base, Texas. Review no. 3-59, Oct. 1958. 20 p.

The problem areas associated with the gathering and reporting of hearing conservation data according to U. S. Air Force Regulation 160-3 on "Hazardous Noise Exposure" are discussed. The problem areas include the class of hearing of each individual, department or location of work, job or noise code, time on job, exposure time, previous noise experience, and influence of room noise on hearing levels.

12095
Weiss, E. 1961
A COMPUTING AUTOMATIC AUDIOMETER FOR TESTING HEARING LOSS. — In: Digest of the 1961 [4th] International Conference on Medical Electronics (New York City), p. 69. Princeton, New Jersey: RCA Laboratories, 1961.

An audiometer has been developed incorporating information storage and decision making circuitry based on binary logic. Information is entered into this system by having the subject press a button each time he hears a tone presentation. The resultant threshold is printed out automatically on a standard audiogram by a specially modified typewriter. The machine may be externally programmed to vary the number of test frequencies and their order of presentation. A maximum of ten 5-decibel increment tests are made at any one frequency. Test tones are of two seconds duration, and it is virtually impossible to predict the time the next tone will be initiated. Responses are electronically examined for certain patterns of response, and if a pattern is recognized before ten tests, the machine prints out the score and goes on to the next frequency. (Quoted in part)

12096
Zaslavskii, I. E. 1959
[ON THE PRACTICE OF THE ENT FLIGHT MEDICAL BOARD IN CASES OF HEARING LOSS] O LOP ekspertize letnogo sostava pri ponizhenii slukha. [Abstract]—Voenno-meditsinskii zhurnal (Moskva), 1958 (11): 89. Nov. 1958. In Russian.

English translation in: Military Medical Journal, 1958 (11): 146. New York: U.S. Joint Pub. Research Serv., No. 1249-N, Feb. 19, 1959. (Available from Office of Technical Services, U.S. Dept. Commerce)

Flight personnel with hearing defects in varying degrees, mainly with defective sound perception in the speech range, were examined by the whispered speech method using words from the V. I. Voiachek Table (bass and treble frequency characteristics). The results indicated a need for a more differentiated use of words in the treble group. Three subgroups should be distinguished in the treble group; words consisting of phonemes with (1) high-pitch frequency characteristics, (2) medium-frequency, and (3) bass frequency characteristics. The differential use of these words serves not only to demonstrate hearing defects, but also to establish the character of frequently developing latent hearing difficulties in flight personnel.

g. Sanitation and Hygiene

[*Exclusive of cabins, for which see 11-e*]

12097
Duff, F. L., and T. A. Collins 1960
SPACECREW EPIDEMIOLOGY.—Astronautics 5 (2): 42, 44, 46, 48. Feb. 1960.

A discussion is presented of the preventive measures designed to reduce or eliminate the possibility of space-crew noneffectiveness, before or after launch, due to communicable disease processes. Three principal avenues of attack are described: (1) careful selection of space crews and their alternates in order to eliminate susceptibles, carriers, those with relapsing diseases such as malaria, and those with mild inapparent infections which might flare up under the stressful conditions of space flights; (2) isolation of the crew and support personnel from infecting agents, from contact with potential human carriers of disease or fomites emanating from outside the holding facility, and from potential disease vectors such as mosquitoes, flies, ticks, lice, mites, and bugs; and (3) development of acquired group immunity by artificial means prior to congregation, and administration of initial or booster immunizations for the particular launch area.

h. Public Health Aspects

12098
Galun, R., and G. Fraenkel 1961
THE EFFECT OF LOW ATMOSPHERIC PRESSURE ON ADULT AEDES AEGYPTI AND ON HOUSEFLY PUPAE. — Jour. Insect Physiol. (Oxford), 7 (3-4): 161-176. Dec. 1961.

The mortality of the mosquito Aedes aegypti at low atmospheric pressure (below 1/6 atmosphere) is due to at least three factors acting independently: desiccation, lack of oxygen, and low pressure. The mortality is higher at low air pressures than at atmospheric pressure of the same partial pressure of oxygen. At 60 mm. Hg there appears to be an effect of pressure on respiration over and above that caused by oxygen tension. Similar results were obtained with the pupae of the housefly Musca vicina. (Authors' abstract, modified)

12099
Hayes, W. J. 1961
SAFETY OF DDVP FOR THE DISINSECTION OF

AIRCRAFT. — Bull. World Health Organization (Genève), 24 (4-5): 629-642. 1961.

DDVP (0,0-dimethyl-2,2-dichlorovinyl phosphate) is an organic phosphorous insecticide proposed for use in the disinsectization of aircraft at vapor concentrations within the range of 0.15-0.25 mg. per liter of air for 30 minutes. Safety tests showed that men can withstand brief exposure to concentrations as high as 6.9 mg. per liter, and daily 8-hour exposure to concentrations as high as 0.5 mg. per liter without clinical effect and with little or no depression of blood cholinesterase. DDVP can be safely used at the concentrations and exposure periods required for aircraft disinsectization, although further studies are suggested before the procedure is definitely recommended. (Author's abstract, modified)

12100
Jensen, J. A., 1961
G. W. Pearce, and K. D. Quarterman
A MECHANICAL SYSTEM FOR DISPENSING KNOWN AMOUNTS OF INSECTICIDAL VAPOURS. — Bull. World Health Organization (Genève), 24 (4-5): 617-622. 1961.

The requirements for a self-contained semi-automatic insecticidal vapor dispenser for aircraft disinsectization are presented and a prototype device meeting these requirements is described along with data on its performance using the insecticide DDVP (0,0-dimethyl-2,2-dichlorovinyl phosphate). In this system a miniature air compressor forces air through a membrane impregnated with DDVP, and the vapor-laden air exits into the cabin through a tubular distribution system equipped with orifices. The vapor output is governed by the volume and the temperature of air passing through the membrane and the system is adaptable to all types of aircraft at present in use or projected for the near future. This system can also be adapted for use in the disinsectization of other closed or semi-closed spaces. (Authors' abstract, modified)

12101
Pearce, G. W., 1961
H. F. Schoof, and K. D. Quarterman
INSECTICIDAL VAPOURS FOR AIRCRAFT DISINSECTION. — Bull. World Health Organization (Genève), 24 (4-5): 611-616. 1961.

A general discussion is presented of the problem of aircraft disinsectization with special reference to the weakness of the present aerosol method, the limitations imposed by airline operators, government officials and others, and the potential value of insecticidal vapors as a means of aircraft disinsectization. An apparatus is described for the screening of insecticides for their vapor toxicity to houseflies and mosquitoes. This apparatus led to the discovery of DDVP (0,0-dimethyl-2,2-dichlorovinyl phosphate) and its remarkable vapor toxicity to insects, and to the subsequent studies of its potential use in the vapor state for aircraft disinsectization. (Authors' abstract, modified)

12102
Schoof, H. F., 1961
J. A. Jensen, J. E. Porter, and D. R. Maddock
DISINSECTION OF AIRCRAFT WITH A MECHANICAL DISPENSER OF DDVP VAPOUR. — Bull. World Health Organization (Genève), 24 (4-5): 623-628. 1961.

In-flight and on-ground tests in commercial aircraft demonstrated the feasibility of using DDVP (0,0-dimethyl-2,2-dichlorovinyl phosphate) vapor for disinsectization purposes. Treatment of the passenger compartments of DC-6 and DC-7 airplanes was accomplished by passing cabin air through a fibrous cartridge impregnated with DDVP. During in-flight tests, vapor concentrations of 0.20 and 0.24 mg. of DDVP per liter of air gave 100% mortality of caged houseflies located at 12 sites at three different levels and exposure for 30 minutes. No effect of the vapor was noticed on the cholinesterase levels of three individuals exposed to the treatment during 24 tests. (From the authors' abstract)

12103
Schreuder, O. B. 1960
PUBLIC HEALTH AND AEROMEDICAL ASPECTS OF INTERNATIONAL AIRLINE OPERATION. — GP (Kansas City, Mo.), 22 (4): 122-129. Oct. 1960.

The extensive international airline operations of the modern age have presented a diversity of medical problems which have required the enforcement of special precautions by airline medical departments. Prevention of the spread of diseases such as cholera, smallpox, typhoid, and yellow fever is being accomplished by disinsectization of aircraft to prevent transportation of infected vectors and by vaccination of aircrews against the major infectious diseases. The chief goal of the airline medical departments is the promotion of the health of employees by vaccination drives, periodic medical examinations, education to prevent contraction of diseases such as diarrhea, malaria, and infectious hepatitis, and, in ground personnel, prevention of accidents and noise-induced ear damage. Of importance to the public welfare is the maintenance of strict hygienic methods and purity of food aboard aircraft. The aeromedical problems of high altitude flight, particularly in the Boeing 707 jet, have been met by structural strengthening of the aircraft to prevent decompression, by provision of individual emergency oxygen masks, and by the familiarization of the aircrew with the physiology of hypoxia and decompression and with misconceptions of the hazards of high altitude flight.

9. TOXICOLOGY

a. General

12104

Durante, U. 1961

[GENERAL AND SPECIFIC PREVENTIVE MEASURES FOR SOME SPECIAL AVIATION OPERATIONS] Misure preventive generiche e specifiche relative ad alcune lavorazioni speciali aeronautiche.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 273-282. Roma, 1961. In Italian.

A review is presented of the toxicity hazards to personnel handling substances used in rocket fuels, including nitric acid and its nitrous vapors, aniline, xylidine, and furfural alcohol. The tolerance levels for these substances are given along with the symptomatology produced and diagnostic and preventive measures. The following general and specific measures are recommended for persons exposed to these toxic substances: (1) periodic medical examination to diagnose the appearance of toxic signs; (2) all work should be performed under the direction of specialized personnel having experience with the substances, who can handle cases of poisoning and institute protective measures; (3) carbureting liquids must be separate from oxidant substances to reduce the hazard of explosion; (4) prohibition of smoking in or around the work area; (5) cans containing substances must be handled carefully to prevent loss of fluids or direct contact with personnel during transport; (6) in case of injury with liquid fuels, the area should be washed as soon as possible and the worker report to the first aid station; (7) protective clothing and equipment should be worn during various operations (a descriptive table of items is included); (8) maintenance of proper ventilation and cleanliness of work area; and (9) personnel must be in good health, not drink alcoholic beverages, and bathe after work.

12105

Kitzes, G. 1958

AIR FORCE PROBLEMS IN TOXICOLOGY.—A.M.A. Arch. Indus. Health, 17 (5): 556-562. May 1958.

Materials capable of producing toxic atmospheric contamination in flight are listed including the following: jet fuels, hydraulic fluids, lubricants, fire-extinguishing agents, and the combustion and decomposition products of these materials. With the improvement of propulsion devices and engines, fuels have become more complex and their toxicity has increased greatly. Occasionally, new chemicals have been developed for which little or no toxicity information is available. Therefore it is deemed necessary to study the toxicological properties of these materials. As a result of animal experimentation carried out by the Air Force, it was shown that some of the new-type engine oils and their thermal decomposition products are not toxic at concentrations found in the cabin atmospheres of operational aircraft and consequently do not constitute a health hazard. However, they were found to cause eye and nasal irritation, nausea, and headache, symptoms that may constitute a safety hazard by impairing the efficiency and performance of the air crew. The Air Force is presently attempting to arrive at realistic threshold limit values for chemical materials in accordance with the concepts of flight safety.

12106

Nuttall, J. B. 1958

TOXIC HAZARDS IN THE AVIATION ENVIRONMENT.—Jour. Aviation Med., 29 (9): 641-649. Sept. 1958.

Base aircrew effectiveness reports for all Air Force units from June 1955 to July 1957 were reviewed in order to determine the frequency of toxic hazard incidents in aircraft. Of 112 reported toxic incidents, 34 involved carbon monoxide and exhaust fumes. In reciprocating engine aircraft, investigators found unequivocal evidence of hazardous CO level in the aircraft cockpit, while in jet aircraft (8 cases) CO poisoning was not unequivocally demonstrated. Predominant symptoms experienced were disturbance of consciousness, nausea, and headache. Twenty-nine cases of contaminated oxygen were reported, with occurrence of an odor the most frequent reason for suspecting contamination. Although potentially serious symptoms occurred in one-third of the cases, fear and anxiety are considered to be a greater hazard. Cockpit contamination by oil pyrolysis smoke and fumes occurred in 20 cases involving jet aircraft. Most of the potentially serious symptoms were mild in degree, and the most frequent symptoms were related to local irritation of the eyes and upper respiratory tract. Seven cases of electrical fires, smoke, and fumes were reported in reciprocating engine aircraft, with no serious toxicologic threat occurring. Contamination by fuel fumes was reported in six cases in jet aircraft. Several incidents involving unusual substances and unusual sources of common contaminants were reported, suggesting the need for vigilance by flight surgeons in the investigation of toxicologic incidents. Comparison of the frequency of toxic hazard incidents reported to flight surgeons with their actual rate of involvement in aircraft accidents revealed that medical reporting and investigation of toxic incidents are often inadequate.

12107

Sandage, C. 1961

TOLERANCE CRITERIA FOR CONTINUOUS INHALATION EXPOSURE TO TOXIC MATERIAL. I. EFFECTS ON ANIMALS OF 90-DAY EXPOSURE TO PHENOL, CCl_4, AND A MIXTURE OF INDOLE, SKATOLE, H_2S, AND METHYL MERCAPTAN.—Midwest Research Inst., Kansas City, Mo. (Contract AF 33(616)-7055); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-519 (I), Oct. 1961. vi+31 p.

Physiological changes in rats, mice, and monkeys were studied during continuous 90-day exposure to controlled atmospheres of toxic vapors and gases. Concentrations of test chemicals were those recognized as Industrial Threshold Limit Values and included: (a) CCl_4 (25 p.p.m.), (b) phenol (5 p.p.m.), and (c) a mixture of indole (10 p.p.m.), skatole (3 p.p.m.), H_2S (20 p.p.m.), and methyl mercaptan (50 p.p.m.). Clinical laboratory and terminal stress tests were followed by autopsy with gross and microscopic pathology. The mortality rates from toxic effects were surprisingly low, and were not in ac-

cord with prediction based on reputable toxicological theory. (Author's abstract) (25 references)

12108
Shelanski, M. V., and K. L. Gabriel 1959
CUTANEOUS TOXICITY EVALUATION OF AIR FORCE DEVELOPMENT MATERIALS. III.—Industrial Biology Research and Testing Labs., Inc., Philadelphia, Pa. (Contract AF 33(616)-5595); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). WADC Technical Report no. 1959-124, June 1959. iii+6 p. AD 215 535

Three crystalline substitute phenyl ethers, three DORK flame-resistant cotton fabrics, one untreated cotton sateen fabric, and four fungicidal-treated (fluorinated diphenyl sulfide) cotton sateen fabrics were studied via the prophetic patch test method on laboratory animals and volunteer human subjects to determine the primary irritant effect and the sensitization index of these materials. The patch test studies with rabbits indicated that there were no contraindications to proceeding with the patch testing on the human subjects. All of the materials were found safe to use in contact with the human skin after the test with the human volunteer subjects. (Authors' abstract)

12109
Shelanski, M. V., and K. L. Gabriel 1961
CUTANEOUS TOXICITY EVALUATION OF AIR FORCE MATERIALS. IV. — Industrial Biology Research and Testing Labs., Inc., Philadelphia, Pa. (Contract AF 33(616)-6962); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). ASD Technical Report no. 61-77, April 1961. iii+8 p.

Twelve Air Force development materials were studied via the prophetic patch test method on laboratory animals and volunteer human subjects to determine the primary irritant effect and the sensitization index of these materials. These materials were also studied by the Shelanski repeated insult patch test method on human volunteers to determine the primary irritation effect, fatiguing effect, and sensitization index. The patch test studies with rabbits indicated that only one material, Alkyldecalin, was too severe a primary irritant to test on humans. Upon testing the remaining materials on humans, Diethylcyclohexane was found to be a severe primary irritant. All other materials were found to be safe to use in contact with the human skin. (Authors' abstract)

b. Fuels and Lubricants

12110
Asset, G., M. A. Ross, and S. Ryan 1958
EFFECTS OF INHALATION OF AEROSOLS OF THREE ENGINE OILS (U).—Chemical Warfare Labs., Army Chemical Center, Md. (Project no. 4-61-14-002). Report no. 2068 (Revised), March 1958. vi+7 p. AD 159 285

Rats, rabbits, and dogs were exposed at room temperature on four successive days for 5 to 6 hours per day to aerosols of engine oils WF108, WF109, WF110 in concentrations of 94 to 244 mg./cu.m. The rats and rabbits showed no tissue changes which could be attributed to the oils, but a histologic tissue examination of the exposed dogs indicated irritation of the respiratory system. No fatalities occurred as a result of exposure to the oils.

12111
Baldridge, H. D. 1961
PROPULSION CHEMISTRY AND ROCKET LAUNCHING HAZARDS: ASPECTS OF ROCKET CHEMISTRY OF INTEREST TO THE MILITARY TOXICOLOGIST. — Military Med., 126 (11): 825-833. Nov. 1961.

The motors of all presently operational rocket systems are heat engines of the chemical type involving the generation and ejection of large amounts of materials potentially toxic to the skin, lungs, and eyes of missile workers. Propellant materials are of necessity extremely active chemicals. The simple molecular combinations and low intermolecular interactivity in propellant molecules give rise to significant vapor pressures and thus lead to high hazard potential in the case of most liquid propellants. In the drive towards the use of elementary forms of low atomic weight elements, the problems of handling materials such as liquid hydrogen and liquid fluorine at extremely low temperatures will require a level of attention by medical personnel above that now given to such present day cryogenic materials as liquid oxygen. It is the objective of the chemical rocket researcher to develop propellant systems which will sustain the greatest thrust with the least weight penalty. It is the responsibility of the military chemist, toxicologist, and industrial hygienist to insure that unreasonable additional penalties do not appear in the form of uncontrollable personnel hazards. (From the author's summary and conclusions)

12112
Bedwell, T. C., A. F. Meyer, and G. R. Anderson 1961
MEDICAL SUPPORT OF ICBM OPERATIONS.—Aerospace Med., 32 (5): 401-406. May 1961.

The rapid development of operational strategic missile capability has resulted in a number of special needs for medical support. The actual medical support in Strategic Air Command is divisible into three broad areas: Community Medicine for routine health maintenance of military personnel and their dependents; Mission Medicine for all activities directly associated with operations; and Disaster Control for situations arising from a peace-time disaster or war operations. The preventive medicine and occupational health program in Strategic Air Command bases is similar to that of a large chemical industry. In the propellant storage area, there is an adequate water supply to insure that fire protection or firefighting can be achieved effectively. Showers and eye baths are furnished to take care of the possibility of a spill or pressure line failure. Propellant handlers are required to wear protective clothing and the two-man team approach is used. The occupational program is considered to be preventive in nature rather than simply concerning itself with taking care of those who may become exposed as part of their occupational environment. Photographs of the bus-type ambulance in operation at Vandenberg Air Force Base are included.

12113
Brousaides, F. J., 1961
R. Bersin, J. C. McCue, C. O. Hommel, and D. J. MacDonald
RESEARCH ON THE FEASIBILITY OF PROPELLANT DETECTION BY INDUCED RADIOACTIVE TECHNIQUES. — Tracerlab, Inc., Waltham, Mass. (Contract AF 33(616)-7846); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-654, Dec. 1961. iv+68 p.

Detection of five toxic materials (nitrogen dioxide, hydrazine, unsymmetrical dimethyl hydrazine, boron hydrides, beryllium oxide) in the atmosphere was attempted by using the decay characteristics of radioactive materials. Activation analysis and inverse radioactive tracer techniques (processes in which a constituent to be analyzed undergoes a reaction — or reactions — which results in the ultimate release of a tracer gas whose concentration is proportional to the original constituent to be analyzed) were used. Emphasis was placed upon the use of Kr^{85} quinol clathrates for the detection systems. Properly controlled, these systems were found to be selective to a narrow band of redox materials and gave predictable responses to toxic gas concentrations. (Authors' abstract, modified) (40 references)

12114
Buscaglia, R., 1961
and S. Wallack
FEASIBILITY STUDY OF A MULTIPURPOSE INFRARED PROPELLANT DETECTOR. — Leesona Corp., Patterson Moos Research Div., Jamaica, New York (Contract AF 33(616)-6412); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). ASD Technical Report no. 61-382, Aug. 1961. v+17 p.

An outline is given of the procedures used during the developmental stages of a prototype model of an open-path narrow absorption infrared instrumentation capable of detecting and measuring toxic propellant vapors in very low concentrations. The system was applicable to ethylene oxide, unsymmetrical dimethyl-hydrazine, dinitrogen tetroxide, and hydrazine. System feasibility was demonstrated in tests performed with this prototype instrument wherein measurement sensitivity was in all cases within one order of magnitude of that required and, in most cases, substantially better than this. Some modifications are presented which if incorporated may considerably improve the sensitivity values.

12115
Delgado, J. M. R., 1961
and K. C. Back
IMPLANTATION AND USE OF BRAIN ELECTRODES FOR TOXICOLOGICAL APPLICATION. — Yale Univ. School of Medicine, New Haven, Conn. (Contract AF 33(616)-6899); and Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 716305). ASD Technical Report no. 61-609, Nov. 1961. iii+16 p.

A decaborane derivative, used as high-energy fuel and identified as HEF-3, was injected intraperitoneally in monkeys with electrodes permanently implanted in the brain. Administration of 1 mg./kg. for a few days evoked a typical pattern of electrical activity characterized by high frequency, with high voltage bursts mainly localized in the hypothalamus without spread to limbic structures or other cerebral areas. Spread, however, was observed after long periods of burst activity. The electrical abnormality coincided with a typical set of symptoms: the animals were depressed, somnolent, with generalized twitching and short motor seizures. A selective effect of HEF-3 on the hypothalamus, or perhaps in motor structures located in its neighborhood, is suggested by our experiments. (Authors' abstract)

12116
Dill, D. B., 1960
and K. H. Jacobson
TOXICITY OF PROPELLANT FUELS AND OXIDIZERS. — U.S. Armed Forces Med. Jour., 11 (2): 125-131. Feb. 1960.

The initiation and development of a joint service project for the investigation of the hazardous effects of rocket propellants and military chemicals, conducted at the Army Chemical Center in Maryland, are described. The physiological effects of various chemicals studied under the project, including hydrazine, propellant oxidizers, liquid oxygen, and boron hydrides, are briefly considered.

12117
Ito, K. 1961
EXPERIMENTAL HYPERTENSION BY REPEATED CARBON MONOXIDE EXPOSURES OF RABBITS AND THE CATECHOLAMINE EXCRETION IN URINE. — Med. Jour. Shinshu Univ. (Marsumoto, Japan), 6 (1-2): 45-55. Aug. 1961. In English.

Twenty rabbits were fed a special diet, and ten of these were exposed to 0.13% carbon monoxide for two hours a day for 350 days. Exposed rabbits showed a blood pressure increase within 2-3 days, and the significant rise persisted throughout the time of exposure. Both adrenaline and noradrenaline rose significantly in the exposed animals with no apparent difference in the sexes. Serum fat and cholesterol showed no significant changes. Upon autopsy no indications of arteriosclerosis or atherosclerosis were found. It is concluded that adrenaline and noradrenaline play an important role in the hypertension produced by repeated carbon monoxide exposure. (30 references)

12118
Kraul, C. W., 1961
and R. D. Duguid
TOXICITY PROBLEMS WITH SOLID MISSILE PROPELLANTS. — Arch. Environmental Health, 3 (6): 680-683. Dec. 1961.

The various solid fuels are reviewed as to their chemical type and pathologic effects, and the hazards associated with making solid propellant motors are categorized. Some of the newer fuels and materials such as the polystyrenes, urethane, beryllium, lithium, boron, and magnesium are discussed as to their combustion products and toxicity. It is suggested that better engineering, education, and enforcement be carried out and supplemented with regular surveys to determine safe concentrations in the air and on the skin.

12119
Lythgoe, C., 1960
and D. Green
THE EFFECTS OF AVIATION TURBINE GASOLINE (AVTAG) AND OTHER AEROSOLS ON ANOXIC RATS. — Flying Personnel Research Committee (Gt. Brit.). FPRC/Memo. no. 154, Dec. 1960. i+24 p.

Rats were subjected to anoxia in a decompression chamber at four simulated altitudes (34,000, 36,000, 38,000, and 40,000 ft.) and to anoxia and anoxia plus aviation turbine gasoline aerosols in the ground-level chamber with gas mixtures containing from 0 to 5.0 per cent oxygen. Also, they were subjected to other aviation fuels and fluids using an air/nitrogen mixture containing 4.1% oxygen. Rats did not succumb to anoxia as easily as man (4-10 minutes for resting man at 25,000 ft.); fairly active rats at 34,000 ft. took 3.5-5.5 minutes to become unconscious. In the presence of anoxia, gasoline aerosols in excess of 20 mg./liter, as well as on other aviation fuels and fluids, produce a very marked reduction in the time to unconsciousness.

12120
Miller, Dwight F., 1960
A. A. Tamas, L. Robinson, and E. Merriweather
CUMULATIVE EFFECTS OF BORANE TOXICITY AS REVEALED BY A CLINICAL TEST.—Wright Air Development Division. Biomedical Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). WADD Technical Report no. 60-604, Aug. 1960. iii+11 p.

A series of studies on various aspects of the toxicology of the boron-derivative, high-energy fuels is presented. These studies, made possible by a new technique, supply information on the absorption and transport of boranes in the body. Evidence for the chronic buildup of boranes in the body is presented. The animal data are correlated with studies and observations of accidental human exposures and the analytical technique is evaluated. (Authors' abstract)

12121
Pinkerton, M. K., 1961
J. M. Lauer, P. Diamond, and A. A. Tamas
A COLORIMETRIC DETERMINATION FOR 1,1-DIMETHYLHYDRAZINE IN AIR, BLOOD, AND WATER.—Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-708, Dec. 1961. iii+10 p.

A simple, rapid colorimetric procedure is described for measuring microgram quantities of 1, 1-dimethylhydrazine (UDMH) in blood and water. The method, with minor modification, has also been adapted for analysis of air samples. The report provides a calibrated range for analysis of 1-60 micrograms UDMH per milliliter fluid and a 2.5-50 p.p.m. in air; its useful range may be considerably extended by manipulative dilution techniques. The test has additional, limited qualitative application to the analysis of urine. (Authors' abstract)

12122
Poulos, N. A. 1961
AMPEROMETRIC PROPELLANT-COMPONENT DETECTOR. — Olin Mathieson Chemical Corp., New Haven, Conn. (Contract AF 33(600)-39311); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). ASD Technical Report no. 61-154, May 1961. vi+39 p.

The data obtained in production of an improved multipurpose detector capable of measuring low airborne concentrations of nitrogen tetroxide (N_2O_4), ozone (O_3), hydrazine (N_2H_4), unsymmetrical dimethylhydrazine (UDMH), and hydrogen fluoride (HF) is presented. The concept of "forward and reverse polarization" was applied and considerable specificity was obtained for oxidizing and reducing substances. Sensitivities were obtained of 100 microamperes per part per million of nitrogen tetroxide, 52 microamperes per part per million of ozone, 40 microamperes per part per million of hydrazine, and 20 microamperes per part per million of unsymmetrical dimethylhydrazine. (Author's abstract)

12123
Schlang, H. A. 1961
POISONING CAUSED BY TETRAETHYL LEAD.—Aerospace Med., 32 (4): 333-335. April 1961.

A case of tetraethyl lead poisoning of a 20-year-old seaman is presented. Treatment of disorder may be considered as supportive and specific. Supportive treatment consists in maintenance of the nutrition, hydration, ventilation, and control of potential infection and energy wasting in the patient. Without adequate sedation, the individual may spend almost 24 hours a day in constant motion, with the resulting drain of energy in the constant struggle of delirium. The mainstay of specific therapy is calcium disodium versenate. Acting as a chelating agent, this compound can dissolve readily ordinarily insoluble salts, and this property accounts for the value of the agent as a means for mobilizing heavy metals from the body.

12124
Schoettlin, C. E., 1961
G. M. Cianko, R. D. Walter, and T. Freedman
TOXICOLOGICAL RESEARCH ON CENTRAL NERVOUS SYSTEM EFFECTS OF BORANE FUELS. — North American Aviation, Inc., Los Angeles, Calif. (Contract AF 33(616)-7186); issued by Aeronautical Systems Division, Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). ASD Technical Report no. 61-438, Sept. 1961. iv+36 p.

Investigations are described conducted by North American Aviation, Inc., Los Angeles, California, on the central nervous system subsequent to accidental human exposure to boron hydrides. Serial electroencephalographic (EEG) tracings were used to identify the effects. Results of the study indicate little or no central nervous system damage was experienced by the participants. Methods, machines, and techniques used are described in detail. A complete data summary of all subjects tested is included. (Authors' abstract)

12125
Stumpe, A. R. 1958
HEALTH HAZARDS OF NEW AIRCRAFT AND ROCKET PROPELLANTS: A REVIEW OF THE LITERATURE.—Jour. Aviation Med., 29 (9): 650-659. Sept. 1958.

A review is presented of the chronic and acute toxic effects and safe exposure levels of new aircraft and rocket propellants and oxidizers, including methyl alcohol, ethyl alcohol, asym-dimethylhydrazine, ammonia, JP-4 fuel, boranes, red-fuming nitric acid, fluorine, hydrogen peroxide, ozone, and liquid oxygen.

12126
Sturiale, G. 1961
EFFECTS ON MENTAL FUNCTIONING OF PERSONNEL WORKING WITH PENTABORANE AS A ROCKET ENGINE FUEL. — Directorate of Rocket Propulsion. Liquid Systems Division, 6593d Test Group (Development), Edwards Air Force Base, Calif. Technical Note no. SSD-TN-61-3, Aug. 1961. x+33 p.

Personnel subjected daily to potential exposure to pentaborane (on Project Joshua) for varying periods and a control group were tested on two occasions (10 months apart) with the Wechsler Adult Intelligence Scale (mental functioning measuring device). Also, two psychodiagnostic tests (Cornell Index) were administered to both military and civilian personnel on Project Joshua for six months and to controls to determine the relation of test performance to job adjustment as measured by number and nature of sick calls, job performance, and work attitudes. No significant changes in mental performance were observed. The psychodiagnostic tests yielded information utilizable as part of the personal medical history which can facilitate the diagnosis of propellant intoxication complaints.

12127
Venditti, G., 1960
and G. Lalli
[FUEL POISONING WITH SPECIAL REFERENCE TO THAT OCCURRING IN THE FIELD OF AVIATION] Le intossicazioni da carburanti con particolare riferimento a quelle che si verificano in campo aeronautico.—Rivista di medicina aeronautica e spaziale (Roma), 23 (1): 57-102. Jan.-March 1960. In Italian, with English summary (p. 99).

A discussion is presented on the nature, composition, and toxic effects of fuels with special emphasis on those used in aviation (gasoline, kerosene, fuel oil). symptomatology, etio-pathogenesis, and pathology of gasoline poisoning of the pilot during flight and of the ground crew involved in aircraft maintenance is described and the manifestations of kerosene poisoning are noted. The following protective measures are recommended for the ground crew: (1) selection of a well-aerated work environment; (2) medical selection and periodic examination of personnel in contact with toxic fuels (every 4 months for persons handling gasoline; every 6 months for those in contact with kerosene and derivatives); (3) collective hygienic education of personnel and instruction in the uses of personal protective equipment; and (4) use of drugs for prevention and therapy (vitamin B_{12}, B-complex, anti-anemic, vitamin C preparations). It is stressed that during flight personnel use oxygen masks at the first indication of gasoline fumes within the cockpit.

12128
Weeks, M. H., 1961
G. C. Maxey, M. E. Sicks, and E. A. Greene
VAPOR TOXICITY OF UDMH IN RATS AND DOGS FROM SHORT EXPOSURES.—Army Chemical Center. Army Chemical and Development Labs., Md. (MIPR (33-616) 60-32)); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). ASD Technical Report no. 61-526, Oct. 1961. iii+13 p.

A study was made of the inhalation toxicity of 1,1-dimethylhydrazine (UDMH) in animals from single short exposures. Five- to sixty-minute exposures of dogs and rats to high concentrations of UDMH produced toxic signs similar to those seen at longer inhalation exposures. No clinical abnormalities resulted from these single short-term exposures. Dogs exposed to 50, 200, and 600 p.p.m. of UDMH for single or multiple 60-, 15-, and 5-minute periods, respectively, showed no adverse physiological effects. These levels of UDMH should serve as a basis from which short-term exposure standards may be estimated for man. (Authors' abstract)

12129
Weir, F. W., 1961
D. W. Bath, and M. H.. Weeks
SHORT-TERM INHALATION EXPOSURES OF RODENTS TO PENTABORANE-9. — Army Chemical Center. Research and Development Labs., Md. (Contract MIPR (33-616) 60-41); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-663, Dec. 1961. iii+6 p.

The concentrations of pentaborane causing 50% deaths of rats and mice for single 5-, 15-, 30-, and 60-minute exposures were determined. Toxic signs were tremors, ataxia, convulsions, and death. The LC50 values for single 5-, 15-, 30-, and 60-minute exposure periods were: for rats, 66.6, 31.2, 15.2, and 10.4 p.p.m., respectively; for mice, 40.5, 18.6, 10.6, and 7.8 p.p.m., respectively. Small differences were noted between the concentration producing no apparent toxic response and maximum response. (Authors' summary)

c. Paints, Solvents, etc.

12130
Durante, U. 1961
[RESEARCH ON THE FURFURAL CONTENT IN THE ATMOSPHERE OF SOME AERONAUTICAL ENVIRONMENTS] Ricerche sul contenuto in furfurolo nell'atmosfera di alcuni ambienti aeronautici.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 265-272. Roma, 1961. In Italian.

Following a brief review of experimental research on the toxicity of furfural (used as a solvent and cleaning agent for aircraft motors) inhalation, a study was made of the furfural concentration in the hangar environmental air. Cleansing operations were performed under cold conditions or at 65° using soap containing furfural. Environmental concentrations were determined 5, 15, 24, 36, and 48 hours after cleansing operations. Personnel exhibited the following subjective symptomatology: itching of the eyes, throat, nose, or lips; slight, minor, or severe headache; or no sensation. The environmental concentration was found to vary between 0.15-1.50 parts per million. Considering that the maximum tolerable dose for furfural is 5 parts per million, its use in aviation appears to be satisfactory.

12131
Garassini, G., 1961
and G. Russo
[EXPERIMENTAL CARBON TETRACHLORIDE WITH SPECIAL CONSIDERATION TO THE HEMATOLOGICAL EFFECTS] Intossicazione sperimentale da tetracloruro di carbonio con speciale riguardo agli effetti ematologici.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 523-526. Roma, 1961, In Italian.

The following changes in the blood and hematopoietic organs were found in rats experimentally poisoned with carbon tetrachloride: (1) marked anemia in the peripheral blood, partly of hemolytic origin as demonstrated by the accumulation of iron in the splenic reticular cells, with granulo-lymphocytic leukocytosis; (2) reticular splenic hyperplasia with myeloblastosis and erythroblastosis which in all animals during the advanced phase of poisoning approached the leukemic and erythremic type, and deficiency of the immature elements in the peripheral blood; (3) intense splenic hemosiderosis due to excess of iron caused by lack of erythroblastic maturation and consequent lack of hemoglobin synthesis, associated with hyperhemolysis, marked erythroblastogenesis and myeloblastogenesis; (4) hepatocellular necrosis and steatosis, and (5) renal alterations.

12132
Germini, P., 1961
and V. Sarnari
[THIOCTIC ACID IN EXPERIMENTAL CARBON TETRACHLORIDE POISONING] L'acido tioctico nell'intossicazione sperimentale da tetracloruro di carbonio.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 466-469. Roma, 1961. In Italian.

Rats subjected to carbon tetrachloride (CCl_4) poisoning and simultaneously treated with intraperitoneal thioctic acid exhibited a double survival with respect to untreated, poisoned control animals. Histopathological changes in the liver and kidney were similar in the two groups from the qualitative viewpoint, but quantitatively less widespread and less severe in the thioctic acid-protected group. Animals treated with CCl_4 for 15 days and with thioctic acid for 30 days, showed at the end of the 30 days complete or almost complete restoration of weight and of the general condition. On the contrary, animals treated for 15 days with CCl_4 hardly survived 30 days without protective treatment. These two groups were sacrificed after 30 days and histopathological studies of the liver, kidney, and spleen revealed similar changes; however, the thioctic acid-treated group presented changes that were less marked, especially in the liver.

d. Organic and Technological Waste Products (Including CO and CO_2)

12133
Bokonjic, N., 1961
and F. Buchthal
POSTANOXIC UNCONSCIOUSNESS AS RELATED TO CLINICAL AND EEG RECOVERY IN STAGNANT ANOXIA AND CARBON MONOXIDE POISONING.—In: Cerebral anoxia and the electroencephalogram, p. 118-127. Springfield, Ill.: Charles C. Thomas, 1961.

The correlation was investigated between the duration of postanoxic unconsciousness, electroencephalographic abnormalities, and the clinical course and final result of recovery in 27 individuals after stagnant anoxia (hanging and cardiac arrest) and 47 after carbon monoxide poisoning. The type of anoxia, the age of the individual, and the state of the cardiovascular system influenced the relationship between postanoxic unconsciousness and recovery. The postanoxic electroencephalographic (EEG) changes depended on the type of anoxia, the duration of postanoxic unconsciousness, and the phase of clinical recovery in which the EEG was recorded. The prognostic value of the EEG changes after acute anoxia is limited, an abnormal EEG being compatible with complete clinical recovery. Conversely, after stagnant anoxia the EEG could become normal in the face of irreversible damage of mental functions. (Authors' summary and conclusions, modified)

12134
Bottoni, A., 1961
and A. Belluschi
[EFFECTS OF HYPERCAPNIA ON RETINAL ARTERIAL PRESSURE] Effets de l'hypercapnée sur la tension artérielle rétinienne. — Annales d'oculistique (Paris), 194 (4): 320-327. April 1961. In French, with English summary (p. 327).

A constant increase in retinal arterial blood pressure was found in subjects breathing a mixture of air containing 5% carbon dioxide. This phenomenon was possibly due to the vasodilatory effect of carbon dioxide on the cerebral and retinal blood vessels.

12135
Bullard, R. W., 1961
and J. R. Crise
EFFECTS OF CARBON DIOXIDE ON COLD-EXPOSED HUMAN SUBJECTS. — Jour. Applied Physiol., 16 (4): 633-638. July 1961.

Human subjects were exposed to an ambient temperature of 5° C. for 75-minute periods. Subjects breathed 2.5%-6% carbon dioxide for selected time periods during the exposure. Carbon dioxide appeared to inhibit shivering. After carbon dioxide inhalation, shivering and metabolism were greatly increased. When 6% carbon dioxide was inhaled for 30 minutes, the inhibition was overcome and shivering and metabolism approached high levels. The increased respiratory heat loss associated with carbon dioxide breathing may be one factor causing the breakthrough of the inhibition. (Authors' abstract)

12136
Carson, T. R., 1961
M. H. Weeks, F. T. Wilinski, and F. W. Oberst
THE RESPONSE OF ANIMALS INHALING HYDROGEN FLUORIDE FOR SINGLE, SHORT EXPOSURES.—Army Chemical Center. Army Chemical Research and Development Lab., Md. (MIPR (33-616) 60-32); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-744, Dec. 1961. iii+14 p.

Rats were exposed to various concentrations of HF for single 5-, 15-, 30-, and 60-minute periods, and the LC50's were calculated. Guinea pigs were exposed for 15 minutes to various concentra-

tions and the LC50 calculated. In addition to the lethal exposures, rats, dogs, and rabbits were exposed to lower concentration levels ranging from 6 to 50% of the rat LC50's. The toxic signs were eye and nasal irritation. There were gross changes in the lungs of all species exposed to HF at the higher concentrations. The signs and pathologic changes decreased in severity as the concentration levels were lowered. At a given concentration level dogs and rabbits tolerated HF better than rats. The concentrations of HF causing mild toxic signs and no gross changes in the lungs of rats were 307 p.p.m. (0.3 mg./liter) and 103 p.p.m. (0.08 mg./liter) for 15 and 60 minutes, respectively. (Authors' abstract)

12137
Coburn, K. R., 1959
E. T. Carter, E. Reininger, and J. F. Tomashefski
CARDIOPULMONARY RESPONSES OF ANESTHETIZED DOGS TO LETHAL CONCENTRATIONS OF CARBON MONOXIDE.—In: Cardio-respiratory responses to environmental stress, p. 30-63. Ohio State Univ. Research Foundation, Columbus (Contract DA-49-007-MD-189). AD 226 852

Respiratory and circulatory effects of lethal concentrations of carbon monoxide were determined in anesthetized mongrel dogs. Typical hyperventilatory states were produced (increased ventilation with decreased carbon dioxide tension of the blood and an increase in pH). It appears that there is a remarkable lack of compensation on the part of the animal to protect the mean blood pressure. If carbon monoxide was discontinued, oxygen supplied, and artificial respiration instituted to the recently apneic dog, spontaneous breathing resumed and the blood pressure increased. Although death in carbon monoxide poisoning is usually considered a respiratory death, the failure of the respiratory center is probably a secondary effect due to the progressive loss of vascular tone without a compensatory increase in cardiac output.

12138
Eldridge, F. 1959
and J. M. Davis
EFFECT OF MECHANICAL FACTORS ON RESPIRATORY WORK AND VENTILATORY RESPONSES TO CO_2.—Jour. Applied Physiol., 14 (5): 721-726. Sept. 1959.

The end-tidal pCO_2, mechanical work of breathing, and ventilation were determined in normal subjects breathing air, 2.2, 4.2 and 5.8% CO_2, with no added resistance and with three grades of added airway resistance. With increasing resistance, pCO_2 and work rose in parallel where ventilation remained constant or even decreased. In the presence of a constant CO_2 stimulus, increasing airway resistance caused a progressive decrease in ventilatory response to CO_2. The maximum breathing capacity was not in itself the limiting factor in the ventilatory response to CO_2. It is concluded that mechanical abnormalities of the respiratory apparatus are an important factor in reducing the ventilatory response to CO_2, and that work of breathing is a more satisfactory index of respiratory stimulation than ventilation. (Authors' abstract)

12139
Fishman, A. P., 1960
H. W. Fritts, and A. Cournand
EFFECTS OF BREATHING CARBON DIOXIDE UPON THE PULMONARY CIRCULATION. —Circulation, 22 (2): 220-225. Aug. 1960.

The effects of the inhalation of five per cent carbon dioxide in air on pulmonary arterial blood pressure and blood flow were investigated in five normal subjects and in ten patients with chronic pulmonary emphysema. In normal subjects, with an average increase in arterial CO_2 pressure of six mm. Hg and a three-fold increase in minute ventilation, both pulmonary arterial blood pressure and blood flow remained unchanged. In emphysematous patients, with a similar increase in arterial CO_2 pressure and a two-fold increase in ventilation, a fourteen per cent increase in cardiac output and a rise of four mm. Hg in pulmonary arterial mean pressure were observed. An appreciable increase in pulmonary blood flow was invariably associated with an increase in pulmonary blood pressure. The mechanisms responsible for the increase in pulmonary blood flow in emphysematous patients during CO_2 breathing are not apparent.

12140
Gadaskina, I. D., 1961
E. I. Liublina, N. A. Minkina, and M. L. Rylova
[SOME DATA ON THE EFFECT OF CARBON MONOXIDE ON THE ANIMAL ORGANISM DURING CONTINUOUS AND INTERMITTENT EXPOSURE] Nekotorye dannye o vliianii na organizm zhivotnykh okisi ugleroda v usloviiakh nepreryvnogo i intermittiruiushchego vozdeistviia. —Gigiena truda i professional'nye zabolevaniia (Moskva), 5 (11): 13-18. Nov. 1961. In Russian, with English summary (p. 18).

Three groups of animals (albino mice, albino rats, guinea pigs, and rabbits) were used in a comparative investigation. The first group was exposed to the action of carbon monoxide in a constant concentration (0.0363-0.00044 mg./liter) for periods of four hours daily; the second group was subjected to intermittent exposures for four hours to carbon monoxide with a mean concentration of 0.036 mg. and peak concentrations of 0.45-0.50 mg./liter; the third group served as controls. A total of 104 experiments were carried out over a four-month period. In rabbits of the second group the amount of carboxyhemoglobin was increased to 15-16% immediately after exposure to the peak concentration. In all groups there was no carboxyhemoglobin before poisoning or after exposure to a constant CO concentration. Judging by a number of indications the effect of carbon monoxide applied in variable concentrations proved to be more harmful, suggesting that in setting standards the maximal concentration of CO should be considered in addition to the mean concentration.

12141
Hille, H., 1959
and R. Hild
[THE EFFECTS OF CO_2 INHALATION ON THE BLOOD VESSELS OF SKIN AND MUSCLES IN MAN] Über die Wirkung von CO_2-Inhalationen auf die Haut- und Muskelgefässe des Menschen [Abstract].—Pflügers Archiv für die gesamte Physiologie (Berlin), 270 (1): 44-45. 1959. In German.

The conflicting viewpoints in regard to the effects of CO_2 on the vascular system of the musculature, though based on experimental evidence, may be attributed to the fact that several factors interact following CO_2 inhalation, each one of them capable of arousing a vascular reaction. The experiments under discussion eliminated the hyperventilation effect in that the CO_2 action was compared to the reaction evoked by hyperventilating a similar amount of air. The emotional situation, likewise, is similar in either case, particularly if the gas mixture does not contain more than 7% CO_2. During inhalation of CO_2 muscular circulation increased in almost all instances. However, the increase, while breathing a 4% CO_2-air mixture, was only 61% of that caused by hyperventilation with air; at 7% CO_2 the increase was only 25%. This effect was noted in spite of the fact that the arterial pressure rises during hyperventilation with CO_2 and falls in hyperventilation with air. The skin circulation is lowered in both cases, the decrease apparently resulting from a maximum constriction of the blood vessels during hyperventilation with air, which cannot be further significantly increased during CO_2 breathing. Thus it may be concluded that CO_2 inhalation results in vasoconstriction of the skin and musculature vessels. The increase in blood volume circulating through muscle is caused by an overlapping vasodilatory reflex as a result of hyperventilation and an increase in the arterial blood pressure.

12142
Kennedy, T. J. 1960
THE EFFECT OF CARBON DIOXIDE ON THE KIDNEY. — Anesthesiology, 21 (6, Part I): 704-716. Nov.-Dec. 1960.

This article reviews literature dealing with the role played by CO_2 in the following renal mechanisms or functions: hemodynamics, electrolyte excretion, maintenance of acid base homeostasis, and the extrarenal and renal responses to acidosis and alkalosis. Consideration is also given to (1) the mechanisms involved in urinary acidification, (2) the relationship between acidification and potassium excretion, reabsorption of bicarbonate, urinary CO_2 tension, and (3) the effects of THAM (2-amino, 2-hydroxymethyl 1, 3-propanediol) on the pH of urine. (62 references)

12143
Lindgren, S. Å. 1961
A STUDY OF THE EFFECT OF PROTRACTED OCCUPATIONAL EXPOSURE TO CARBON MONOXIDE POISONING. — Acta medica scandinavica (Stockholm), 167, Supplementum 356. 135 p. 1961.

A review is presented of earlier studies on the effects of prolonged exposure to carbon monoxide including clinical observations and various group investigations. The present work includes methods of group investigation, studies of exposure, medical examination for the determination of effects, psychometric studies, special medical investigations and studies of the duration of illness. (121 references)

12144
Musselman, N. P., 1959
W. A. Groff, P. P. Yevich, F. T. Wilinski, M. H. Weeks, and F. W. Oberst
CONTINUOUS EXPOSURE OF LABORATORY ANIMALS TO LOW CONCENTRATION OF CARBON MONOXIDE.—Aerospace Med., 30 (7): 524-529. July 1959.

Dogs, rabbits, and rats were continuously exposed to 50 p.p.m. carbon monoxide in a dynamic gassing chamber for three months. The effects on performance were determined, and pathological examinations were made at intervals. There were no significant differences between exposed and control animals. Dogs showed no behavioral changes; their general physical condition remained good, and their electrocardiogram, pulse, and rectal temperatures were normal. The voluntary activities of exposed and control rats were not significantly different. No significant differences were noted between body and heart weights of exposed and control animals. At the end of exposure, there were no differences in the weights of the adrenals, thymus, and spleens from rats.

12145
Price, H. L. 1960
EFFECTS OF CARBON DIOXIDE ON THE CARDIOVASCULAR SYSTEM. — Anesthesiology, 21 (6, Part I): 652-663. Nov.-Dec. 1960.

The cardiovascular effects of carbon dioxide are typified according to site of action, i.e., the isolated heart, the blood vessels, and the autonomic nervous system. The hemodynamic effects of increased carbon dioxide tension on cardiac output and peripheral blood flow, pressure, and resistance are summarized. Various hypotheses which have been advanced to explain the causes of posthypercapnic hypertension and cardiac arrhythmias are discussed. (61 references)

12146
Rapoport, K. M. 1959
[THE EFFECT OF INCREASED PARTIAL PRESSURE OF OXYGEN IN EXPERIMENTAL HYPOXEMIA INDUCED BY CARBON MONOXIDE POISONING] O deistvii povyshennogo davleniia kisloroda pri eksperimental'noi gipoksemii, vyzvannoi otravleniem okis'iu ugleroda. — Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 3 (3): 27-32. May-June 1959. In Russian, with English summary (p. 32).

Hypoxemia may be corrected in animals poisoned with carbon monoxide by increasing the partial oxygen pressure in the inspired air up to 3-4 atmospheres. The mechanism of oxygen action under increased pressure consists in the rise of its solubility in the blood plasma (up to values which are able to maintain body activity even in complete hemoglobin block), as well as in the intensification of carboxyhemoglobin dissociation. In animals poisoned with carbon monoxide the oxygen intoxication develops later and at higher oxygen pressures than in the unaffected animals. This may be explained by the combination of the carboxy group with tissue respiratory enzymes preventing direct action of oxygen on the brain. (Author's summary)

12147
Repin, I. S. 1961
[CHANGES IN THE ELECTROENCEPHALOGRAM AND CEREBRAL REACTIVITY IN HYPERCAPNIA] Izmenenie elektroentsefalogrammy i reaktivnosti mozga v usloviiakh giperkapnii. — Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 5 (4): 20-26. July-Aug. 1961. In Russian, with English summary (p. 26).

Rabbits inhaled different gas mixtures (5-50% CO_2 with air and O_2) for up to 8 hours. The EEG changes registered in the parietal cortex, hypothalamus, and pons showed a reduced amplitude, particularly in the parietal cortex. When the gas mixture contained 20-30% CO_2, the EEG disappeared almost entirely in spite of nearly normal blood pressure and regular respiration. The effect produced by 10-20% CO_2 was retained after blocking of the reticular formation in the brain stem by barbiturates, ether, or aminazine. In the hypercapnic depression of the EEG (20-30% CO_2) hypnotic doses of barbiturates did not produce spindles and had no effect on the EEG. Concentrations of 15-20% CO_2 completely abolished changes in electroencephalogram and electromyogram in response to whole-body chilling. A 20-30% CO_2 mixture is well tolerated by rabbits for several hours and its effects are easily reversible. (Author's summary, modified)

12148
Schaefer, K. E. 1961
A CONCEPT OF TRIPLE TOLERANCE LIMITS BASED ON CHRONIC CARBON DIOXIDE TOXICITY STUDIES.—Aerospace Med., 32 (3): 197-204. March 1961.

Results of studies on chronic carbon dioxide toxicity are summarized and a time-concentration curve for adaptation to carbon dioxide is presented which is based on the time to reach a compensation of the respiratory acidosis. Experimental evidence demonstrating significant effects of elevated carbon dioxide tensions in blood independent of pH changes is reported. Based on these findings, it appears doubtful whether long-term adaptation to even slightly increased carbon dioxide tension is possible without altering normal physiologic processes and producing histopathologic states. A concept of triple tolerance limits for carbon dioxide toxicity is proposed for three different levels of activity including one at which no significant physiologic adaptive changes to carbon dioxide occur. (Author's summary) (33 references)

12149
Schaefer, K. E., 1961
M. Hasson, and H. Niemoeller
EFFECT OF PROLONGED EXPOSURE TO 15% CO_2 ON CALCIUM AND PHOSPHORUS METABOLISM.—Proc. Soc. Exper. Biology and Med., 107 (2): 355-359. June 1961.

Calcium and phosphorus metabolism was studied during a period of chronic respiratory acidosis induced by exposure of guinea pigs to 15% CO_2. Plasma calcium increased and plasma phosphorus decreased significantly. These changes appeared to be related to an increased parathyroid activity as demonstrated by an increased urinary phosphorus excretion. Histological studies showed a significant renal calcification in these experimental animals. It is concluded that parathyroid stimulation plays a role in the development of renal lesions in chronic respiratory acidosis. (Authors' abstract)

12150
Schwartz, W. B., 1961
R. M. Hays, A. Polak, and G. D. Haynie
EFFECTS OF CHRONIC HYPERCAPNIA ON ELECTROLYTE AND ACID-BASE EQUILIBRIUM. II. RECOVERY, WITH SPECIAL REFERENCE TO THE INFLUENCE OF CHLORIDE INTAKE. —Jour. Clinical Investigation, 40 (7): 1238-1249. July 1961.

Electrolyte balance studies were carried out in 8 dogs during recovery from chronic respiratory acidosis induced by a CO_2-rich atmosphere. Four animals received a high salt diet and the other four a low salt diet during CO_2 exposure, and each group was maintained on the same diet during the recovery period. At the end of the CO_2 period, plasma bicarbonate ranged from 35 to 38 mEq/liter in both groups; plasma chloride concentration was depressed. Plasma bicarbonate and chloride promptly returned to normal when the high-salt dogs were returned to room air. The low-salt dogs, however, retained a high plasma bicarbonate concentration and became mildly alkalotic. This condition persisted until salt was added to their diet, after which both plasma bicarbonate and chloride returned to their normal levels. A possible mechanism has been considered to account for the observed effect of chloride deficiency in impeding the restoration of the normal acid-base balance.

12151
Sechzer, P. H., 1960
L. D. Egbert, H. W. Linde, D. Y. Cooper, R. D. Dripps, and H. L. Price
EFFECT OF CO_2 INHALATION ON ARTERIAL PRESSURE, ECG AND PLASMA CATECHOLAMINES AND 17-OH CORTICOSTEROIDS IN NORMAL MAN.—Jour. Applied Physiol., 15 (3): 454-458. May 1960.

Twelve male volunteers inspired concentrations of carbon dioxide in oxygen ranging from 7% to 14% for periods of 10 to 20 minutes. Respiratory minute volume, arterial pressure, heart rate, and plasma concentrations of epinephrine, norepinephrine and 17-OH corticosteroids were increased in every subject during hypercarbia. Abnormal cardiac rhythm was infrequently observed. Following substitution of oxygen for the carbon dioxide-oxygen mixture, the altered measurements returned to normal over a period of roughly 10 minutes. Neither marked hypotension nor cardiac arrhythmia was observed after correction of hypercarbia. (Authors' abstract)

12152
Simonson, E. 1961
EFFECT OF BREATHING 6 PERCENT CO_2 ON PERIPHERAL CIRCULATION IN YOUNG AND OLDER HEALTHY MEN. —In: Digest of the 1961 [4th] International Conference on Medical Electronics (New York City), p. 89. Princeton, New Jersey: RCA Laboratories, 1961.

Recordings on an impedance plethysmograph were made on the foreheads and legs of 57 young men and 83 elderly men before and during breathing of a mixture of 6% carbon dioxide, 20% oxygen and 74% nitrogen. During breathing of this mixture there was a greater increase in the amplitude of the forehead pulse in the older men than in the younger men. There was no significant change in the amplitude of the leg pulse. In the older men there was a significant increase in the height of the dicrotic notch. Changes in the peak time and cycle length of the forehead pulse were small in comparison to the large increase of the cerebral circulation under carbon dioxide, and indicated that it mainly represents the extracranial circulation.

12153
Sokoloff, L. 1960
THE EFFECTS OF CARBON DIOXIDE ON THE CEREBRAL CIRCULATION. — Anesthesiology, 21 (6, Part I): 664-673. Nov.-Dec. 1960.

This paper reviews the effects of carbon dioxide on (1) the cerebral circulation in normal man; (2) local cerebral blood flow; and (3) cerebral circulation in various physiological and pathological states (during hypoxemia, acidosis and alkalosis, anesthesia, increased blood pO_2, and cerebrovascular diseases). In general, CO_2 causes cerebral vasodilatation and peripheral vasoconstriction, and has been found to hasten recovery from general anesthesia, to protect against the deleterious effects of hypoxia on the central nervous system, and to increase the tolerance to positive radial acceleration. (71 references)

12154
Stein, S. N., 1959
R. E. Lee, J. H. Annegers, S. A. Kaplan, and D. G. McQuarrie
THE EFFECTS OF PROLONGED INHALATION OF HYPERNORMAL AMOUNTS OF CARBON DIOXIDE. I. PHYSIOLOGICAL EFFECTS OF 3 PERCENT CO_2 FOR 93 DAYS UPON MONKEYS.—Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 24 01 00.01.01 (Vol. 17, p. 527-536), Aug. 31, 1959. AD 230 747

Ten healty Macaca mulatta monkeys were exposed to air containing 3% CO_2 and 21% O_2 for a period of 93 days in a specially designed chamber which maintained these pre-determined gas concentrations at all times. There were no demonstrable changes in activity, weight, hemoglobin, hematocrit, total leukocyte count, non-protein nitrogen, blood glucose, serum chloride, serum calcium, serum phosphorus, thymol turbidity, erythrocyte sedimentation rate, serum bilirubin, cephalin flocculation, or serum cholesterol during the period of exposure or during the follow-up period after the monkeys were removed from the chamber, nor were there evidences of adrenal impairment. (Authors' abstract)

12155
Tenney, S. M. 1960
THE EFFECT OF CARBON DIOXIDE ON NEUROHUMORAL AND ENDOCRINE MECHANISMS. — Anesthesiology, 21 (6, Part I): 674-685. Nov.-Dec. 1960.

This literature review covers the effects exerted by carbon dioxide on the parasympathetic nervous system, the sympathetic nervous system and the adrenal medulla, the diuretic and gastric secretory responses, and salivary secretion. Reference is made to experiments that attempt to distinguish the effects produced by molecular CO_2 from those due simply to changes in hydrogen ion concentration. (88 references)

12156
Thiede, F. C., 1959
E. T. Carter, and F. A. Hitchcock
CARDIO-RESPIRATORY RESPONSES IN DOGS DURING INHALATION OF SUBLETHAL CONCENTRATIONS OF CARBON MONOXIDE.—In: Cardiorespiratory responses to environmental stress, p. 3-29. Ohio State Univ. Research Foundation, Columbus (Contract DA-49-007-MD-189). AD 226 852

Responses of the respiratory and circulatory systems of dogs to inhalation of low, sublethal concentrations of carbon monoxide were determined. An average increase in total ventilation of 68% and in alveolar ventilation of 46% occurred. Cardiac output rose 34%, and stroke volume increased 27%, although heart rate and arterial blood pressure did not vary. Arterial pH, carbon dioxide tension and content, and oxygen tension were not markedly changed. Metabolic rate and carbon dioxide elimination were essentially unaltered. (43 references)

12157
Wilks, S. S., 1959
and R. T. Clark
CARBON MONOXIDE DETERMINATIONS IN POST-MORTEM TISSUES AS AN AID IN DETERMINING PHYSIOLOGIC STATUS PRIOR TO DEATH.—Jour. Applied Physiol., 14 (3): 313-320. May 1959.

Carbon monoxide in the "solid" tissue of animals was quantitated and correlated with the blood carbon monoxide level in a series of controlled experiments with rats and dogs. Experimental conditions simulating aircraft crashes were devised and again the blood and "solid" tissue CO levels were determined. Using the experimental data on animals as a basis for extrapolating blood CO levels, along with tissue CO values, obtained from "control" and CO-asphyxial cases in human beings, an analysis was made of the "solid" tissue specimens obtained in 186 fatal aircraft accidents. From the analysis of tissue specimens from approximately 200 aircraft crash cases, some 30% gave by this method a blood CO level in excess of 30% saturation. These results point to the likelihood that CO was present in the personnel compartments of some or all of these aircraft at some time during flight. (Authors' summary)

12158
Wilks, S. S. 1959
EFFECTS OF PURE CARBON MONOXIDE GAS INJECTION INTO THE PERITONEAL CAVITY OF DOGS.—Jour. Applied Physiol., 14 (3): 311-312. May 1959.

Relatively large quantities of pure carbon monoxide (500 ml.) were injected into the peritoneal cavity of normal dogs, CO-acclimatized dogs, and altitude-acclimatized dogs. Withdrawal and analysis of the gas at timed intervals revealed a rise in oxygen tension from zero to values which were 2 1/2 times the arterial oxygen tension. The intraperitoneal O_2 tension in the acclimatized dogs attained values significantly higher than for the normal dogs. The intraperitoneal CO_2 tension in all dogs approximated the value in normal animals. At no time after the injection did the COHb exceed a 40-50% concentration level. The physiologic mechanism of the observed phenomena is discussed. (Author's summary)

12159
Wilks, S. S., 1959
J. F. Tomashefski and R. T. Clark
PHYSIOLOGICAL EFFECTS OF CHRONIC EXPOSURE TO CARBON MONOXIDE.—Jour. Applied Physiol., 14 (3): 305-310. May 1959.

Seven dogs were given a daily 6-8 hour exposure to CO levels of 0.08 to 0.10% for a period of 36 weeks and their tolerance to CO was compared with that of normal dogs, altitude-acclimatized dogs, and dogs transfused with blood from normal dogs. The

observed increased tolerance to CO was attributed primarily to the increase in concentration of the hemoglobin pigments of the blood. With this increased hemoglobin there was a greater reserve of the pigment for O_2 transport at a given concentration level of HbCO. The time required to reach an equilibrium level with a given P_{CO} was greater for the acclimatized than for normal animals. The arterial oxygen tension was always lower than the alveolar oxygen tension during the acclimatization period. There was no evidence of factors, other than hematologic, which increased the tolerance of the dogs to CO. Animals subjected to other hypoxic stress such as altitude, or normal animals transfused with normal blood to increase the hematocrit level, showed increased tolerance similar to that accomplished by chronic exposure to low CO levels. (From the authors' summary)

e. Other Substances

12160
Bowen, I. G. 1958
THE MEASUREMENT OF ATMOSPHERIC OZONE.—In: Aviation medicine—selected reviews, p. 39-44. Edited by C. S. White and others. London, etc.: Pergamon Press, 1958.

Ozone is considered a possible, though unproven, toxicological threat to aviation personnel. Concentrations of ozone present at various altitudes are set forth, along with the more useful methods of measuring it. The expression of ozone concentration as the volume ratio to air used by upper atmospheric physicists is transformed and plotted, using more common physiologic terminology, e.g., partial pressure as a function of altitude. Employing the above data, the partial pressure of ozone which might occur in the lung is computed on the "wet" basis as a function of cabin pressure and altitude. These data, combined with those setting forth the limits for ozone concentration allowable in industry, indicate a potentially dangerous situation. However, the rather wide discrepancies in the medical literature relevant to toxic concentrations of ozone, along with the instability of the gas, particularly at high temperatures, do not allow the statement of a firm opinion regarding the existence of a hazard. The author suggests actual determination of ozone concentrations in the cabins of pressurized and nonpressurized high-flying aircraft as an initial step in proving or disproving the existence of a toxicologic problem attributable to ozone. (Summary by C. S. White)

12161
King, M. E. 1961
TOXICOLOGY OF AURIN TRICARBOXYLIC ACID AND ITS ANTIDOTAL EFFECTIVENESS AGAINST BERYLLIUM.—Armour Research Foundation, Chicago, Ill. (Contract AF 33(616)-6947); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716501). ASD Technical Report no. 61-674. Dec. 1961. vi+23 p.

Monkeys and dogs were used in a series of studies designed to assess the ability of aurin tricarboxylic acid (ATA) to provide protection against acute beryllium poisoning. The acute LD_{50} of ATA was found to be 344 mg./kg. for monkeys and 164 mg./kg. for dogs. Neither species exhibited significant hematological changes when given weekly ATA doses of 25 mg./kg. over an 8-month period. The lethal intravenous dose of beryllium sulfate was 0.6 mg./kg. for both dogs and monkeys, but the value increased to between 1 and 3 mg./kg. when given by intratracheal injection. Acute toxic effects were not observed by either intravenous of intratracheal doses of suspensions of beryllium oxide. Treatment with ATA appeared to have therapeutic value in monkeys exposed to beryllium, but no significant response was observed in dogs. (Author's abstract)

12162
Lomonaco, T. 1959
[THE EFFECT OF SMOKING ON THE HEALTH OF THE AVIATOR AND ON HIS PSYCHO-PHYSICAL RESISTANCE] Influenza del fumo sulla salute dell'aviatore e sulla sua resistenza psico-fisica al volo.—Rivista aeronautica (Roma), 35 (11): 1983-2003. Nov. 1959. In Italian.

In military circles, and particularly among aviators, the habit of smoking is so wide-spread that it is exceptional to find a nonsmoker. To judge the effect of tabacco smoking upon health and physical endurance of flying personnel, we must understand the composition and action of tobacco smoke upon the body. The smoke consists of a mixture of gases and vapors composed of nitrogen, oxygen, carbon monoxide, carbon dioxide, volatile resins, organic acids, pyridine, ammonia, nicotine, and water vapor. There also might be present traces of arsenic from pesticides used in tobacco growing. Most dangerous, however, is the content of tar substances, especially benzopyrine and bencanthracene, which in animal experiments have shown carcinogenic character. Another harmful effect of tobacco smoking is the premature degeneration of blood vessels leading to arteriosclerosis and coronary diseases. Ophthalmologists maintain that smoking has various harmful effects upon the eyes and generally results in reduced vision. The evolution of carbon monoxide by incomplete combustion has a very harmful effect upon blood hemoglobin. Furthermore smokers suffer frequently from chronic pharyngitis and from inflammation of the eustachian tube. This in turn causes severe earache during ascention and descention of the airplane. The effects of carbon monoxide on the blood are similar to those of anoxia. Thus, an aviator, after smoking 30 cigarettes, has the same oxygen capacity at 3000 m. as a non-smoker has at 5000 m.

12163
Miller, Sol, and R. Ehrlich 1958
SUSCEPTIBILITY TO RESPIRATORY INFECTIONS OF ANIMALS EXPOSED TO OZONE.—Armour Research Foundation of Illinois Institute of Technology, Chicago; issued by School of Aviation Medicine, Randolph Air Force Base, Texas. Report no. 58-64, Aug. 1958. 8 p.

This study attempted to determine whether sublethal concentrations of ozone would sufficiently alter the normal host-parasite balance of mice and hamsters to change their susceptibility to respiratory tract diseases. The experimental sequence consisted of the animals' exposure to various concentrations of ozone for various lengths of time followed by aerosol Klebsiella pneumoniae and Streptococcus sp. Results

of the experiments expressed in terms of mortality, LD_{50}, and survival time indicate that exposure to ozone lowers the resistance of mice and hamsters to respiratory infections with K. pneumoniae and Streptococcus sp. Statistical analysis of the results indicates that the differences in mortality and survival time are significant at the 0.1% level for most of the experimental conditions studied. (Authors' summary, in part)

12164
Mullinax, P. F., 1958
and D. E. Beischer
OXYGEN TOXICITY IN AVIATION MEDICINE: A REVIEW.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (Research Project NM 12 01 11, Subtask 11). Report no. 2, Feb. 24, 1958. ii+13 p.
Also published in: Jour. Aviation Med., 29 (9): 660-667. Sept. 1958.

A review is presented of observations on the effects of oxygen inhalation at atmospheric pressure in man. Topics considered are (1) the mechanisms of toxicity in the lungs, blood, and central nervous system; (2) effects associated with retinal vasoconstriction, nitrogen elimination, and enzyme inactivation; (3) factors modifying or obscuring the effects of oxygen; (4) symptoms and signs of oxygen toxicity in the cardiorespiratory system, lower respiratory tract, and neuro-muscular system; and (5) safe limits of exposure to oxygen. (26 references)

12165
Rothfeld, E. L., 1961
D. Biber, and A. Bernstein
THE ACUTE EFFECT OF CIGARETTE SMOKING ON PULMONARY FUNCTION STUDIES. —— Diseases of the Chest, 40 (3): 284-290. Sept. 1961.

To determine the immediate effect of cigarette smoking, 23 patients with varying pulmonary diseases and 19 normal subjects all of whom were regular smokers were studied for various pulmonary functions just after smoking. No significant differences were observed in vital capacity, timed vital capacity, maximal breathing capacity, or functional residual capacity in either of the groups. A significant increase in the ventilation equivalent and minute ventilation occurred in the normal group. This increase is probably due to impaired oxygenation caused by smoking.

10. SAFETY, SURVIVAL, AND RESCUE

[Evacuation of patients under 8-e]

a. General

12166
AIRCREW COMFORT AND SURVIVAL.—Aeroplane (London), 96 (2481): 348-350. March 20, 1959.

A general discussion is presented of control systems, equipment, and techniques utilized by the RAF to insure the comfort and survival of its airmen in the newer high-speed, high-altitude aircraft. General performance capabilities and operating procedures are outlined for cabin pressure control systems, temperature and ventilation control systems, oxygen systems, and pressure suits and helmets. Ejection seats, parachute assemblies, aircraft dinghies, and emergency radio units are also discussed. Names of manufacturers and illustrations of various items of equipment are included.

12167
ESCAPE AND SURVIVAL: CLINICAL AND BIOLOGICAL PROBLEMS IN AERO SPACE MEDICINE.—Edited by P. Bergeret. iii+117 p. New York, etc.: Pergamon Press, 1961.

This publication considers many of the aspects of escape and survival, such as: problems of escape at high and low altitudes, ejection seats, Arctic survival training, and radiation hazards in space. Pertinent papers are abstracted separately, see items no. 11373, 11797, 12322, 12325, 12347, 12355, 12794.

12168
Glantz, W. M., and V. A. Stembridge 1959
CORONARY ARTERY ATHEROSCLEROSIS AS A FACTOR IN AIRCRAFT ACCIDENT FATALITIES.—Jour. Aviation Med., 30 (2): 75-89. Feb. 1959.

To evaluate the finding that significant degress of coronary sclerosis occur in young age groups, a microscopic study was undertaken, utilizing autopsy material from 222 aircraft accident fatalities received at the Armed Forces Institute of Pathology. Of the 222 cases, 70% ranged in age from 19 to 43 years and showed some degree of coronary sclerosis. Twenty-one per cent showed varying degrees of definite restriction of the coronary lumen. A marked increase in the incidence of restrictive coronary sclerosis is demonstrated in the age group of 30 to 40. A definite occurrence of myocardial infarction in flight was found in three cases, and in one case myocardial infarction caused the accident. The electrocardiogram should be used to the fullest extent to detect coronary sclerosis. (Authors' summary, modified)

12169
Hadley, W. L. 1959
EVALUATING CREW SAFETY FOR ROCKET-POWERED MANNED SPACE VEHICLES.—American Rocket Society, Publication 951-59. 13 p. New York, 1959.

A first approximation to the index of crew safety for a space vehicle is computed. Some of the problems are being met by the analysis of large amounts of failure information and the application of this knowledge to the design of new vehicles. The prime questions in providing adequate safety provisions concern the level of crew safety desired, the type of safety provisions required, and the environmental conditions under which the safety provisions will have to operate. The steps to be followed in the prediction of crew safety and methods of prediction which have been successfully applied to determine the adequacy of safety provisions in manned space vehicles are discussed.

12170
Hanks, T. G. 1961
SYSTEMS SAFETY AND HEALTH.—Aerospace Med., 32 (4): 283-288. April 1961.

The degree of potential hazard implicit in modern weapon and commercial aerospace systems has made it necessary to develop the concept of complete systems health and safety capability in industry and the Armed Services. A short history of the development of engineering and basic scientific orientation among industrial safety personnel is furnished. The need for defining useful standards and the advantage of education and training from the systems standpoint are examined. The total responsibility involved brings to consideration the quality and background of personnel to be assigned throughout a system. Assignment of personnel may have to be based upon selective processes equivalent to those developed for pilots. At this time, task analysis is not available for developing selective techniques. Most effort at present seems to be directed toward the inhabitants of vehicles and not to those responsible for sending them safely on their way.

12171
Lossberg, V. von 1959
[FLIGHT SAFETY] Flugsicherheit.—Truppenpraxis (Darmstadt), 1959 (1): 45-46. Jan. 1959. In German.

Among the various flight safety measures recommended by the author (and already carried out in part by United States authorities) the following are noteworthy: (1) annual re-examination of pilots for adequacy of performance; (2) careful selection of flight personnel with regard to physical and mental fitness; (3) thorough training in the use of protective equipment and in emergency procedures; (4) continuous improvements of all types of safety and rescue equipment; (5) automatization of instruments and simplification of navigational aids; (6) establishment of a well-planned and exhaustive accident investigation and evaluation program; and (7) rigorous enforcement of flight-crew discipline. Statistics show that only a small percentage of flight accidents are "inevitable". Elimination of all avoidable accidents is the final goal.

12172
Marvin, H. P. 1958
HEALTH FACTORS VITAL IN GLOBAL AVIATION.—Rocky Mountain Med. Jour., 55 (12): 53-56, 121. Dec. 1958.

Flight safety in global aviation is increasingly dependent on human factors. Inadequate responses of pilots are among the chief causes of air accidents. Therefore the physical and emotional fitness of the pilot must be considered to be of ultimate importance. With this in mind, disease factors, oxygen and other

physiological requirements of flight personnel, as well as mental, emotional, and nutritional factors are briefly reviewed in this paper. The physiological effects of high-speed and high-altitude flight, humidity, temperature, acceleration, deceleration, weather, noise, motion, and carbon monoxide are discussed.

12173
MEDICAL ASPECTS OF FLIGHT SAFETY (THE UNEXPLAINED AIRCRAFT ACCIDENT).—Edited by E. Evrard and others. North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development. AGARDograph no. 30. ix+308 p. London, etc.: Pergamon Press, 1959.

A selection of 30 reports are presented from two AGARD Aeromedical Panel symposia (Oslo-Copenhagen, 1956, and Paris, 1957) devoted to the medical aspects of flight safety. Chapter I, the essential part of the work, discusses the physiological problems of high-altitude flight, and the psycho-physiological factors considered as a cause of most aircraft accidents. Chapter II (the unexplained aircraft accident) is limited to statistical data and stories of unexplained accidents of obvious interest. Chapter III, devoted to pathology, contains original and as yet little-known views on the importance of this discipline in evaluation of the causes of accidents. Chapter IV summarizes the present achievements in flight protection and proposes solutions for the future. Chapter V is an appendix and includes papers only indirectly related to the main subject. Also included are author and subject indexes. Pertinent papers are abstracted separately, see items no. 9592, 9869, 10385, 11562, 11603, 11620, 11629, 11631, 11703, 11708, 11827, 11856, 11859, 12203, 12352, 12376, 12379, 12383, 12385, 12386, 12392, 12397, 12409, 12417, 12422, 12428, 12431, 12432, 12667.

12174
[MEDICAL-TECHNICAL PROBLEMS OF MANNED SPACE VEHICLES] Medizinisch-technische Probleme bemannter Raumfahrzeuge. — Flugkörper (Bremen), 3 (5): 151-155. May 1961. In German.

An adequate artificial climate in manned spacecraft depends upon maintenance of the proper oxygen level, cabin pressure, and carbon dioxide concentration. Oxygen can be supplied as a gas or liquid, through the interaction of potassium superoxide and carbon dioxide, or through biological or chemical gas exchangers. Water supplies may be replenished through reclamation from urine, cabin air, and wash water through filtration, centrifugation, or vacuum distillation. The provision of concentrated foods and liquids through squeeze tubes, the serving of hot foods, and methods of sanitary human waste disposal are discussed. While the single occupant of the Mercury capsule must wear an air-cooled pressure suit continuously, personnel of the proposed Project Apollo spacecraft will be required to wear pressure suits only during the booster phase and re-entry stage of the flight.

12175
Smith, Douglas E. 1960
SPACE HAZARDS. — Federation Proceedings, 19 (3, Part II): 40-42. Sept. 1960.

A discussion is given of the possible hazards of space travel which may arise from the external and internal environments of the space ship. The most easily recognized external radiation hazards (the Van Allen belt, cosmic rays) are described in terms of their possible origins and locations, their intensities, and their behavior. The dangers of meteoroids, extremes of temperature (especially during re-entry), excessive accelerative and decelerative forces, as well as the lack of information on human performance during the weightless state, are also cited. Less predictable are the internal environmental hazards which may arise from the contents of the space ship. It is stated that these hazards will be similar in nature to those already encountered in submarines and will consist of the accumulation of toxic substances in recirculated cabin air. The more obvious sources of such accumulations are lubricants, refrigerants, and volatile constituents of paints and metals. Toxic by-products may form from the various chemical reactions and reclamations in a closed ecological system, or bacterial contamination of the general cabin environment might occur. The need for considerable further exploration of both the space environment and the internal environment of the space ship is emphasized.

b. Protective Equipment and Clothing

[*Warning devices under 11-c*]

12176
Agadzhanian, N. A., and V. B. Malkin 1961
[PROBLEMS OF ASSURING SAFETY IN HIGH ALTITUDE FLIGHTS (REVIEW OF FOREIGN LITERATURE)] Voprosy obespecheniia bezopasnosti vysotnykh poletov (Obzor zarubezhnoi literatury). — Voenno-meditsinskii zhurnal (Moskva), 1961 (4): 62-66. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (4): 98-103. Washington, U. S. Joint Pub. Research Serv., no. 9786 (1374-N/41), July 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Oxygen supply to the pilot in the extremely lowered atmospheric pressure of high-altitude flight has stimulated research along two main approaches: (1) variable pressure oxygen-breathing devices, and (2) counterpressure applied to the body surface to balance increased pulmonary pressure. Most of the foreign research has centered around the latter, because the first method carries along with it the dangers of hypocapnia. Data are given on the American development of pressure suits T-1, MC-4, MC-3A, MC-2, a navy pressure suit (Hall and Martin) developed for space conditions, and a high-altitude suit developed in conjunction with the X-15 program. The French pressure suit "Ceba-10", and the attempts to merge high-altitude protection with protection against heat by a ventilated pressure suit are also mentioned.

12177
Alexander, G. 1961
NASA DEVELOPS HIGH-MOBILITY SPACE SUIT. — Aviation Week and Space Technol., 75 (1): 57-59. July 3, 1961.

A light and mobile space suit developed by the National Aeronautics and Space Administration is described. The suit, adjustable to any individual's form, is characterized by a portable and universal-sized couch consisting of inflatable bladders and an aluminum grid frame. Complete support is offered for the back, upper arms, buttocks and thighs. The two-piece fiberglass helmet provides for facial support and ventilation.

12178
Alexander, M., 1961
R. S. Zeigen, and I. Emanuel
ANTHROPOMETRIC DATA PRESENTED IN THREE-DIMENSIONAL FORMS.—Amer. Jour. Physical Anthropol., 19 (2): 147-157. June 1961.

Anthropometric data gathered by the physical anthropologist may be used to design personal protective equipment, but must generally be interpreted for the designer and engineer prior to application to practical problems. One approach to the problem of designing close-fitting protective equipment lies in the translation of the anthropometric data into representative three-dimensional forms. In all of the current approaches, statistical sizing systems are set up on the basis of key dimensions, which serve as fitting dimensions in the field. Sizing programs, including minimum and maximum design values, are established by dividing the key dimensions into appropriate size intervals; and a series of forms are sculptured to a particular sizing program. Forms have been developed for the face (key dimensions are face length and lip length); head (using head circumference as a single key dimension); and the body (based on the key dimensions height and weight). Oxygen masks, helmets, and high-altitude protective clothing designed to the reanalyzed data and to the resultant forms have eliminated a number of critical sizing problems in the U. S. Air Force. (Authors' summary, modified)

12179
Allen, R. 1961
QUICK WAY OUT. — Aeronautics (London), 43(3): 24-27. Jan. 1961.

The design and development of British aircraft ejection seats (both altitude and ground-level) are reviewed. Factors, such as the rate and degree of acceleration and the alignment of the spinal vertebrae at time of ejection, which affect man's tolerance to acceleration (and therefore determine the design criteria for ejection seats) are briefly discussed.

12180
Andrews, R. C. 1961
ZERO GRAVITY LIQUID OXYGEN CONVERTER. — MSA Research Corp., Callery, Pa. (Contract AF 33(616)-6189); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). ASD Technical Report no. 61-431, Sept. 1961. v+28 p.

A detailed account is presented of the design and development of a new liquid oxygen converter with capability of operating under zero-gravity conditions. This new device developed by the MSA Research Corporation (Callery, Pennsylvania) differs from conventional converters by using a heat valve, an internal relief valve, and an internal evaporating coil. Tests showed the design concepts to be a promising approach for controlling liquid oxygen under zero gravity conditions.

12181
Barnett, P. W. 1961
T-33 AIRCRAFT SURVIVAL CONTAINER.— Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-61-8, Oct. 1961. 6 p.

Adequate sleeping gear is necessary for aircrew survival in the Arctic, since a great portion of time during survival is spent inactive. This study was done to determine the feasibility of placing an MC-1 sleeping bag in the T-33 aircraft. Specifications for a container for sleeping gear and survival equipment which meets the requirements of T-33 aircraft are presented.

12182
Bartlett, R. G. 1961
A CLOSED CIRCUIT, COMPRESSED OXYGEN SOURCE REBREATHER SYSTEM FOR AIRCRAFT, FEATURING AUTOMATIC ECONOMIC NITROGEN ELIMINATION. — Naval School of Aviation, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 9, Dec. 12, 1961. ii+9 p.

A rebreather oxygen system has been developed which utilizes a new, economic nitrogen elimination technique. A 200 cubic inch oxygen storage reservoir will meet the nitrogen flushing and body oxygen requirements for an aviator for a ten-hour flight. The device is equipped with features which provide the aviator with pure oxygen (open circuit) breathing in the event of the emergencies of cabin pressure loss or power failure. The entire device can be incorporated into the seat assembly of the aircraft and should weigh less than 30 pounds in a production model. (From the author's summary)

12183
Bartlett, R. G. 1960
and N. E. Phillips
A DEVICE FOR THE HUMIDIFICATION OF DRY OXYGEN.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3100; Subtask 6). Report no. 3, April 27, 1960. ii + 5 p.

An aviator's mask was designed for the prevention of the damaging effects of prolonged dry oxygen inhalation. The device transfers moisture from the humid expired breath by surface absorption to silica gel crystals contained in the oxygen inlet of the mask. Moisture is released into the inspired oxygen by the evaporative effect of the dry gas. The device provides an oxygen humidification of approximately 70 per cent.

12184
Bartlett, R. G., 1960
and N. E. Phillips
A DEVICE FOR THE HUMIDIFICATION OF INSPIRED DRY OXYGEN AND THE CONSERVATION OF BREATHING OXYGEN.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project MR005.13-3100, Subtask 6). Report no. 2, April 27, 1960. ii + 9 p.

A self-regulating breathing mask has been designed which transfers moisture from the expired breath to the inspired dry oxygen. The dead-space oxygen is saved by being trapped in a "bellows" and is used during the next breath. Laboratory tests show that the mask brings about a 40 to 60% humidification of the inspired oxygen and a saving of 15 to 20% of the oxygen. (Authors' abstract).

12185
Bartlett, R. G., 1960
and N. E. Phillips
A DEVICE FOR THE HUMIDIFICATION OF INSPIRED DRY OXYGEN AND THE PREVENTION OF HYPERVENTILATION. — Naval School of Aviation Med., Pensacola, Fla. (Project no. MR005.13-3100, Subtask no. 6). Report no. 1, March 1, 1960. ii+11 p.

A breathing mask was constructed to provide humidification of inspired oxygen and to prevent

the undesirable effects of hyperventilation. The mask accomplishes humidification by the transfer of moisture absorbed from the expired breath to the inspired oxygen. The effects of hyperventilation are eliminated through the addition of dead space to the apparatus to increase the CO_2 tension of inspired air. The mask has been successfully tested at several altitudes.

12186
Bartlett, R. G. 1961
IN-FLIGHT ARTIFICIAL RESPIRATION AND PULMONARY RESUSCITATION WITH STANDARD OXYGEN GEAR. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 5, July 11, 1961. ii+9 p.

The use of the unaltered aviator's pressure breathing mask for mouth-to-mouth resuscitation is described. Also described is one small alteration to the pressure breathing mask permitting the union of two masks into a mask-to-mask resuscitation device. When two masks so connected are used in conjunction with a portable oxygen supply, resuscitation with oxygen may be accomplished. A device constructed from the valves from the pressure compensated mask, which may be used for chronic maintenance of the respiratory cripple, has been developed. (Author's abstract)

12187
Bartlett, R. G. 1961
A MINIATURE WALK-AROUND OXYGEN REBREATHER DEVICE. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 7, Dec. 1, 1961. ii+9 p.

An ultraminiature walk-around oxygen rebreather has been developed. The weight is only 1.5 lb., and for a moderate work load the oxygen supply lasts for one hour. The device is a one-part, self-contained apparatus entirely included within a small, easily donned mask. Oxygen is supplied from a coiled, thin-walled, tubing reservoir which reduces both the weight and rupture hazard. CO_2 is absorbed by passing both the inspired and expired breath through an alkaline absorber. The device should be useful as an emergency oxygen source and also in some routine duties when oxygen is required for short periods of time. (Author's abstract)

12188
Bartlett, R. G., 1961
and N. E. Phillips
OLFACTORY IDENTIFICATION OF LIQUID OXYGEN CONTAMINANTS. — Aerospace Med., 32 (7): 621-629. July 1961.

Ten subjects were selected to identify and designate contaminants of oxygen sources by the olfactory sense. The data indicate that differentiation is possible for some subjects when the comparisons are contiguous in time but that designation as to which source is contaminated and which is pure oxygen is not possible. In other words, the sources are noticeably different without either one being objectionable. It is believed that the odor differences detected may not necessarily be due to the presence of the added contaminant but to other unidentified substances. The data also indicate that none of the contaminants tested (methane, ethylene, nitrous oxide, ethane, or isobutane), in the concentrations used, provide meaningful clues for olfactory differentiation.

12189
Bartlett, R. G., 1961
N. E. Phillips, and G. T. Couch
OXYGEN CONTAMINANTS: CYLINDER ODORS. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 7). Report no. 3, Jan. 23, 1961. 8 p.

Each of a pair of cylinders of aviators' breathing oxygen taken from stock at the Pensacola Naval Air Station was differentiated by olfaction by subjects with high olfactory acuity. Thus, oxygen from any cylinder would be said to have an "odor" since it is distinguishable by olfaction from other cylinders. Relationships of "cylinder odors" to bad oxygen episodes are discussed. (Authors' abstract)

12190
Beckh, H. J. von 1958
MULTI-DIRECTIONAL G PROTECTION IN SPACE FLIGHT AND DURING ESCAPE: A THEORETICAL APPROACH. — Jour. Aviation Med., 29 (5): 335-342. May 1958.

A conceptual device is described which provides multi-directional acceleration protection to pilots during flight and escape by automatic supine positioning. The "anti-g ejection capsule" is pivoted about the lateral axis of aircraft, allowing free rotation through 360°. The center of gravity is located so that changes in the direction of acceleration automatically position the capsule such that the resultant force is perpendicular to the heart-head line of the pilot. Operational controls are constructed to allow handling in the supine position during high acceleration, and displays are integrated in the capsule. The capsule can be locked in conventional position during take-off and landing. It is suggested that the principle of the device could be tested before solution of the technical difficulties involved in the practical realization of the capsule.

12191
Beckh, H. J. von 1958
MULTIDIRECTIONAL G-PROTECTION IN SPACE VEHICLES. — Jour. Brit. Interplanetary Soc. (London), 16 (9): 525-533. Sept.-Oct. 1958.

Description, with figures, is presented of a capsule to be used during flight or ejection, which applies the principle of the supinating seat to give multidirectional g-protection by automatic supine positioning. This device is termed the anti-g ejection capsule. Various difficulties involved in the realization of the device include the weight ratio, transmission of all connections via sliprings, adequate damping, and maintenance of the internal environment of the sealed capsule.

12192
Biesele, R. L. 1959
AUTOMATIC TEMPERATURE CONTROLLERS FOR THE MA-1 ALTITUDE HELMET VISOR. — Fenwal Inc., Ashland, Mass. (Contract AF 33 (616)-5250); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6336, Task no. 63619). WADC Technical Report no. 59-232, May 1959. iii+20 p. AD 226 518

This report covers the technical aspects of a contract for the development of automatic temperature controllers for the MA-1 Altitude Helmet Visor. The controllers were designed to mount inside a new high-altitude helmet and to maintain

the interior surface temperature of the helmet visor by control of the power supplied to an electrical heating coating provided in the visor. A single controller has been designed which is suitable for operation from either a 28-volt D. C. supply, or, by means of a separately mounted rectifier power supply, from a 115-volt, 400-cycle supply. The controller, as designed, is transistorized and uses only static switching elements. It was designed for minimum size, weight, and power drain. It can be installed in helmets already provided to the Air Force by relatively minor modifications of the helmet. (Author's abstract)

12193
Billingham, J., 1961
R. H. Farrow, and D. G. Robertson
AN AIR VENTILATED SUIT FOR CONVECTIVE COOLING (TYPE 3B).—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 159, May 1961. i+10 p.

All existing air ventilated suits (A.V.S.) have been designed to give uniform air flows to all regions of the body covered by the suit, in order that evaporative cooling may be effected with maximum efficiency. It has always been assumed that the subject will be hot and sweating, though possibly in a steady state. Recent evidence has shown that there may be some decrement in efficiency at flying tasks if aircrew are allowed to become hot at all, and that the ideal aim should be thermal comfort, which has been taken to be commensurate with a mean skin temperature of 33°C., with a sweat rate of zero, and with skin temperatures which differ little in all regions of the body. To achieve such a thermal state it is necessary to supply cold air to the A.V.S. and to change the pattern of air distribution so that appropriate amounts of heat are removed from all areas of the body that are covered by the suit. This was achieved by changing the distribution of the air exit holes in the A.V.S. Type 3, so that the air was liberated mainly from the distal sections of the pipes, i.e. the bulk of the air was released from the distributing pipes below the knees and elbows, some was released in the back region, and less that 1% of the total flow was released over the chest and abdomen. A suit having these characteristics was tested on subjects exposed to high ambient heat loads, and it was found that complete thermal comfort could be achieved. (Authors' summary)

12194
Billingham, J. 1961
CONTROL OF MICROCLIMATE TEMPERATURE IN VERY HOT ENVIRONMENTS [Abstract]. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 229. 1961.

Very high speed travel through the atmosphere implies high heat loads on the pressure cabin. Should the cooling system fail, cabin temperature may rise to dangerous levels. The dangers to aircrew of exposure to very high cabin temperatures are a general rise in body temperature causing inefficiency or collapse, and local overheating of the skin causing burns. Under such circumstances it is essential to maintain the microclimate temperature at a level compatible with safety. To date the method used has been almost exclusively that of forced ventilation of the cabin with air. Recent experiments show that it is possible to maintain the microclimate temperature of a subject in an unconditioned aircraft cabin with wall temperatures of 125° C. at a reasonable level with forced air ventilation by means of an air ventilated suit. (Author's abstract, modified)

12195
Billingham, J., 1961
and D. G. Robertson
A DESIGN FOR AN AIR VENTILATED SUIT TYPE 5.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 160, June 1961. [13] p.

An Air Ventilated Suit (A.V.S.) Type 5 has been designed. The chief purpose of the suit is to allow an evaporative (i.e. warm) air supply to reach all parts of the body and a convective (i.e. cold or hot) air supply to give a uniform skin temperature distribution. If successful in practice the new suit will replace three existing suits, the A.V.S. Types 3A, 3B and 3C. A prototype suit was made by combining the U.S. Air Force MA-3 Suit with the R.A.F. Type 3B Suit. This prototype was found to give an acceptable skin temperature distribution and comfort level when supplied with cold air in a hot environment. (Authors' summary)

12196
Bitten, J. 1960
LIQUID OXYGEN CONVERTER. — Illinois Institute of Technology. Armour Research Foundation, Chicago, Ill. (Contract AF 33(616)-6756); issued by Wright Air Development Division. Aerospace Medical Division, Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). WADD Technical Report no. 60-669, Oct. 1960. vi+59 p.

A 5-liter zero gravity liquid oxygen converter based on the paramagnetic and surface tension properties of liquid oxygen was designed, and a prototype unit was constructed. The design study showed that the magnitude of the magnetic or surface tension forces is sufficient to operate the unit under zero gravity conditions. Investigations showed that possible operational and construction problems due to thermal stresses in the magnet, the magnetic field on the gaging system, the physical properties of the liquid oxygen, and the wettability of the metal tubes of the liquid oxygen will not adversely affect the construction or operation of the converter. Theoretical calculations determined the magnitude of the magnetic forces on various sizes of liquid oxygen droplets and correlated the data obtained from measuring the flow rate of liquids in horizontal capillaries. (Author's abstract) (76 references)

12197
Bryan, A. C., 1961
W. G. Leach, and R. A. Stubbs
AIRCREW OXYGEN REQUIREMENTS IN HIGH ALTITUDE TRANSPORT AIRCRAFT.—Aerospace Med., 32 (1): 30-34. Jan. 1961.

In two series of tests at simulated altitudes of 8,000 to 40,000 feet, it was determined that pilots should have oxygen masks "at readiness" up to 35,000 feet, but on the face above this altitude.

12198
Burns, N. M., 1961
and R. L. Burdick
COCKPIT DESIGN STUDIES: STANDARD COCKPIT MOCKUP, PRESSURE SUIT MOBILITY. II. THE PROJECT MERCURY SUIT. —— Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-443, Feb. 21, 1961. iv+10 p.

Six astronauts wearing pressure suits, seated at a modified Mercury control panel, received 25 sequence stimuli (involving groups of 6 switches or controls) and about 50 single stimuli (involving only a simple response to one light). Reaction times were tested under two conditions of pressure suit inflation: 0 p.s.i. and 5 p.s.i. Under the 5 p.s.i. condition, reaction times increased significantly as did the frequency of inadvertent actuation (i.e., errors).

12199
Burns, N. M., 1961
and R. L. Burdick
EFFECTS OF PRESSURE SUIT INFLATION ON REACTION TIMES OF PROJECT MERCURY ASTRONAUTS.—Aerospace Med., 32 (9): 849-852. Sept. 1961.

Reaction times of six Project Mercury astronauts were tested under two conditions of pressure suit inflation: 0 p.s.i. and 5 p.s.i. Under the 5 p.s.i. condition, reaction times increased significantly as did the frequency of inadvertent actuation. (Authors' summary)

12200
Burns, N. M., 1961
and T. D. Hanna
AN INVESTIGATION INTO THE PHYSIOLOGICAL LIMITATIONS ASSOCIATED WITH THE USE OF ANTI-EXPOSURE SUITS: THE EFFECTS OF PROTECTIVE AVIATOR CLOTHING ON OPERATOR PERFORMANCE. —— Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Subtask MR005.13-4004.4). Report no. NAMC-ACEL-463, Sept. 8, 1961. v+12 p.

Measurements for psychomotor tasks, a manual dexterity task, a sustained effort task, and a choice reaction time task as well as heart rate, body skin temperature and pre- and post-epinephrine and norepinephrine excretion indicate a decrement in performance when subjects wore modified MK5 anti-exposure suit assembly as compared to when they wore only the light summer flight suit. Since thermal equilibrium was attained under both conditions, deterioration in performance was attributed to factors other than the various aspects of the physical environment. Physiological changes in various body systems must be measured during the performance of the task in order to assess properly performance efficiency under varying conditions of stress.

12201
Burns, N. M., 1959
and E. C. Gifford
PRESSURE SUIT MOBILITY: A PRELIMINARY STUDY.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AV-43003, Part 4). Report no. NAMC-ACEL-412, Oct. 15, 1959. v+15 p.

Four subjects were used in this study, with each subject wearing each of three basic pressure suit configurations on at least one occasion. The time taken to activate the appropriate switch, once the signal was given, and the time taken to complete a sequence of movements was recorded. The data were plotted graphically in order to demonstrate the restricting effects of the various suits and the effects of inflating the suit to 5 p.s.i. The results indicate two primary findings. First, the three suits tested appear to be roughly equivalent with regard to their respective mobility. Secondly, in the event of a loss of cabin pressure, inflation of the suit to 5 p.s.i. can be expected to lengthen the reaction time (RT). The differences in RT among the three suits at 0 and 5 p.s.i. were statistically significant in every case. (Authors' summary)

12202
Chrenko, F. A., 1961
and L. G. C. E. Pugh
THE CONTRIBUTION OF SOLAR RADIATION TO THE THERMAL ENVIRONMENT OF MAN IN ANTARCTICA. —— Proc. Roy. Soc. (London), 155 (959): 243-265. Nov. 21, 1961.

Observation of solar radiation and its effects on clothing and skin temperatures of men standing on snow at Scott Base, Antarctica, are reported. From measurements of the spectral reflectance of the outer garments and the regional thermal insulation of the clothing made subsequently, the solar heat gain at the clothing surface and its effect on heat transmission through the clothing and on heat loss to the environment were calculated. The effective surface area of the clothed body surface exposed to direct and reflected solar radiation, and the effective surface areas concerned in low temperature radiation exchange and convective heat loss are considered. An attempt was made to determine these areas by direct measurement. The results were used to calculate values for the solar heat gain by the whole body and the cooling power of the environment under Antarctic conditions, the combined effects of which are expressed in terms of a temperature increment to be added to the ambient temperature. Representative figures and tables are included. (Authors' summary, modified)

12203
Cole, E. L. 1959
TRENDS IN PERSONAL EQUIPMENT.—In: Medical aspects of flight safety, p. 208-212, 3 unpaged leaves. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

A brief historical review is presented of the development of the airman's personal protective equipment with special consideration given to the parachute, oxygen mask, anti-g suit, heavy winter clothing, survival equipment (A-1 kits for land, C-2A raft kits for sea), and the altitude suit. A series of photographs are included to demonstrate in detail the different pieces of flight clothing such as the integrated g and partial-pressure altitude suit, ventilation suit, liner providing proper clo value, exposure suit, pressure helmet, underarm life preserver, parachute, survival kit, integrated harness, oxygen equipment, etc. With the development of modern aircraft the necessity is stressed for constant modifications in flight clothing.

12204
Colin, J., 1961
C. Jacquemin, and P. Varene
[THE PHYSIOLOGICAL BASES FOR CONTROL

OF TRAINING FOR THE PRESSURIZED SUIT] Les bases physiologiques du contrôle de l'entraînement au vêtement pressurisé.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 181-187. Roma, 1961. In French.

Pilots of high-performance French aircraft are familiarized with their pressure equipment and suits by means of a specialized training and indoctrination program. It includes conferences, ground training, medical measurements of cardiac frequency, respiration under pressure breathing, and exposure of a subject wearing a pressure suit to decompression-chamber tests. With perfectly adjusted clothing no change in blood circulation is found. Integumentary mechanical counterpressure abolishes the pressure differential which could be created by intrapulmonary pressure. When integumentary counterpressure is insufficient, there is evident circulatory unbalance due to positive-pressure breathing. Tachycardia is one of the manifestations of unbalance and is very easy to diagnose. Studying positive-pressure breathing contributes to better understanding of the physiological problem involved in regulating the blood mass, and easily verifies adaptation of the subject to his equipment by clinical observation and control of respiratory and cardiac frequencies.

12205
Colin, J. 1958
[A STATISTICAL STUDY OF ONE HUNDRED FLIGHTS WITH PRESSURE SUITS TO ALTITUDES ABOVE 15,000 METERS] Etude statistique de cent montées effectuées au-dessus de 15,000 m. d'altitude avec des vêtements pressurisés.—Médecine aéronautique (Paris), 13 (1): 75-82. 1958. In French, with English summary (p. 82).

Twelve airplane flights and 88 simulated flights in the decompression chamber at altitudes of either 17,000 m. (55,700 feet) or 20,000 m. (65,600 feet) were carried out to test French, American, and British altitude suits, flight helmets, and accessories. Only two incidents occurred (hyperventilation) which indicated incomplete fitness of the French "Aerazur" suit (Type 10, without inflatable pressure vest). The French "Aerazur" suit, Type 22, and the American T1-A suit (the latter supplemented by a pressure vest covering the whole trunk) provided effective protection at high altitudes. The French "EFA" and the British "GQ" flight helmets were found to require improvements.

12206
Colin, J. 1960
[THE PROTECTION OF FLYING PERSONNEL AGAINST THE EFFECTS OF VERY HIGH ALTITUDE] La protection du personnel navigant contre les effets de la très haute altitude.— Revue des Corps de santé des armées (Paris), 1 (5): 625-635. Oct. 1960. In French.

The performances of the full-pressure and partial-pressure high altitude suits are compared for the conditions of normal flight, loss of pressurization, ejection, and forced landing. It is demonstrated that the full-pressure suit allows greater mobility, provides superior protection against heat, aeroembolism, and explosive decompression, and avoids the cardiovascular complications of positive pressure breathing following loss of cabin pressurization. The two suits are shown to produce similar problems of vision, and to provide equal protection against acceleration and during ejection.

12207
Comfort, E. 1960
EFFECTIVE DEAD SPACE IN THE MA-3 HELMET. — Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio. WADD Technical Report no. 60-362, May 1960. iii+4 p.

The respiratory response of a group of subjects wearing the MA-3 full-head helmet was compared with the response to known dead space volumes. Comparison of these data showed that the average effective dead space or volume of rebreathed air was approximately 235 cc. when the MA-3 helmet was supplied with oxygen at three or four inches of water positive pressure from a standard pressure suit regulator. The concentration of inspired CO_2 was calculated to be 0.8 per cent. (Author's abstract)

12208
Contini, R., R. Drillis, and L. Slote 1959
DEVELOPMENT OF TECHNIQUES FOR THE EVALUATION OF HIGH ALTITUDE PRESSURE SUITS.—New York Univ. College of Engineering. (Contract AF 33(616)-3592); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 6333, Task no. 71516). WADC Technical Report no. 58-641, Dec. 1959. ix+121 p.

A study was made to develop objective criteria to facilitate the selection of that pressure suit or component which permits the operator maximum function, and to make available to the manufacturer of the suit or component objective data from which improvements may be made in the design of the item. To accomplish these purposes, the techniques and methodologies associated with biomechanics were studied for their application to pressure-suited personnel. Psychological and physiological techniques were investigated for usefulness in the over-all investigation. During the course of this study only the basic movements of the upper extremities were considered. Nonetheless, the methods can be applied generally to other body segments, and, therefore, an over-all evaluation of a pressure suit or suit component can be accomplished. (From the authors' abstract)

12209
Cramer, K. R., and T. F. Irvine 1960
THERMAL ANALYSIS OF SPACE SUITS IN ORBIT. — Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63114). WADD Technical Note no. 60-144, May 1960. vi+15 p.

The thermal analysis of a model space suit in orbit is presented as a guide for designers and as a basis for more extensive studies for the prediction of a suited man's thermal environment in an earth orbit. The results demonstrate the feasibility of passive suit-temperature control through the proper choice of materials and surface spectral properties. (Authors' abstract)

12210
Creswell, A. W., 1959
J. Ernsting, I. D. Green, R. E. Nagle, and P. R. Wagner
DURATION OF PROTECTION AFFORDED BY THE PRESSURE BREATHING MASK, PRESSURE JERKIN AND ANTI-G SUIT COMBINATION.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC Memo 117, June 1959. i+7 p.

The protection against anoxia at 56,000 feet afforded by pressure breathing at 60 mm. Hg with the pressure mask, jerkin, and anti-g suit system was investigated using the Mk 21 demand oxygen regulator. Experiments demonstrated that two additional stresses are applied to the subject during pressure breathing with this system. One is associated with the discomfort and stimulation of the carotid artery baroreceptors due to the use of an oronasal mask to deliver the pressure to the respiratory tract. The other stress is that of anoxia due to the use of an intrapulmonary pressure of 126 mm. Hg absolute (alveolar oxygen tension of approximately 50 mm. Hg). Of the 5 subjects who were exposed to a simulated altitude of 56,000 feet with this system two collapsed within 3 minutes. Each of the remainder completed a 6 minute exposure. This pressure breathing system cannot be relied upon to provide adequate protection against anoxia if the period of exposure exceeds 30 seconds at 56,000 feet followed by a descent to 40,000 feet at 10,000 feet per minute. It is recommended that the pressure breathing mask, pressure jerkin, anti-g suit, and the Mk 21 oxygen regulator combination should only be used in aircraft which exceed an altitude of 50,000 feet by a small margin only and which can descend from maximum altitude to below 40,000 feet rapidly. (Authors' summary and recommendations)

12211
Crockford, G. W., 1961
R. F. Hellon, P. W. Humphreys, and A. R. Lind
AN AIR-VENTILATED SUIT FOR WEAR IN VERY HOT ENVIRONMENTS. — Ergonomics (London), 4 (1): 63-72. Jan. 1961.

Fifteen men, wearing an air-ventilated clothing assembly, were exposed to an ambient temperature of about 81° C. The suit was ventilated with dry air (6-7 mm. Hg) at volumes between 283 and 707 liters/min. at temperatures between 30° C. and 37.8° C. At ventilating volumes of 424 liters/min. and over, the subjects were able to establish bodily thermal equilibrium in an hour, irrespective of the temperature of the air delivered to the suit. Thermal equilibrium was never achieved when only 283 liters/min. were supplied. In the interests of safety, it is recommended that such a suit in use ought to be supplied with dry air at a volume of not less than 707 liters/min. at a temperature of not more than 30° C. (Authors' abstract)

12212
Crowe, N. 1959
EMERGENCY PASSENGER OXYGEN SYSTEMS.—Jour. Royal Aeronaut. Soc. (London), 63 (583): 417-419. July 1959.

An emergency passenger oxygen system for use at high altitude in case of pressure cabin failure is described and illustrated. Mask presentation units included with the system are located in the luggage rack, and in the event of pressure cabin failure an oxygen mask is automatically presented in front of the head of each passenger. It is then only necessary for the passenger to pull the mask onto his face to obtain a supply of oxygen at sufficient flow to safeguard him until the aircraft has been brought down to a lower altitude. Each presentation unit also includes an attachment point for medicinal or therapeutic oxygen, which is independent of the emergency system, and from which a supply is always available. The weight of the equipment is approximately two lb. per passenger.

12213
David Clark Co., Inc. 1960
DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT COVERALL, HIGH ALTITUDE, VENTILATION-EXPOSURE TYPE CSU-5/P. — David Clark Co., Inc., Worcester, Mass. (Contract AF 33(600)-36627); issued by Wright Air Development Division. Operational Support Engineering Division, Wright-Patterson Air Force Base, Ohio (Project no. 6336, Task no. 63619). WADD Technical Report no. 60-809, Nov. 1960. vi+9 p.

Developmental prototypes of an emergency pressure suit, Type CSU-5/P, are described. Subsequent sizing of this coverall in the eight-size height-weight program was based on the fourth model (Size Large Long, PNS-848C). The development of this coverall presents an opportunity to consolidate the anti-exposure and altitude coveralls with a minimum penalty for weight, when used on a specific mission profile which requires protection at altitude, and exposure on land and water in cold climates. A review of the attempts to integrate the neck seal bladder and coverall, in conjunction with quick entry methods, indicates definite progress, but requires that modifications be considered. (Author's summary)

12214
DeForest, R. E., 1961
and E. L. Beckman
SOME MEDICAL CONTRAINDICATIONS TO THE USE OF THE STANDARD LIFE JACKET FOR SURVIVAL. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task no. MR005.13-4003.4, Report no. 1). Report no. NADC-MA-6135, Aug. 9, 1961. iv+17 p.

The Mae West type of flotation equipment causes two deleterious, physiological effects: (1) profuse diuresis based upon the Gauer-Henry left atrial volume receptor reflex which is stimulated by the negative pressure breathing required in partial water immersion, and the externally applied gradient pressure, and (2) the rapid heat loss from the immersed part of the body which would be incapacitating even at sea temperatures of 78° F. which are now thought to be innocuous. These physiological effects which result from the use of the Mae West type survival equipment increase the severity of an already overwhelming stress. An alternative type of individual flotation garment which would obviate many of these difficulties has therefore been recommended for further consideration. (From the authors' summary) (23 references)

12215
DEVELOPMENT OF IMPROVED FLIGHT HELMET LINER.—Bjorksten Research Labs., Madison, Wis. (Contract AF 33(600)-34149); issued by

Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6336, Task no. 63619). WADC Technical Report no. 59-435, Oct. 1959. v+17 p.

Various low-density plastic foam systems were evaluated for suitability for a padding helmet liner providing maximum comfort with greatest protection against shock and impact. Means of fabricating uniform and reproducible liners by injection of fluid foam into molds were studied. A liner was developed which appears to meet specification requirements for comfort, protection, ease of application, and durability. It consists of a complete inner layer of a maximum-comfort, open-celled, hydrophobic polyurethane foam, integrally bonded to an outer layer of high-energy, absorbent polyurethane foam which is thickest over the parietal, upper occipital, and temporal areas and also provides chin area protection. Density of the composite material is approximately 4 pounds per cubic foot. Polyurethane foam systems are shown to be capable of providing the desired combination of properties for this application, utilizing techniques adaptable to production processing. (Author's abstract)

12216
Dreyer, J. F. 1961
FEASIBILITY STUDY AND DESIGN OF A SELF-ATTENUATING LIGHT VALVE: SUPERSEDES WADC TR 59-81.—Polacoat Inc., Blue Ash, Ohio (Contract AF 33(616)-6715); issued by Wright Air Development Center. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71839). WADD Technical Report no. 60-827, Feb. 1961. iv+20 p.

The use of phototropic materials as self-attenuating light valves is re-evaluated in the light of additional information. Sunglass application still appears to be feasible. As eye-protective devices to prevent flashblindness and retinal burns from nuclear detonations, phototropic filters appear to be feasible. However, it is impossible to state that they will provide complete eye protection under all operational conditions until more information is available on: (1) the absorption coefficients of the materials and (2) the tolerance of the human retina to short-duration, high-intensity radiation. (Author's abstract)

12217
Dupont, M. 1958
[VARIATIONS IN THE TEMPERATURE OF THE EXTREMITIES IN SUBJECTS EXPOSED TO THE EFFECTS OF COLD] Les variations de la température des extremités chez les sujets soumis aux effects due froid.---Comptes rendus de la Société de biologie (Paris), 152 (1): 64-69. 1958. In French.

Estimates were made of the thermal value of flight clothing by the Winslow-Herrington formula, in which the protective value is equal to the ratio of skin temperature minus air temperature to the heat given off by the body in a given time interval. An average protective value of 3.3 clo (sufficient to maintain body temperature during exposure to -10° for at least 3 hours) was found for conditions of thermal neutrality in 7 subjects. During test exposures for 1 hour to a temperature of -20° C., the skin temperature of the chest varied from 36° to 34°, while the temperature of the feet varied from 30° to 20°. It is concluded that the protective efficiency of clothing should be evaluated in terms of temperature changes of the extremities as well as of the body.

12218
Eisen, L., and R. S. Zeigen 1959
A SUPINE SEAT FOR HIGH-STRESS TESTING OF PRIMATES.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71749). WADC Technical Report no. 59-165, April 1959. iii+18 p. PB 151976

This study summarizes the design rationale of a supine seat and restraint harness, with surrounding enclosure, for high stress bioscience experiments with a Macaca cynomolgus monkey (Macaca iris). This configuration is intended for test under various abnormal stresses including high-g centrifuge runs. Testing and feeding of the subject in the enclosure will be accomplished to determine his reaction to these stresses. With minimum modification, the Macaque supine seat and restraint harness could accept any primate for ground tests or bio-experiments in space flight. A brief description of an earlier supine test seat and restraint harness for low-stress experiments using a squirrel monkey is included. (Authors' abstract)

12219
Emanuel, I., M. Alexander, and E. Churchill 1959
ANTHROPOMETRIC SIZING AND FIT-TEST OF THE MC-1 ORAL-NASAL OXYGEN MASK.—Antioch Coll., Yellow Springs, Ohio (Contracts AF 18(600)-30 and AF 33(616)-3841); and Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7214, Task no. 71728). WADC Technical Report no. 58-505, March 1959. 23 p. AD 213 604

A sizing program for oral-nasal oxygen masks, based on total face length and lip length, was developed through a reanalysis of the 1950 USAF Anthropometric Survey head and face data. Face forms, based on this sizing program, were constructed for use in the preparation of such masks. The MC-1 Oxygen Mask, an oral-nasal, pressure-demand type mask, was fabricated in accordance with this sizing system and through the use of these face forms. In the fit-tests, one-hundred-forty-nine of one-hundred-fifty subjects fit-tested were satisfactorily fitted in their indicated sizes. This report includes a discussion of the theoretical and practical aspects of the sizing procedure. Design limits and related statistical material and suggested procurement tariffs for each of the six sizes proposed are given. The MC-1 mask is described and the fit-test procedure and results are presented. (Authors' abstract)

12220
Emanuel, I., M. Alexander, E. Churchill, and B. Truett 1959
A HEIGHT-WEIGHT SIZING SYSTEM FOR FLIGHT CLOTHING.—Antioch Coll., Yellow Springs, Ohio (Contract AF 33(616)3841); and Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7214, Task no. 71739). WADC Technical Report no. 56-365, April 1959. v+109 p. AD 130 917

This report presents a height-weight sizing system for use by designers and fitters of flight clothing. The observations and recommendations reported here are based on a re-analysis of the body-size data of the 1950 Anthropometric Survey of Air Force flying personnel. This re-analysis consisted of selecting pairs of dimensions and correlating these with

other dimensions important in clothing design. Among the pairs studied, height and weight were chosen as basic sizing dimensions because they generally yield the highest correlations with other bodily dimensions. In addition to presenting the methodology used in the present problem, the practical and statistical problems of developing a sizing system are thoroughly discussed. Finally, tables of body dimensional data are presented for several basic size programs (6-size, 8-size, 9-size, and 12-size), since the number of sizes varies with the type of garment. These tables include fitting charts, estimated procurement tariffs, design ranges, mean values for size groups, and bivariate tables for height and weight with size categories marked off for each program. The choice and application of these programs are discussed in detail. Descriptions of the selected body dimensions are included. Advantages of the height-weight system include improved fit, fewer alterations, minimal adjustability, and simplified procurement, distribution and fitting procedures. (Authors' abstract)

12221
Ernsting, J., 1960
and H. L. Roxburgh
AN ASSESSMENT OF THE CONCEPT OF A BAROMETRIC COMPENSATED EXPIRATORY VALVE.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 153, Oct. 1960. i+21 p.

The disadvantages of a standard compensated expiratory valve are reviewed. Many of the disadvantages may be overcome by using an expiratory valve which is held shut by a spring at altitudes below 40,000 feet and is compensated at altitudes above 40,000 feet. This report consists of an assessment of a barometric compensated expiratory valve constructed by the Auster Aircraft Company. The behavior of the valve at ground level, during breathing, at reduced barometric pressure, and during rapid decompression were observed. The measurements show that below 35,000 feet compensation does not occur, while at and above 40,000 feet the valve is fully compensated.

12222
Ernsting, J. 1961
A PHYSIOLOGICAL ASSESSMENT OF THE PRINCIPLE OF PHASED DILUTION IN OXYGEN BREATHING SYSTEMS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1145, Jan. 1961. i+19 p.

The efficiency of an oxygen/air breathing system using a fixed continuous flow of oxygen, in which 100% oxygen is delivered at the beginning of each inspiration and is followed by air ("phased dilution") has been compared with that of a system in which the same volumes of oxygen and air are thoroughly mixed before delivery to the respiratory tract. Two pairs of comparisons were carried out on 5 occasions. In all but one of the experiments the respiratory state of the subject was the same breathing on both systems. There was no significant difference between the arterial oxygen tensions attained with the two systems (difference between means of pairs of determinations of arterial oxygen tension with each of the systems was 0.5 mm. Hg). The increase in mean alveolar oxygen tension to be expected in the phased dilution system in which the dead space is filled only with air at the end of inspiration is negated by an increase in the difference between the mean alveolar and the arterial oxygen tensions caused by unevenness of alveolar oxygen tension in different parts of the lungs. (Author's summary)

12223
Fawcett, H. H. 1961
SPEECH TRANSMISSION THROUGH RESPIRATORY PROTECTIVE DEVICES. —— Indus. Hygiene Jour., 22 (3): 170-174. June 1961.

The articulation index, or measure of the intelligibility of the spoken word, has been determined for 15 respiratory protective devices (respirators, masks, etc.) in common use. Speech transmission is definitely inhibited by these devices, many of which would preclude effective communication in any kind of noisy environment. The use of built-in telephones or two-way radios appears to be the most practical solution to this problem.

12224
Figur, A., 1959
and P. R. Tiller
EVALUATION OF THE EFFECTS OF VENTILATION OF THE APH-5 HELMET ON AUDITORY PERCEPTION.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-5209.1). Report no. NAMC-ACEL-397, Feb. 17, 1959. iv+3 p. AD 216 045

Ventilation of the APH-5 helmet by positive pressure produces noise within the helmet. This noise does not interfere with sound perception of pure tone frequencies in the presence of in-flight noise levels recorded in an F11F cockpit. (Authors' abstract)

12225
Fletcher, J. L. 1961
A FIELD EVALUATION OF THE ACOUSTIC REFLEX EAR DEFENDER SYSTEM.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X95-25-001). Report no. 524, Dec. 21, 1961. i+7 p.

A field evaluation of the Acoustic Reflex Ear Defender System was made. The evaluation was made in two phases. Phase I consisted of pre- and post-exposure tests of the hearing of 16 tank-crew members firing the 76 mm cannon or an M-41 tank with and without the protection of the reflex system. The reflex system provided 14 db. of "protection" (reduction in temporary threshold shift). Phase II involved moving-target gunnery by expert gunners. It was conducted to determine whether the time delay introduced by the reflex system adversely affected gunnery. No significant difference in gunnery with and without the reflex system operating was indicated. Use of the Acoustic Reflex Ear Defender System in armored vehicles is recommended. (Author's abstract)

12226
Fust, H. D. 1960
[DEVELOPMENT OF SEAT CUSHIONS FOR GLIDER FOR THE PREVENTION OF IMPACT INJURIES TO THE SPINE] Entwicklung von Sitzkissen für Segelflugzeuge zur Vermeidung von Wirbelsäulenstauchschäden.—Deutsche Versuchsanstalt für Luftfahrt, Mülheim (Ruhr). Report no. 139, Oct. 1960. 20 p. In German.

A theoretical determination of the shock forces as they appear at the pilot's seat of a glider in the

course of bumpy or crash-landings is practically impossible. Exact values can be obtained only by tests. Tests were conducted to determine the shock absorbency of synthetic crepe rubber seat cushions in an attempt to avoid spinal cord injuries. The modification of the shock forces was directly dependent on the thickness of the rubber and the height of crash. The rubber seat cushions could be used in gliders to prevent injuries on abrupt landings.

12227
Gell, C. F., 1959
E. L. Hays, and J. V. Correale
DEVELOPMENTAL HISTORY OF THE AVIATOR'S FULL PRESSURE SUIT IN THE U.S. NAVY.—Jour. Aviation Med., 30 (4): 241-250. April 1959.

A historical summary of the development of full-pressure suits for aviators is presented, from Wiley Post's suit in the 1930's, to the gradual refinement by elimination of problems of bulk, mobility, headpiece design, oxygen regulation, and watertight integrity. Schematic diagrams of full-pressure suit control systems are included. At present, the garment has all the qualifications of a form-fitting minimally vulnerable capsule. It provides a 35,000-foot personal atmospheric environment for the aviator at any altitude above this level. It provides 25 minutes or more of bailout protection. It protects against explosive decompression. Its skin is tough enough to be ejected from a high-speed sled without damage and it provides ventilation, cold-water protection, and inherent flotation.

12228
Gell, C. F., 1958
E. L. Hays, and J. V. Correale
THE NAVY'S FULL-PRESSURE SUIT.—Office of Naval Research, Research Reviews, 1958 (April): 12-21.

This history of bioengineering developments in the full-pressure suit starts in 1934, with Wiley Post's attempt to break the altitude record of 47,352 feet. The use of a simplified breathing mask was introduced in 1949. Other weaknesses in the suit, such as lack of mobility, manual pressurization, bulk, and weight were gradually eliminated. The development of six recent prototypes of suits is outlined, and photographs of six suit models are included. In its present stage of development, the full-pressure suit system consists of the suit proper, headpiece, controlling instruments, emergency oxygen supply, and connections to air and oxygen in the airframe. Under the suit, the pilot wears a ventilation-insulation garment and an anti-g suit.

12229
Good, D. R. 1959
AIRCRAFT OXYGEN SYSTEMS USED BY THE UNITED STATES AIR FORCE.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6358). WADC Technical Note 59-322, Sept. 1959. iii+5 p.

A comparison of liquid and gaseous oxygen systems is presented. Following a brief historical outline, dating back to 1930, a detailed comparison is given in chart form. Factors considered include weight, bulk, explosion hazards, ground servicing and stand-by losses, servicing hazards, complexity and reliability, freezing, temperature limitations, target area, orientation, and hydrocarbon contaminants. It is concluded that except for limitations of weight and bulk, a low-pressure oxygen system would be as effective as liquid in reducing the hazards of explosion and moisture inherent in high pressure systems. (Author's abstract)

12230
Grandpierre, R., 1959
R. Munnich, and J. Colin
[THE FRENCH PRESSURIZED SUIT] Le vêtement pressurisé français.—In: Medical aspects of flight safety, p. 197-207, 1 unpaged leaf. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

A pressurized suit developed in France was tested in the low-pressure chamber at 60,000 feet with very good results. A description, with diagrams, is presented of the principal component parts: (1) body equipment (pressurized garment); (2) head gear (pressurized helmet); and (3) pneumatic equipment (regulators). In case of ejection, the emergency control becomes operative automatically. Experience in the chamber shows that at an equivalent altitude of 60,000 feet a pilot could continue to fly or eject himself with a seat having its actuating mechanisms below elbow level.

12231
Gray, R. F., 1960
and M. G. Webb
HIGH G PROTECTION.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task no MR005.12-0007.2, Report no. 7). Report no. NADC-MA-5910, Feb. 12, 1960. iii+18 p.
Also published in: Aerospace Med., 32 (5): 425-430. May 1961.

The advantages, problems, and limitations of older types of g-protective systems are discussed. Theories are presented for using liquid or form-fitting external supports for the body along with respiratory pressurization, to counteract distorting forces. The application of these theories has been facilitated by such devices as the "Mayo Tank" for testing g protection by immersion in water; the "G Capsule" (a water-filled, semi-form-fitting rigid structure) and associated equipment; and the "Moulded Couch", built by the National Aeronautics and Space Administration according to some of these ideas, and incorporating several other devices or procedures such as partial supination to avoid chest pain. Through the use of these various devices, several new records of tolerance to centrifugal acceleration have been established, indications have been gained for improvement on these devices, and it is expected that higher levels of g tolerance will be attained. (From the authors' abstract)

12232
Groth, H., 1959
and J. Lyman
EFFECTS OF MASSED PRACTICE AND THICKNESS OF HANDCOVERINGS ON MANIPULATION WITH GLOVES.—Jour. Applied Psychol., 43 (3): 154-161. June 1959.

This study was designed to evaluate the importance of surface friction and thickness of handcovering materials during prolonged manipulatory performance. The surface friction and the thickness of material were controlled experimentally using three types of handcovering. Manipulatory skill was evaluated by three criterion measures:

mean prehension force, total number of transports, and mean time per transport. Twenty-four male subjects, randomly divided into 4 equal groups, performed a simple manipulation task of 30 min. duration. Each group performed with one type of handcovering only. All three criterion measures were directly affected by change in surface friction and to a lesser extent by thickness of the material. The performance with the arctic mittens (3.50 mm.) corresponded to performance with a thin handcovering with a very low coefficient of friction. The results of this investigation supported the earlier findings demonstrating the importance of characteristics of surface friction and bulkiness of material for the design of protective handcovering.

12233
Hall, A. L., 1960
and R. J. Martin
PROLONGED EXPOSURE IN THE NAVY FULL PRESSURE SUIT AT "SPACE EQUIVALENT" ALTITUDES.—Aerospace Med., 31 (2): 116-122. Feb. 1960.

A naval aviator-flight surgeon was fitted with a Navy Mark III, Mod II, full-pressure suit. He was exposed to simulated altitudes between 30,000 and 170,000 feet for 72 hours. Results indicate that: (1) Man can tolerate 100% oxygen at 35,000 feet for 72 hours. (2) The Navy Mark III, Mod II, full-pressure suit is tolerable at extremely high altitudes for extended time intervals. (3) Under such severe conditions, man can function adequately with negligible physiological or psychological deterioration. It is determined that, for actual space cabin use, the oxygen should be recirculated and the moisture content increased to ameliorate the drying effects noted in this experiment. (Authors' summary, modified)

12234
Hall, J. F., 1958
A. P. Kearney, J. W. Polte, and S. Quillette
BODY COOLING IN WET AND DRY CLOTHING.—Jour. Applied Physiol., 13 (1): 121-128. July 1958.

A study was made of the feasibility of the use of water-permeable clothing rather than the impractical water-impermeable survival suits in emergencies in which Air Force crews are exposed to extreme cold air and water conditions. Metabolic rate and skin, rectal, and extremity temperatures were measured in subjects exposed in a life raft to ambient temperatures of -28.9 to +4.4° C. with or without prior immersion for 15-120 seconds in 0° water. Mean metabolic increase and body cooling rates were found to be significantly higher in subjects wearing wet clothing. Calculations of predicted tolerance (potential rescue) time indicated a marked difference between the wet and dry clothing conditions for air temperatures from -40° to 0°, with little difference above 10° C. It is concluded, however, that a cold-water exposure procedure utilizing the wet-suit principle, with immediate entry into a life raft and vigorous exercise to increase the metabolic level, has practical survival value in Air Force emergency situations.

12235
Hall, J. F., 1960
and J. W. Polte
THERMAL INSULATION OF AIR FORCE CLOTHING: A CATALOG AND PART 5 OF A SERIES. — Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71830). WADD Technical Report no. 60-597, Sept. 1960. vii+75 p.

Results of the fifth of a series of thermal insulation studies performed with electrically heated hand, foot, head, and entire body models are presented. The experimental data include results obtained with light, medium, and heavy clothing types, as well as with thermal protective items of a specialized nature. A revised catalog listing individually the insulation in clo units of numerous recently developed clothing items is included. These are arranged in order of increasing value in each clothing category (i.e., light, medium, and heavy). Since catalog values were obtained either by separate measurement, or by a difference method, these two techniques for body clothing insulation measurement are described. Advantages and limitations of each respective method are discussed. Relationship between the measured and calculated thermal insulation of clothing assemblies is shown graphically and correction factors for use with each category of catalogued clothing are graphed. The effect of laundering on thermal insulation of many recent Air Force clothing assemblies is illustrated and discussed. (Authors' abstract)

12236
Hankins, D. L., 1961
and P. J. Gardner
LIQUID OXYGEN CONVERTER FOR WEIGHTLESS ENVIRONMENT.—Bendix Corp. Pioneer-Central Div., Davenport, Ia. (Contract AF 33(616)-6190); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). ASD Technical Report no. 61-634, Nov. 1961. iii+11 p.

A liquid oxygen converter has been designed to supply breathing oxygen in a weightless environment. The converter is self pressurizing, using small quantities of liquid oxygen which are directed into a pressure build-up circuit where the liquid oxygen is vaporized and expanded to create and maintain operating pressure. The random orientation of the liquid oxygen in a weightless environment is overcome by a flexible hemispherical diaphragm attached to the inner end of the supply port. By application of build-up pressure to the exterior of the diaphragm, the collapsing diaphragm forces liquid to and through the supply port. Testing that could be accomplished in the laboratory gave every evidence that the design concept is satisfactory for weightless operation. (Authors' abstract)

12237
Hanna, T. D. 1961
THE EFFECTS ON MOTOR PERFORMANCE OF ACUTE VENOUS IMPEDIMENT AND MUSCULAR TENSION. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (BuMed. Subtask MR005.15-2003.1). Report no. NAMC-ACEL-451, April 6, 1961. v+17 p.

Because of the fatigue and decreased efficiency resulting from wearing various aviation protective gear on prolonged flights, the following study was conducted. Two measures of stress, (1) static muscular tension, and (2) brachial venous impediment, were used to evaluate various aspects of

motor performance. Two degrees of each of these two stress conditions were employed. The results show that manual dexterity was deleteriously affected by all stress conditions, while fine weight discrimination and rapidity of sustained finger movement were not so affected. A significant increase in heart rate was observed to accompany every stress condition. (Author's abstract)

12238
Hansen, R. G., and D. T. Blackstock 1958
FACTORS INFLUENCING THE EVALUATION OF EAR PROTECTIVE DEVICES.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71700). WADC Technical Report no. 57-772, May 1958. vi + 30 p. AD-142 266, PB 140909

The primary purpose of this study was to determine the number of subjects and the number of repeat measurements necessary to obtain a reliable value for the average attenuation of an ear plug under specific controlled conditions. The method established by the American Standards Association for determining "real-ear" attenuation of ear protectors was employed to provide a trial study of the method. Attenuation values for the V-51R ear plug were obtained at each of nine frequencies for each of 20 subjects on each of five separate occasions. Results indicate that satisfactory data would be obtained with six subjects making three repeat measurements. Approximately the same results would be obtained with six subjects making five replications or 15 subjects making one replication. As the variability of attenuation measurements exceeded the differential which could be attributed to judgment, the factors contributing to this variability, such as static pressure, eardrum and skin lining impedances, and their effect on attenuation variability are discussed. (Authors' abstract)

12239
Hawkes, R. 1959
FIT, FLEXIBILITY, HEAT CONTROL ARE VITAL IN SPACE SUIT.—Aviation Week, 70 (25): 292-307. June 22, 1959.

A space suit newly devised at Litton Industries of Beverly Hills, Calif., utilizes gimbal rings in the sleeves to allow for flexibility, an aluminum helmet and torso with umbilical hose, and rubber vapor jackets over the hands to insure against leakage. Pure oxygen for ventilation and breathing enters and leaves the suit through the umbilical hose which passes into the aluminum belly. Further modifications of the suit to protect against possible ultraviolet and nuclear radiations, and against meteorite showers, are anticipated.

12240
Headley, R. N., J. W. Brinkley, G. Lokatos, and R. F. Managan 1960
HUMAN FACTORS RESPONSES DURING GROUND IMPACT. — Wright Air Development Division. Aerospace Medical Division, Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71748). WADD Technical Report no. 60-590, Nov. 1960. iii+31 p.

Forty-six vertical impact experiments utilizing a simulated B-70 escape capsule were conducted on eleven subjects in the seated position (+ Az). Three drops only are reported in toto in this preliminary report. Impact velocities ranged from 9.8 ft. per sec. up to 30 ft. per sec.; a crushable paper honeycomb material was employed as an impact attenuator. Three restraint systems were tested in this program: (1) the standard military lap belt-shoulder harness configuration, (2) an experimental nylon full restraint suit, and (3) the Stanley B-58 capsule restraint harness. Accelerometer data from the subjects revealed mean rates of onset of deceleration as high as 1620 g per sec. with maximum g-loadings up to 35 g. Complete pre- and post-test clinical examinations were performed and the only noteworthy finding was one episode of microscopic hematuria lasting for one month. After conservative evaluation of the data, the authors conclude that impact decelerations of 24 g with a velocity change of 30 ft. per sec. and a rate of onset of 500 g. per sec. (maximum calculated value) can be tolerated by human subjects in the seated position. This tolerance was attained, however, by using a proper body restraint system with good upper torso support, proper torso and neck positioning, and by eliminating all possible elastic recoil components in the subject-support restraint complex. (Authors' abstract)

12241
Berall, A. S. 1960
PRECISE MEASUREMENT OF CLOTHES INSULATION DURING CONTROLLED OPERATION OF THE HUMAN. — Jour. Basic Eng. (Ser. D), 82(3): 513-527. Sept. 1960.

It has been demonstrated that it is possible to measure the resistance of clothing as an ohmic relation between time-averaged equilibrium values of the flux of power (metabolism) and the potential difference between average skin temperature and ambient temperature. Specifically, this has been demonstrated on the human in what has been referred to as the comfort mode of operation of the human system. In this mode of operation, the metabolic level of activity is changed by signaling command to attempt to maintain a specific control level of the average skin temperature. With control attempted to approximately 0.1° C., sufficient precision has been achieved to resolve one or two per cent difference in clothes resistance. The dynamic input-output data obtained during clothes measurements are presented. (Author's abstract)

12242
INTEGRATION OF PERSONNEL EQUIPMENT.—David Clark Co. Inc., Worcester, Mass. (Contract AF 33(616)-3329); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6325). WADC Technical Report no. 59-382 [Aug. 1959]. vi+28 p.

A review of the attempts to integrate the anti-exposure coverall and the altitude coverall and helmet has indicated definite progress but requires that modifications be made in the standard components of the anti-exposure coverall and the pressure helmet. These modifications would not nullify the primary purpose of the items to be used separately, as originally designed; however, some interchangeable sections would be required. The development of the emergency descent coverall, which has almost 100% coverage of the body with impermeable fabric, presents an unusually good opportunity to consolidate the anti-exposure and altitude coveralls with a minimum of penalty for weight, when used on a

specific mission profile which requires protection at altitude and exposure on land and water in cold climates. (From the author's summary)

12243
Irvine, T. F., 1960
and K. R. Cramer
THERMAL ANALYSIS OF SPACE SUITS IN ORBIT. —— Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio. WADD Technical Note no. 60-145, May 1960. vi+15 p. (Project no. 6373, Task no. 63124).

The thermal analysis of a model space suit in orbit is presented as a guide for designers and as a basis for more extensive studies for the prediction of a suited man's thermal environment in an earth orbit. Calculations show the feasibility of passive suit-temperature control through a wide range of temperatures by the proper choice of materials and surface spectral properties. (Authors' abstract, modified).

12244
Jackson, M. M. 1960
USAGE RATES OF AIRCRAFT OXYGEN. —— Wright Air Development Center. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71832). WADD Technical Report no. 60-106, May 1960. iii+16 p.

An investigation was conducted to evaluate aircrew oxygen requirements for current and future aircraft. A literature review of studies on the rate of oxygen use in flight is presented. Data from actual flights, altitude chamber studies, and simulated missions on a jet trainer and F-102 simulator with subjects wearing full-head pressure helmets or oxygen masks are presented and discussed. Results of the investigation indicate that aircraft oxygen installation figures, when based on a pulmonary ventilation rate of 25 liters/min. BTPS, will provide an adequate oxygen supply for 99 percent of the Air Force personnel performing duties equivalent to light work at cabin altitudes up to 35,000 feet. Loss of cabin pressure with subsequent exposure to higher altitudes increases the requirement for oxygen. (Author's abstract)

12245
Jacobson, M. G., 1959
and N. W. Hartz
NEW DEVELOPMENTS IN OXYGEN DEFICIENCY TESTING.—Amer. Indus. Hyg. Assoc. Jour., 20 (1): 36-44. Feb. 1959.

The existing methods are described and evaluated for oxygen-deficiency testing utilizing the flame safety lamp, chemisorption of oxygen in liquids such as pyrogallol, chromic salt solution, etc., and magnetic and electrochemical methods. Consideration is given to the development of the Portable M.S.A. Oxygen Indicator. While this oxygen indicator has several limitations, it represents an ideal, all around, practical portable oxygen measuring instrument for laboratory as well as for field use.

12246
Jenkins, W. L. 1958
THE SUPERIORITY OF GLOVED OPERATION OF SMALL CONTROL KNOBS. —— Jour. Applied Psychol., 42 (2): 97-98. April 1958.

The least amount of turn on a tactual-kinesthetic basis and the time to make settings on a linear scale were studied in barehand operation and with MA-1 double flying glove. With small knobs, gloved operation was superior in both. With larger knobs, the superiority was lost. No ready explanation of the phenomena has been developed. (Author's summary)

12247
Kagarise, R. E., 1960
and R. A. Saunders
THE ANALYSIS OF CONTAMINANTS IN AVIATORS' BREATHING OXYGEN. —— Naval Research Lab., Washington, D. C. NRL Report no. 5554, Oct. 19, 1960. ii+20 p. PB 161946

Trace impurities in liquid and compressed breathing oxygen were collected and concentrated by an adsorption-desorption technique, employing activated carbon as the adsorbent. Impurities at concentrations as low as 0.5 parts per billion were detected and identified by an analytical system involving a combination of infrared spectroscopy and gas chromatography. The observed contaminants were primarily hydrocarbons in the C_1 to C_6 range and included paraffins, olefins, and alkynes. No compounds having intolerable odors or profound toxicological effects were observed. Only the olefins have odors which, while not offensive or toxic under ordinary circumstances, are rather strong and unpleasant. In situations where an airman is under physical or mental strain, the presence of such odors may be sufficient to produce nausea and headache. The insertion of a filter with a nonflammable adsorbent in the pilot's breathing tube is suggested as a solution to the problem. (Quoted in part)

12248
Keating, D. A. 1960
DESIGN STUDY OF HIGH PRESSURE OXYGEN VESSELS.—Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 6373, Task no. 63120). WADC Technical Report no. 59-767, Feb. 1960. iv+23 p.

The theoretical feasibility of storing gaseous breathing oxygen under extreme high pressures for life support in flight operations was investigated by analytic and graphic techniques. Optimum internal pressure was determined from the minimum mathematical product of vessel weight and volume and from evaluation of the strength characteristics of the vessel material. High-pressure oxygen storage vessels utilizing an internal pressure at approximately 7500 p.s.i.a. were found for missions of moderate duration to be theoretically superior on a weight-volume basis to standard liquid oxygen converters. (Quoted in part)

12249
Kiehl, P. F. 1960
GUIDE TO AIRCREW PERSONAL AND AIRCRAFT INSTALLED EQUIPMENT (SUPERSEDES WADC TR 58-259, DATED AUGUST 1958). —— Wright Air Development Division. Operational Support Engineering Division, Wright-Patterson Air Force Base, Ohio (Project no. 6325). WADD Technical Note no. 60-230, Sept. 1960. xv+140 p.

A catalog format has been used to describe and illustrate both personal equipment for aircrews and the equipment installed in aircraft that is of

special interest to aircrews. The document includes information on special high-altitude and long range flight clothing, personal and aircraft-installed oxygen equipment, survival kits, life rafts and preservers, parachutes, in-flight feeding systems, survival food packets, and aircraft-installed food service equipment. Brief descriptions of 128 items are included along with photographs illustrating the items. This technical note is intended as a supplement to Air Force supply catalogs and Air Force Manual 64-4, "Handbook For Survival Training and Personal Equipment Personnel." (Author's abstract)

12250
Kircher, J. F., 1959
J. S. McNulty, J. L. McFarling, and A. Levy
THE EFFECTS OF RADIATION ON OXYGEN DESIGNED FOR HUMAN CONSUMPTION.—Battelle Memorial Institute, Columbus, Ohio. (Contract AF 33(616)-5659); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Petterson Air Force Base, Ohio. (Project no. 7165, Task no. 71838). WADC Technical Report no. 59-618, Dec. 1959. v+33 p.

Both liquid and gaseous aviator's breathing oxygen, contained under controlled pressure and temperature in stainless steel vessels, were subjected to gamma irradiation. The rate of ozone formation in liquid oxygen was nearly constant to 5.9×10^8 ergs/g. (C), the maximum dose used in these studies. Ozone formed during irradiation of gaseous oxygen reached a maximum concentration at about 3×10^7 ergs/g.(C) and decreased to an equilibrium concentration at about 10^9 ergs/g.(C). The ozone yield appeared to be independent of pressure and dependent upon temperature and dose rate. There were marked increases in the ozone yield with decreasing temperature and with increasing dose rate. In mixed-field irradiations, induced radioactivity due to argon-41 was found. The equilibrium activity was 10 to 14×10^{-5} microcuries per cc. (Authors' abstract)

12251
Kugler 1961
AIRCRAFT OXYGEN SYSTEMS. —— Aeronautics (London), 44 (5): 67-71. Sept. 1961.

A review of the history of the use of oxygen systems is given. The current trend toward the use of liquid oxygen is discussed as to its advantages and disadvantages in comparison with standard gaseous oxygen equipment. One advantage of the liquid system is the increased safety derived from operating at lower pressures. The physical properties of liquid oxygen, the design of materials for suitable containers, and the functional operating system are discussed.

12252
Levashov, V. V. 1959
[THE HYGIENIC PROPERTIES OF REGULAR-ISSUE FIELD (AIRBASE) CLOTHING, UNDER CLIMATIC CONDITIONS PREVAILING IN CENTRAL ASIA] O gigienicheskikh svoistvakh poosednevno-polevoi (aerodromoi) formy odezhdy v usloviiakh Srednei Azii.—Voenno-meditsinskii zhurnal (Moskva), 1959 (4): 65-68. April 1959. In Russian.
English translation in: Military Medical Journal, 1959 (4): 108-112. New York: U. S. Joint Pub. Research Serv., No. 1736-N, July 13, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

A study of the physiological and hygienic properties of everyday field clothing worn by fully acclimatized air force officers stationed in Central Asia was made by the Scientific Research Testing Institute of Air Force Medicine. An experimental light-weight uniform was compared with the regular type, which consisted of an open wool double-breasted blouse and trousers, a shirt and tie, and high boots. In addition to taking readings of body temperature, blood pressure, pulse, and respiratory rate during daily activity, the temperature of the air under the clothes was determined every hour at four points (headgear, chest, back and thigh), as well as the relative humidity in the chest area and the absolute humidity in the area of chest and foot. The regular issue clothing was found to be inferior, chiefly because of reduced ventilation, which restricted the heat-exchange and rate of evaporation of perspiration.

12253
Lewis, B. M., 1958
R. E. Forster, and E. L. Beckman
EFFECT OF INFLATION OF A PRESSURE SUIT ON PULMONARY DIFFUSING CAPACITY IN MAN.—Jour. Applied Physiol., 12 (1): 57-64. Jan. 1958.

Measurements of the diffusing capacity of the lung for carbon monoxide inspired in gas mixtures containing 21-90% oxygen were made in four subjects wearing a full-pressure half suit. No significant change was observed in pulmonary diffusing capacity, despite a presumed increase in transmural pressure in the capillaries. Since calculations of the pulmonary capillary blood volume and diffusing capacity of the pulmonary membrane revealed no changes during suit inflation, it is concluded that the lack of an effect on diffusing capacity cannot be attributed to pulmonary edema. It is suggested that the size of the capillaries was not influenced by lateral pressure across their walls, and that a mechanism exists which protects closed capillaries from being opened by increased pressure at rest.

12254
Lewis, S. T., 1958
and J. P. Stapp
HUMAN TOLERANCE TO AIRCRAFT SEAT BELT RESTRAINT.—Jour. Aviation Med., 29 (3): 187-196. March 1958.

Parameters of tolerance to decelerative forces were determined in subjects restrained by a 3-inch lap belt while seated in the forward-facing position in an aircraft seat hanging by cables forming a swing-pendulum, or in two different catapult-sled devices. The tests showed that (1) minor injuries are produced by the application of 10 g at 300 g per second onset with a duration of .002 second; (2) abdominal muscle strain and tenderness occur with a force of 13 g at 300 g per second with .002 second duration; and (3) back muscle soreness can occur following 26 g at 850 g per second with a duration of .002 second. The degree of injury varied with the pain threshold and physical condition of the individual subject.

12255
'LUNAR SUIT' PROPOSED FOR ASTRONAUTS.—Missiles and Rockets, 5 (47): 32-33. Nov. 16, 1959.

Many of the assumed hazards to man's ability to live and operate on the Moon include: cosmic radiation, Van Allen radiation, meteorites, extreme

temperature changes, atmospheric pressure changes, solar radiation, and magnetic field conditions. A lunar suit proposed for astronauts is described which will contain at least three complete electronic subsystems providing environmental controls, communications capability, and sensing equipment for emergencies expected on the Moon. Essentially, the suit is to provide the wearer with the same environment as that of the Earth.

12256
Lutz, C. C. 1959
DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT (COVERALLS, HIGH-ALTITUDE, TYPE CSU-4/P).—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6336, Task no. 63619). WADC Technical Note no. 59-148, July 1959. iv+20 p.
AD 226 056

This report describes the various features evaluated during the development of Coveralls, High-Altitude, Type CSU-4/P. Each progressively improved prototype garment is described and test results are reported. The final model of this coverall is considered physiologically adequate to meet the specified requirements. Comfort and mobility features of this garment in the unpressurized condition are considered superior to previous partial pressure suits. Preliminary flight tests indicate that this suit is favored over previous types. An operational evaluation of the final model will be accomplished. (Author's abstract)

12257
McCutchan, J. W. 1960
THE PREDICTION OF HUMAN THERMAL TOLERANCE WHEN USING A VENTILATING GARMENT WITH AN ANTIEXPOSURE SUIT. —Jour. Heat Transfer (Ser. C), 82 (3): 243-251. Aug. 1960.

The physiological responses of human subjects have been investigated in the thermal environments ranging from 120° to 240° F. while wearing the MA-2 ventilating garment, an MK-IV exposure suit, and other garments comprising 2.15 clo (the unit of thermal resistance for clothing) of thermal resistance. The ventilating garment was given air inputs ranging from 2 to 14 cu. ft./min. in volume, and from 50° to 90° F. in temperature. The thermal responses of the subjects are shown graphically in terms of heat storage, heart rates, sweat rates, and composite indexes of these variables. The results of these experiments have been prepared in terms of an equation which is presented as a nomograph. This nomograph predicts the cooling power of the MA-2 ventilating garment and is to be used in conjunction with the tolerance chart. The tolerance data, which were determined on steady exposures in a preheated chamber, are used to predict human tolerance for conditions where the air and wall temperatures are not constant. (Author's abstract, modified)

12258
MacDonald, J. A. 1960
READYING CREW STATIONS FOR NEAR-SPACE AIRCRAFT.—SAE Jour., 68 (6): 63-64. June 1960.

Improvements in personnel equipment and survival training have resulted in a decrease in escape casualties and an increased interest in flying high-speed aircraft. These improvements have come about through developments in human engineering, wherein man is the constant and machine designs are aimed to integrate and complement him rather than accommodate him. Automatic lap belts and shoulder harnesses with sensing devices which cause them to position the body so that maximum accelerations can be absorbed correctly, allow crew members to work in comfort and still have the full safety of restraining equipment. Advances in crew seat design have increased the g load tolerance for the occupant, and increased the crash load absorption capabilities of the seat. Future design of crew station components will adhere to established human engineering principles and closely follow today's configuration, because the operator's experiences require this similarity.

12259
McFadden, E. B., 1959
J. J. Swearingen, and C. D. Wheelwright
THE MAGNITUDE AND DIRECTION OF FORCES THAT MAN CAN EXERT IN OPERATING AIRCRAFT EMERGENCY EXITS.—Human Factors, 1 (4): 16-27. Nov. 1959.

An attempt was made to determine the maximum force and direction of force applied by men, women, and children on emergency exit release handles under various simulated aircraft conditions. A D-ring covered with a two-inch shield, a 0.3-inch diameter steel D-ring, and a 0.67-inch diameter rubber-covered handle were used in the tests. Maximum force during a five-second muscular contraction and during jerk action was measured. The subjects were tested in the following positions: using left and right hands; seated in a passenger type aircraft seat; standing with seats occupied and unoccupied; and subject's choice of position and method. Jerk force was determined only for the standing position. The rubber-covered ring was demonstrated to be the most satisfactory type tested, results of maximum force applied in this case being 19% above those obtained for the unprotected D-ring, which in turn gave results 18% above those obtained for the shielded handle. Pooled results from testing of the rubber-covered handle gave a mean maximum jerking force in women of 155 lbs., and a five-second muscular contraction force of 74 lbs. in the right-handed standing position (found to be most favorable). Comparable figures for men were 329 lbs. and 134 lbs., respectively. Results obtained from children were unreliable. In general, the normal position of the emergency exit handle in relation to seats was not found to interfere with results. Measurement of resultant forces applied were variable, and seemingly dependent on the height of the subject. It is noted that the results obtained are undoubtedly conservative for the estimation of capacity force available during an emergency.

12260
McGuire, T. F. 1960
PHYSIOLOGY AND OPERATIONAL COMPARISON OF MC-1 AND MC-3 (MC-4) PARTIAL PRESSURE SUITS. —Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6333, Task no. 63612). WADD Technical Report no. 57-536 (I), Oct. 1960. vi+37 p.

A theory on the physiological limitations of partial pressure suits, with supporting evidence, is discussed. Loss of "effective" blood volume, workload placed on the heart, available oxygen, a number of reflexes that can work separately or

together to the individual's disadvantage, and other contributory mechanisms are stressed. The comparative operational characteristics of the MC-1 and MC-3 (MC-4) partial pressure suits are presented. (Author's abstract) (138 references)

12261
Manolescu, N., 1960
I. Pintilie, V. Teodorescu, M. Stoian, S. Schiau, L. Pascalov-Stoenescu, R. Stoenescu, and G. Arsenescu
[CARDIOVASCULAR CHANGES IN AVIATORS DURING THE OXYGEN PRESSURE BREATHING TEST WITH THE USE OF THE HIGH ALTITUDE PRESSURE SUIT] Modificări cardio-vasculare la aviatori în timpul probei de respirație a oxigenului sub presiune crescută, cu utilizarea costumului de compensare pentru altitudine. —— Studii și cercetari de fiziologie (București), 5 (1): 119-126. 1960. In Rumanian, with French summary (p. 126).

Ten aviators were subjected to oxygen pressure breathing while wearing the high altitude pressure suit. Prior to the test there was found a decrease in systolic and minute volume, and in the ratio of the isotonic/isometric phases, at the expense of the isotonic phase. During the test, there was observed a moderate decrease in the transverse diameter of the heart; moderate decrease of diastolic and systolic volume; moderate increase in the diameter of the vascular stems, greatest in the pulmonary artery and less in the vena cava, indicating moderate functional difficulty in venous return; moderate tachycardia; bradypnea with a tendency towards respiratory arrhythmia, and varied and non-specific changes of the electric axis. The phase of returning to normal was very short with slight tachycardia and elevation of arterial pressure. The results indicate that the test was well withstood by the subjects. Included are several hypotheses for interpretation of the results. (Authors' summary, modified)

12262
Mayer, J. 1960
COLD WEATHER TEST OF INSULATED UNDERWEAR.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. AAL Technical Note no. 60-21, Nov. 1960. [10] p.

Two different types of underwear were tested. Type A has an outer shell of 100% nylon with polyester fiber fill and snap closures on the jacket and trousers. This garment is manufactured by the Arctic Feather and Down Company, Bloomfield, New Jersey. Type B is constructed of the same material as that of Type A, but has a snap and zipper closure on the jacket and snap closure on the trousers. This garment is manufactured by the Satellite Outer-wear Corporation of New York. Test results show (Figure 1) that Type B insulated underwear is superior to that of type A in the standing phase of the test and equal to Type A in the exercising phase. In the standing position or any immobile position a man is more vulnerable to cold exposure; therefore, the garment affording the most protection in this position is considered superior. It is recommended that the insulated underwear be considered for standardization and issue in the Alaskan Air Command. Further, it is recommended that the insulated underwear have the zipper and snap closure, and snaps connecting trousers to the jacket. Also, the insulated underwear should not be worn next to the skin; some light underwear should be worn with the insulated underwear over them. (Quoted in part)

12263
Meeker, W. F. 1959
ACTIVE EAR DEFENDER SYSTEMS: DEVELOPMENT OF A LABORATORY MODEL.—Radio Corp. of America, Camden, N. J. (Contract AF 33(616)-3051); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). WADC Technical Report no. 57-368 (II), Dec. 1959. iv+41 p.

A laboratory model active ear defender using negative acoustic feedback to provide noise reduction was constructed. Approximately 15 db. of active noise reduction was achieved in the 100-200 c.p.s. range with appreciable noise reduction outside this range, falling to zero at approximately 600 c.p.s. Improved transducer arrangements were developed. An arrangement for insert or semi-insert use should permit 20 db. of active noise reduction from 100 to 400 c.p.s. An arrangement similar to a conventional over-the-ear head-set should provide 20 db. of active noise reduction from 100 to 300 c.p.s. Extension of active noise reduction to higher frequencies will require an increase in microphone bandwidth and the use of very wide band amplifiers. (Author's abstract)

12264
Michel, E. L., 1958
and H. S. Sharma
THE DETERMINATION OF THE EFFECTIVE DEAD AIR SPACE OF RESPIRATORY EQUIPMENT AND SYSTEMS THROUGH PHYSIOLOGICAL MEASUREMENT.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. BUMEN NM 12 01 13 5). Report no. NAMC-ACEL-375, June 10, 1958. iv+7 p.+6 plates.
Also published in: Jour. Aviation Med., 30 (4): 280-286. April 1959.

A method is described which permits the physiological measurement of the resultant dead air space effect produced by dead air space inherent in breathing equipment. Physical measurement, alone, of equipment dead space does not give a realistic insight into inherent physiological limitations. The physical measurement of the dead air space in the full pressure suit helmet was found to be two liters. Results of tests conducted to determine the "effective dead air space" of the helmet gave values of only 350-550 ml. (Authors' abstract)

12265
Michel, E. L. 1958
PHYSIOLOGICAL LIMITATIONS OF MASK MOUNTED REGULATOR P/N1732-2; DETERMINATION OF.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-5194). Report no. NAMC-ACEL-367, Jan. 6, 1958. ii+7 p.

Tests were conducted for purposes of determining the physiological limitations of mask mounted regulator part number 1732-2. Results indicate that subjects can tolerate breathing against 16 inches of water pressure for five-minute periods without any adverse effects. In addition, results of tests conducted indicate that respiratory minute volumes of volunteers using the subject regulator increased with decreasing reducer outlet gage pressure; but this increase was not subjectively noticed by the volunteers at altitude. It was concluded that this dangerous condition would not occur provided oxygen handling directives are followed. (Authors' abstract)

12266
Miller, A. E. 1959
WHEN YOU'RE HIGH, USE OXYGEN.—Flying, 65 (4): 57, 70, 74, 76. Oct. 1959.

The physiological manifestations of oxygen deficiency at altitude, as reflected in vision, judgment, and neuro-muscular cóntrol, are described. Two types of equipment currently used for the prevention of hypoxia are evaluated, and their uses in various situations are indicated: (1) O_2 masks of the constant-flow type, which are best suited for private fliers and are adequate for use at altitudes up to 30,000 feet; and (2) diluter-demand oxygen regulators which deliver the proper O_2 mixture under all conditions and are available to crews of military and commercial transports. The intensified effects of oxygen-lack, when combined with alcohol, heavy smoking, and various drugs, are discussed.

12267
Nelms, J. D. 1961
LOW TEMPERATURE PERFORMANCE OF FULL PRESSURE SUITS. I. VISOR DEMISTING, EXTREMITY AND BODY PROTECTION IN FRANKENSTEIN FULL PRESSURE SUITS TYPES 27 AND 51. II. EXTENDED VISOR DEMISTING, EXTREMITY AND BODY PROTECTION IN FRANKENSTEIN FULL PRESSURE SUIT TYPE 51, SERIAL NO. 52.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 168, Jan. 1961. 48 p.

I. Two full pressure suits have been tested at a variety of low temperatures and windspeeds. The oxygen monitored type 27 afforded partial protection to visor, body and extremities at -20°C. and 10 m.p.h. wind. The air monitored type 51 with type 4 A.V.S. provided more than 50% demisting, but requires further development in the matter of body protection and the design of gloves and socks. II. Tests carried out on Frankenstein Full Pressure Suit Type 51 Serial No. 52 demonstrated the ability of one subject to remain pressurised at -40°C. and 10 m.p.h. wind for 5 hours. Heating of the hands and feet was just adequate, but voltages greater than those available from aircraft were used. Body protection was good, but slight burning of the chest and cooling of the legs occurred towards the end. Visor demisting was complete at flows of 8 c.f.m. and gallery temperatures of 60-65° C., but distribution of the available heat was relatively unequal between upper and lower parts of the visor. Recommendations for further improvements are made. (Author's summary)

12268
[Newbauer, J. A.] 1959
KEEPING YOUR FEET ON THE GROUND IN SPACE.—Astronautics, 4 (6): 28. June 1959.

A brief note is given on current and projected experiments with magnetic shoes which will allow men to walk in normal fashion in spacecraft during periods of weightlessness.

12269
Nicholson, J. F., 1960
and D. W. Naas
MAGNETIC SHOES FOR HUMAN ORIENTATION IN SPACE.—Wright Air Development Division. Aeronautical Research Lab., Wright-Patterson Air Force Base, Ohio. (Project no 7021, Task no. 70651). WADC Technical Note 59-352, Feb. 1960. iii+9 p.
PB 161 727

This report describes both permanent and electromagnetic shoes for human orientation in a weightless environment. The electromagnetic shoes operate on a low-voltage power source which may be adjusted to the individual requirements of the wearer. A microswitch which interrupts the magnetic circuit each time the heel is raised reduces walking fatigue and increases the operational life of the batteries. An inertia switch is included in the magnetic circuit as a safety device. When the switch senses any sudden acceleration or deceleration, it shunts the potentiometer and allows additional current to flow to the electromagnet thereby increasing the holding force. (Authors' abstract)

12270
Nixon, C. W., 1959
R. G. Hansen, and D. T. Blackstock
PERFORMANCE OF SEVERAL EAR PROTECTORS.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71700). WADC Technical Report no. 58-280, May 1959. viii+54 p.
AD 229 459L

Attenuation and wearability features were evaluated for a number of ear protective devices; earplugs, ear muffs, helmets, and various combinations of devices. Attenuation is the prime objective of an ear protector; however, other features may eventually determine the suitability or non-suitability of an item for Air Force use. The current Air Force standard earplugs (V-51R) and ear muffs (PRU-1/P) were the best "over-all" ear protectors of the reported evaluation. Many other devices considered unsatisfactory for military use in their present form contain particular features that are superior to the respective features of the standard items. Minor modifications of certain of these devices might well result in items suitable for Air Force use. (Authors' abstract)

12271
Phillips, N. E., 1960
and R. G. Bartlett
GROSS EFFECTS OF LIQUID O_2 CONTAMINANTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3100, Subtask 7). Report no. 1, Jan. 9, 1960. ii+21 p.

Tests were conducted to measure the ability of jet pilots to distinguish between pure and contaminated oxygen. Individual variation exists in the ability, but in the strengths used in this experiment contamination was not reliably detected. Ability to distinguish between two samples of gas was greatest when one was tested immediately following the breathing of the other. The ability to detect a difference in samples is greater than the ability to designate toxicity or nontoxicity. Contamination does not necessarily indicate toxicity. (Authors' abstract)

12272
Phillips, N. E., 1960
and R. G. Bartlett
GROSS EFFECTS OF LIQUID O_2 CONTAMINANTS: ADDITIONAL STUDIES. — Naval School of Aviation Medicine. Naval Aviation Medical Center, Pensacola, Fla. (Research Project no. MR005.13-3100, Subtask no. 7). Report no. 2, April 27, 1960. ii+7 p.

A series of tests was made in which jet instructor training pilots were asked to differentiate by

odor between samples of intentionally contaminated oxygen and pure oxygen taken from stock at the Pensacola Naval Air Station. The contaminants used were ethane and isobutane in low concentrations. None of the subjects was able to identify, as such, any of the samples of contaminated oxygen, although several of them were able to distinguish between contaminated and pure oxygen. Two subjects were able to distinguish between two lots of pure oxygen taken from stock at the Naval Air Station. Recommendations are made for certain changes in procedure and for precautions to be observed if further tests are made.

12273
Pierce, B. F. 1960
MANUAL FORCE CAPABILITIES OF A PILOT IN A FULL-PRESSURE SUIT: TECHNIQUES OF MEASUREMENT AND DATA PRESENTATION. — Eng. and Indus. Psychol., 2 (1): 27-33. Spring 1960.

This is a preliminary exploration of the strength limits of a pilot in relation to several types of manual controls placed in different locations. The subject, whose height and weight fell within the 20th and 45th percentiles, respectively, in an Air Force population, wore a light-weight, full-pressure suit fully inflated to 3.5 p.s.i.g. Six types of measurements of force, four of which were torque forces and two of which were concerned with pulling and pushing, were taken for the right hand at fifteen locations measured from the seat reference point along the reach limits of the subject. It was shown that at every measuring point the pull force exceeds the push force. Considerably greater mean torque forces can be exerted with the stirrup handle than with the knob. The difference between mean forces for clockwise versus counterclockwise direction for either the stirrup handle or the knob seems to be insignificant.

12274
Poppen, J. R. 1958
SUPPORT OF UPPER BODY AGAINST ACCELERATIVE FORCES IN AIRCRAFT.—Jour. Aviation Med., 29 (1): 76-84. Jan. 1958.

A prototype harness intended to provide support against vertical forces was designed on the basis of an analysis of the support structure and mass distribution characteristics of the upper part of the body. The harness provides support under the axillae, crosses over the manubrium, extends along lines consonant with the resultant of anticipated forces, and ends in two points for attachment to an aircraft seat structure. Comparison of data from tower drop tests conducted with the prototype and standard military harnesses indicated that support of the upper body mass eliminates compressive loads on the lumbar spine by reduction of the dynamic response between the upper and lower masses.

12275
[THE PROTECTIVE CLOTHING OF FLYING PERSONNEL. I.] La protection vestimentaire du personnel navigant. I. — Forces aériennes françaises (Paris), no. 172: 73-110. July 1961. In French.

This review on the protective clothing for flying personnel includes discussions of the evolution of flight clothing and of recent experimental methods in evaluating this clothing. Calculations are given in an assessment of the requirements for modern flight clothing with regard to its role in the caloric exchange of the body.

12276
Raichlen, F. 1959
PERSONAL PROTECTIVE EQUIPMENT FOR MISSILE ROCKET FUEL HANDLERS. — Air Proving Ground Center. Human Factors Office, Eglin Air Force Base, Fla. (Project no. 976HS01). APGC Technical Note no. 59-8, March 1959. v+20 p.
AD 210 620

A discussion is presented of some types of personal protective equipment now being used by military rocket fuel handlers. The developments in the field are mentioned along with a discussion of methods of cooling and ventilation being attempted. The results of a questionnaire on protective clothing, which was administered to oxidizer handlers at Eglin Air Force Base, are presented. The features which are considered desirable for such garments are a lighter, more comfortable garment, a hard cuff for the glove-sleeve connection to give a positive seal between garment and glove, a suit fastener other than a zipper to afford quicker donning and doffing of the garment, and a nontogging facepiece. Three different types of clothing sets, each designed to provide adequate protection and maximum comfort for a specific type of operation, are recommended: (1) a full-protection garment for operations where there is a possibility of gross spillage; (2) a limited-protection garment for operations where a small spillage is possible; and (3) apron, gloves, and goggles for operations where there is very little chance of spillage.

12277
Roach, C. G., 1958
and R. W. Roundy
PRESENT STATUS OF AIRCRAFT LIQUID OXYGEN BREATHING SYSTEMS.—Jour. Aviation Med., 29 (12): 898-902. Dec. 1958.

Developments and problems encountered in conversion from gaseous to liquid oxygen systems in Air Force aircraft are discussed. Because of the extensive equipment and trained personnel required to support the liquid oxygen system, the conversion was made in new fighter and bomber aircraft only after a successful test program under actual service conditions. Application to transport aircraft has been limited by the unsuitability of liquid oxygen for standby use or for large numbers of people. Standardization of the equipment has resulted in the development of various sizes of containers with two operating pressures for stationary or walk-around use. Coils used for the evaporation and warming of the oxygen in early models have been replaced by tubing or evaporator plates installed in the aircraft. Other improvements made since the introduction of the system include a reduction in weight of the oxygen containers, changes in the valving system, and development of quantity-indicating instruments based on electrical capacitance.

12278
Roebuck, J. A., 1961
and B. H. Levedahl
AIRCRAFT GROUND EMERGENCY EXIT DESIGN CONSIDERATIONS. — Human Factors, 3 (3): 174-209. Sept. 1961.

A review of the literature shows that emergency ground conditions for aircraft occur with sufficient frequency to require emergency escape devices. The nature of these emergencies allows for a reasonable possibility of escape if care is taken in

selection and design of escape provisions. For normal low-wing aircraft, the inflatable escape slide provides for reliable support during descent. Extensive experimental data are given for design of overwing emergency exits and similar installations. These data show some significant relations to body dimensions and agility of the subject. Standard methods are necessary for comparing escape exit tests in the future, if optimum design of exits and devices for minimum weight and space requirements is to be achieved. (Authors' abstract)

12279
Ross, J. C., 1960
T. H. Lord, and G. D. Ley
EFFECT OF PRESSURE-SUIT INFLATION ON PULMONARY-DIFFUSING CAPACITY.—— Jour. Applied Physiol., 15 (5): 843-848. Sept. 1960.

Measurements were made of the pulmonary diffusing capacity, central venous pressure, and the effect of alveolar volume and the Valsalva maneuver during pressure-suit inflation over the lower body. An average increase of 13% in diffusing capacity at both small and large alveolar volumes was observed during suit inflation in 21 of 22 subjects. The increase in diffusing capacity was greater in seated subjects (18%) than in supine subjects (9.8%). Diffusing capacity was significantly decreased by the Valsalva maneuver both without applied pressure and during suit inflation. It is suggested that the pulmonary capillary bed is passively dilated by pressure-suit inflation.

12280
Rowlands, R. P. 1961
A CATALOGUE OF AVAILABLE WHOLE BODY PROTECTIVE CLOTHING.—United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Harwell, Didcot, Berkshire. Report no. AHSB(RP) R 9, June 1961. 70 p.

The Catalogue provides a record of the equipment available and in regular use within the United Kingdom Atomic Energy Authority for whole body protection. Attention has been focused on the suits themselves without undue reference to ancillary and installed equipment which may also be required when the suits are in use. Brief descriptive details of the design and fabricating materials of each suit are given together with an outline of its uses. (Author's introduction)

12281
SantaMaria, L. J., 1960
S. J. Klein, and H. R. Greider
THE MAINTENANCE OF THERMAL COMFORT IN A FULL PRESSURE SUIT AT SIMULATED ALTITUDE.—Aerospace Med., 31 (4): 288-295. April 1960.

The effects of environmental temperature on flow rates necessary to maintain comfort in a full-pressure suit at 18,000 feet simulated altitude were determined. Three subjects were exposed to ambient temperatures of 125° and 150° F. in combination with ventilating temperatures inside the suit of 60° and 90° F. Ventilation demands for comfort increased significantly by an average of 24% as the ambient temperature increased from 125° to 150° F. Differences in total weight loss and evaporative weight loss were affected independently by ambient temperatures, ventilating temperatures, and differences between subjects. The total weighted skin temperatures increased significantly by an average of 3.6% (1.25° C.) with an increase in ambient temperature from 125° to 150° F. (Authors' summary and conclusions, modified)

12282
SantaMaria, L. J. 1961
PHYSIOLOGICAL EVALUATION OF THERMAL UNDERWEAR WORN WITH PROTECTIVE AIRCREW ASSEMBLIES UNDER EXTREME ENVIRONMENTAL CONDITIONS.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-446, Feb. 15, 1961. v+7 p.

Open-weave underwear manufactured by the Norwegian-American Knitting Mills was tested and evaluated as a component in survival suit systems in the alleviation of the effects of thermal stress. "Valhalla" underwear was worn with the MK4 Full Pressure Suit and the MK4, MK5, and MK6 Anti-Exposure Suits under environmental conditions giving rise to heat and cold stress. Measurements of skin and rectal temperatures and evaporative and total weight loss were made on a group of subjects, each serving as his own control. From the results of this investigation, no advantage was found in using the Valhalla underwear, as compared to the standard long underwear, lightweight cotton or winter-weight cotton-wool, currently used in warm or cold environmental conditions, respectively. (Author's abstract)

12283
Scholz, N. 1960
[OXYGEN EQUIPMENT AND THE NECESSITY FOR IT IN PASSENGER AIRCRAFT] Sauerstoffanlagen und ihre Notwendigkeit in Passagierflugzeugen. —— Deutsche Flugtechnik (Berlin), 4 (8): 235-239. Aug. 1960. In German.

Built-in oxygen devices for the aircrew and passengers on commercial air transports are suggested for emergency use to prevent hypoxia in case of a leak in the pressurization system. In view of the different requirements of the flight crew and the passengers, several types of oxygen equipment are discussed with emphasis on their distinctive features, efficiency, and the best method of placement. It is debatable whether there is a need for emergency oxygen equipment for passengers on an aircraft flying below 8 to 9 km. altitude. A few portable oxygen respirators may suffice for passengers with cardiac insufficiency. Further, storing of oxygen in liquid form may be of advantage to save space and weight. Schemes are outlined for two types of oxygen equipment for the flight crew, one type of oxygen equipment for the passengers, and a functional scheme of equipment for evaporation of liquid oxygen, all based primarily on the Soviet equipment.

12284
Seeler, H. W. 1961
DEVELOPMENT OF COMBINED AND PRESSURE-COMPENSATED, INHALATION-EXHALATION VALVE FOR PRESSURE BREATHING. —— Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6352, Task no. 63102). ASD Technical Report no. 61-396, Sept. 1961. iii+7 p.

The development of smaller and lighter weight oxygen masks made necessary the design of a

pressure-compensated inhalation-exhalation valve to replace the three valves normally used in oxygen masks. The valve development program described was in two steps, i.e., the design of a valve with a convoluted compensating diaphragm and the modification of the valve by adding damping chambers and flow resistance reducing characteristics. (Author's abstract)

12285
Seeler, H. W. 1961
DEVELOPMENT OF ORAL-NASAL MASKS, OXYGEN, MC-1 AND MBU-5/P. —— Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6352, Task no. 63102). ASD Technical Report no. 61-395, Aug. 1961. v+16 p.

A small, lightweight, nonfreezing, oral-nasal, pressure-breathing oxygen mask for use at altitudes to 45,000 feet has been developed. The development program covered two masks, the single-size MC-1 mask and the four-size MBU-5/P mask. The one-size mask would not accommodate a large enough segment of the Air Force flying population. Pilots enthusiastically indorsed the MBU-5/P mask. Each mask has a single-pressure-compensated, inhalation-exhalation valve as well as provisions for a small, lightweight, noise-suppressing microphone. A single-strap, self-oriented harness requiring only one buckle for adjustment was developed. An altitude-compensating harness tension system and a quick-donning mask harness are described. (Author's abstract)

12286
Seeler, H. W. 1958
A NEW AVIATION OXYGEN MASK WITH ALTITUDE-CONTROLLED SUSPENSION ADJUSTMENT. —— Jour. Aviation Med., 29 (2): 130-135. Feb. 1958.

A description is presented of the newly-developed MC-1 pressure-breathing mask. The mask incorporates the following design principles: (1) a single size for all faces, (2) light weight and comfort for long-range flying, (3) a single respiratory valve combining the functions of the three valves formerly used for inhalation and exhalation, (4) a light-weight noise-cancelling microphone, (5) a quick-release harness coupling, (6) an acceleration- and windblast-proof harness, and (7) a supporting harness equipped with an altitude-controlled tension-compensating system. A two-ear flight test program was conducted which resulted in excellent recognition of the mask for short- and long-range flying in fighter and transport aircraft.

12287
Sierracin Corp. 1960
MA-3 ELECTRICALLY HEATED FACEPIECE. —— Sierracin Corp., Burbank, Calif. (Contract AF 33-(616)-3746); issued by Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6333, Task no. 63617). WADD Technical Report no. 60-88, Jan. 1960. iv+21 p.

A proprietary, transparent, electrically conductive coating, "Sierracote III", was successfully incorporated into laminated, formed, optically and thermally satisfactory facepieces. Success in the heating of polyester-vinyl laminates was achieved in a shorter than anticipated period. This permitted the addition of surface-coated parts of monolithic acrylic structure to the program. (Author's abstract)

12288
Silverman, A. J., 1958
S. I. Cohen, G. D. Zuidema, and L. L. Vickery
PSYCHOLOGIC AND BIOELECTRIC ASSESSMENT OF G-SUIT PROTECTION. —— Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7215. Task no. 71713). PB 151476 AD-97 278

Six subjects performed a psychomotor task better during ten successive 3-g rides when protected by the anti-g suit. No evidence of progressive decrement in performance during the ten rides was seen. In general, galvanic skin reflex (GSR) findings suggested that the centrifuge rides were more stressful when subjects were unprotected, and that this hyperarousal was associated with performance decrements. However, both the performance decrement as well as the hyperarousal associated while the subject was being centrifuged could, of course, be due to the relative degree of hypoxia present. Subjects experienced in wearing the anti-g suit performed better during centrifugations and showed less arousal as measured by the GSR. Inexperienced subjects, however, had greater GSR evidence of arousal when wearing the suit, interpreted this as a stress, and did not perform better after each protected centrifugation. Progressive decreases of basal skin resistance were noted during the unprotected rides. Also noted was the fact that blackout or dimming began to occur after several rides. These symptoms were not seen during protected centrifugations. This suggests that when unprotected, the pressor reflexes induced by acceleration became progressively less brisk or effective. Spontaneous subjective comments after the experiment agreed with the anecdotal evidence suggesting that there is less sense of fatigue after wearing the g-suit. (From the authors' summary and conclusions)

12289
Skrettingland, K. R. 1961
ARCTIC FIELD EVALUATION OF VAPOR IMPERMEABLE GLOVE, FLYING. —— Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-60-30, Feb. 1961. 9 p.

Leather-rubber-wool gloves (8415-NL-WADC-492843) were evaluated by 115 aircrew personnel at temperatures ranging between -5° and -50° F. The design is considered unsatisfactory and the glove should not be adopted for Arctic use. Since hand gear must be removed and replaced many times during the performance of preflight activities, the principle of vapor impermeability is not applicable.

12290
Skrettingland, K. R., 1961
J. Clogston, and J. H. Veghte
EVALUATION OF VARIOUS TYPES OF BOOTS IN COLD ENVIRONMENTS. —— Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-61-7, Oct. 1961. 16 p.

To determine the suitability of various boots and types of footgear for wear in a cold environment, laboratory and field evaluations were conducted on four types of boots. During the sitting and rest experiment at -14° C. in the laboratory, the Chippewa Alert Boot was superior to the Dehner Boot. The standard Air Force Mukluk was superior to the

other types with respect to foot temperature changes and toe temperature changes during sitting and rest at -23° C., probably due to the greater insulation on the foot. Field experiments to ascertain the tolerance limit for the boots showed that three types of boots stood up well, but the Bean Shoepac should not be considered for use.

12291
Smedal, H. A., 1961
H. C. Vykukal, R. P. Gallant, and G. W. Stinnett
CREW PHYSICAL SUPPORT AND RESTRAINT IN ADVANCED MANNED FLIGHT SYSTEMS. — ARS Journal, 31 (11): 1544-1548. Nov. 1961.

A new concept in physical support and restraint for pilots and crews of space flight simulators or advanced space vehicles is described. This system incorporates an integrated helmet and restraint suit on a lightweight support frame which permits easy ingress and egress from the vehicle. Its capability as a functional support and restraint for vehicle control studies during sustained accelerations was established by its use in three human centrifuge programs, but its capability for tolerance to impact accelerations is unproved. Further improvement and testing is required in order to qualify it as an omnidirectional support and restraint system adequate for sustained and impact accelerations of high magnitude. (Authors' summary, modified)

12292
Smedal, H. A., 1960
G. W. Stinnett, and R. C. Innis
A RESTRAINT SYSTEM ENABLING PILOT CONTROL UNDER MODERATELY HIGH ACCELERATION IN A VARIED ACCELERATION FIELD.— National Aeronautics and Space Administration, Washington, D. C. NASA Technical Note no. D-91, May 1960. 19 p.

A restraint system is described which was used in a joint centrifuge program by the Ames Research Center of the National Aeronautics and Space Administration and the Aviation Medical Acceleration Laboratory of the Naval Air Development Center. The program was designed to study the ability of a pilot in a forward-facing position to control an entry vehicle which employed lift. The pilot was required to carry out a relatively complex tracking problem on a flight simulator which involved the centrifuge operated as a closed loop system. Dynamics typical of an entry vehicle were used and the pilot was subjected to varied acceleration-time profiles with relatively high accelerations, up to 7 g, from various directions for approximately 2 to 5 minutes duration. In order to conduct these tests, it was necessary to design a special restraint system. This combined the use of a modified NASA posterior mold or couch with an anterior restraint made from nylon straps and nylon netting. A special support for the head and face was also incorporated in the restraint system. The use of this restraint system permitted a thorough study of some of the control problems of entry vehicles. (Authors' summary)

12293
Spells, K. E. 1961
THEORETICAL MODEL OF THE AIR-VENTILATED SUIT: THE CASE WHEN THE BOUNDARY CONDITION AT THE OUTER SURFACE IS THAT OF HEAT FLUX DEPENDENT ON A HEAT TRANSFER COEFFICIENT.— RAF Inst. of Aviation Medicine. Biophysics Lab. (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1137, Jan. 1961. i+11 p.

Formulae in previous reports, derived by assuming the usual "prescribed temperature" boundary conditions, are modified in accordance with the assumption of a heat flux across the outer surface proportional to the temperature difference between the surface and its surroundings. The latter assumption, although less commonly used, is probably closer to the truth in this problem. (Author's summary)

12294
Stoll, A. M. 1961
THERMAL PROTECTION CAPACITY OF AVIATOR'S TEXTILES. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. Report no. NADC-MA-6120, May 22, 1961. iv+11 p.

A method has been devised for the selection and evaluation of textiles on the basis of their resistance to degradation by thermal irradiation of appropriate intensity and their protective capacity when in contact with living skin. At the present time, although field testing is not yet complete, a satisfactory thermally-resistant anti-g suit appears to have been achieved through this effort. This suit is fabricated of DuPont Experimental Fiber HT-1 in a twill weave and double-layer construction. On the basis of percentage of total body burns indicated by fuel flame exposures of clothed dummies, it has proven superior to a double-layer nylon suit and the regulation fire-retarded cotton coverall over the cutaway anti-g suit. The present method is being modified to yield surface temperature measurements during irradiation to provide for the ultimate goal of devising a thermal protection index based on previously established relationships between these temperatures and the tissue damage resulting from thermal irradiation. (From the author's summary)

12295
Thiessen, G. J., 1958
and E. A. G. Shaw
EAR DEFENDERS FOR NOISE PROTECTION.— Jour. Aviation Med., 29 (11): 810-814. Nov. 1958.

A discussion is presented of vibration characteristics of ear defenders at frequencies of sound below 1000 c.p.s. With a well-sealed ear protector, low-frequency sound reaches the ear by vibration of the whole protector. The vibration of a circumaural type of ear defender is determined by the mass of the cup and cushion, and the compliance of the cushion and the flesh around the ear. Sound attenuation is dependent on the volume of the cup and the spring constant of the cushion and flesh. Use of a liquid-filled cushion with a vinylite sheath having a relatively high Young's modulus provides a tight seal and high spring constant, so that attenuation is limited only by the compliance of the flesh. Addition of earphones to ear defenders requires reduction of the cup volume with increasing frequencies to reduce resonance and achieve high sensitivity. It is concluded that a suitably designed ear defender can provide 20 decibels attenuation at a frequency of 50 c.p.s.

12296
Tiller, P. R., 1958
and H. R. Greider
EFFECTS OF ACTIVITY ON METABOLIC RATES

OF SUBJECTS WEARING THE AVIATOR'S FULL PRESSURE SUIT.—Jour. Aviation Med., 29 (2): 117-121. Feb. 1958.

Metabolic rate and oxygen consumption were measured in three subjects performing a simple simulated pilot task while wearing either a summer flying suit, an unpressurized pressure suit, or a pressure suit pressurized at 2 pounds per square inch. Both oxygen consumption and heat production were increased over basal levels during exercise. The increases were similar when the summer flying suit or unpressurized pressure suit was worn, but were significantly greater with the pressurized suit. Calculation of estimated metabolic rates under simulated combat and emergency conditions indicated a considerably higher value for the pressurized suit than for the summer flight suit.

12297
Turi, L. H. 1960
WORK IN COLD ENVIRONMENTS: CLOTHING FOR COLD CONDITIONS.—Jour Occupational Med., 2 (3): 123-128. March 1960.

The importance of the interrelationships of temperature, wind, humidity or water, solar radiation, and work level in the determination of requirements for the design of clothing adaptable to varying conditions of cold and levels of activity is discussed. On the basis of considerations concerning the physical processes of heat loss and insulation, it is concluded that clothing should combine features of maximum permeability to water vapor, maximum water repellency, high wind resistance, adequate ventilation, and minimum weight and stiffness.

12298
Veghte, J. H., 1961
and G. Solli
DETERMINING ARCTIC CLOTHING DESIGN BY MEANS OF INFRARED RADIOMETRY. — Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8242-2). Technical Report no. 61-31, Oct. 1961. 12 p.

A scanning infrared radiometer proved to be an effective method of accurately assessing radiative heat loss from nude and clothed subjects in temperatures of 0° to -35° C. The radiometer is sensitive to infrared radiation between 1.8×10^4 and 10×10^4 Å, and traces a corresponding picture in visible light which is recorded on polaroid film. Experiments were conducted with five subjects wearing various clothing assemblies. The pictures show the critical importance of wrinkles, insulation compression, and the excessive heat loss which occurs from the head and extremities. (Authors' abstract)

12299
Veghte, J. H., 1961
and J. I. Clogston
A NEW HEAVY WINTER FLYING CLOTHING ASSEMBLY.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-61-4, Sept. 1961. 9 p.

Four subjects participated in five experiments to test three different clothing assemblies for cold exposure. Average skin and rectal temperature responses, mean body temperature, total body heat storage, and body storage rates were calculated to determine the effective insulation of the clothing assemblies. Two of the clothing assemblies appear comparable in effective insulation despite a difference in absolute weights. The third clothing assembly is not considered as adequate as the other assemblies.

12300
Webb, P. 1959
CLOSED BREATHING-VENTILATING SYSTEMS USING RECIRCULATED OXYGEN.—Jour. Aviation Med., 30(4): 273-279. April 1959.

Current high-performance aircraft and future spacecraft require closed breathing systems and closed ventilating systems to save weight of stored gases. It appears that a single recirculated gas could serve both respiratory and ventilatory requirements. Laboratory results of an instrument in which man essentially occupies a wide space in a circular duct are described. In general terms, the choices made for the various functions are: (1) for gas storage, a high-pressure cylinder; (2) CO_2 removal by chemical absorption; (3) water and heat removal at the same point in a special cooler which uses water as an expendable coolant; and (4) recirculation by a special oxygen pump which is electrically driven. Complete, isolated ecological systems, foreseen for long space flights, are noted, and the requirements are mentioned.

12301
Weinreb, L. 1960
IMPROVED EARCUSHIONS FOR A FLYING HELMET. — Radio Corp. of America. Defense Electronic Products, Camden, N. J. (Contract AF 33 (616)-5248); issued by Wright Air Development Division. Directorate of Systems Engineering, Wright-Patterson Air Force Base, Ohio (Project no. 7-(77-6336), Task no. 63619). WADD Technical Report no. 60-568, Oct. 1960. vi+27 p.

An improved earcushion has been developed for use in flying helmets. This earcushion is superior in comfort, fit, durability and acoustical properties to any prior earcushions used in a similar application. It employs a special drawback provision which appreciably aids the user in donning and removing the helmet and which permits him to relieve headband pressure when in low noise. The earcushion assemblies are provided in kit form with mounting instructions for use with the MA-3 high altitude helmet. However, with minor modification they can be adapted to other helmets. This report presents the background and theory underlying the approach to the development and design of this earcushion. Mounting techniques and earcushion materials and their influence on acoustical performance, comfort, fit, durability and helmet integration are discussed. Psychoacoustic testing and the calculation of articulation index are described and related test data are presented. (Author's abstract)

12302
Weinreb, L., 1960
and M. L. Touger
VARIATION IN EAR PROTECTOR ATTENUATION AS MEASURED BY DIFFERENT METHODS.—Jour. Acoust. Soc. America, 32 (2): 245-249. Feb. 1960.

Differences in attenuation of ear protectors were measured by the following techniques: (1) real-ear attenuation at threshold using pure tones in a free field, (2) loudness balance using pure tone in a free field with the reference level held at a sound pressure level of approximately 60 db., and (3) the objective measurement with a small microphone placed

at the entrance to the ear canal using pure tones in a free field with the sound pressure level maintained at approximately 110 db. Four types of protectors, differing in the volume under the protector and in the principal sound transmission at low frequencies, were evaluated. The test subjects and the room environment were the same for all measurements. The results indicate that threshold shift measurements yield higher values for attenuation than either loudness balance or the microphone method. However, the results vary widely for different types of protectors as a function of frequency.

12303
Weis, E. B., 1959
A. Marko, M. A. McLennan, and E. G. Correll
DEVELOPMENT OF AN OXYGEN PARTIAL PRESSURE TRANSDUCER.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71751). WADC Technical Note no. 59-395. Nov. 1959. iii+15 p. AD 234 462

This is a report of an investigation undertaken to establish a method for monitoring oxygen supply of man during stress experiments. An analysis of various systems for measuring oxygen partial pressure led to the selection of the polarographic principle. The polarographic system of analysis was examined in detail and a modified polarographic cell with a bare cathode and a fast response time was investigated. The bare cathode oxygen sensor has instabilities due to interface variations which will require extensive study to achieve accuracy. Polarographic analysis is useful for blood and atmospheric oxygen tension monitoring. (Authors' abstract)

12304
White, F. E. 1960
DRY COLD EVALUATION OF THE CRAWFORD PAPER BLANKET. — Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. AAL Technical Note no. 60-19, Nov. 1960. 5 p.

Cold-weather tests were conducted to evaluate a paper blanket for use in cold climates as an emergency substitute for regular blankets in case of mass evacuation or other emergencies. A series of four tests was conducted, each using two or four paper blankets. Although the skin and rectal temperatures were maintained at a high level, it was the general opinion for all four test subjects that this type of blanket would be inadequate for climatic conditions encountered in the North during the winter.

12305
Wight, R. 1959
SIMPLE PERISCOPE PROTECTS PILOTS FROM NUCLEAR FLASHES.—Space-Aeronautics, 32 (3): 89-94. Sept. 1959.

A rapidly-closing optical viewing device has been devised for protecting pilots from sudden, high-intensity light flahhes, such as those from a nuclear explosion. The lens and mirror systems, image size, field of view, and other characteristic properties of the device are described. Operational models could have a maximum weight of 40 lb. with a closure capability of 500 microseconds or less, and could be quickly removable from the pilot's forward field of view.

12306
Willis, R. G., 1959
and S. C. White
CLOSED RESPIRATION-VENTILATION SYSTEM FOR USE WITH HIGH ALTITUDE FULL PRESSURE GARMENT.—Jour. Aviation Med., 30 (5): 344-350. May 1959.

Considerable economy of oxygen utilization in the use of the full-pressure altitude suit may be realized by a closed system over an open system. Other advantages of the closed system are automatic defogging, reduced electrical power requirements, simplified regulator requirements, and reduced dehydration of the man. Preliminary requirements for a closed chemical exchanger system are diagrammed, and the characteristics of the ideal CO_2 absorbent are listed. (Authors' summary and conclusions, modified)

12307
Wilson, C. L., 1960
and M. B. Zinn
MEDICAL PROBLEMS IN TESTING HIGH ALTITUDE PRESSURE SUIT.—Aerospace Med., 31 (1): 49-56. Jan. 1960.

In experimental pressure-suit testing, new and unproved suit types are tested for longer time intervals and lower barometric pressure than routine indoctrinations using standard profile chamber tests. Four cases of syncope due to poorly-fitted suits are reported. The procedures for testing are given. A program of experimental testing involves physiological evaluation of cardiopulmonary, electrocardiographic, and gas-tension measurements; practical considerations of speed and ease of donning, comfort, and reliability; windblast and emergency protection in the event of cabin decompression.

12308
Wilson, C. L., 1961
OPERATIONAL USE OF THE UNITED STATES AIR FORCE PARTIAL PRESSURE SUIT.—Aerospace Med., 32 (9): 825-828. Sept. 1961.

The use of the currently operational U. S. Air Force MC-3A partial pressure suit is described, and five problem cases are discussed which occurred when the suit was improperly used. A pressure suit is indicated when flying at altitudes between 45,000 and 50,000 feet, and is absolutely necessary above 50,000 feet. The MC-3A partial pressure suit ensemble pressurizes all of the body except the feet. Regular boots offer enough foot protection. The criteria for assessing proper fit of the pressure suit include ability to make a maximum inhalation, using chest and abdomen, without suit restriction, and ability to stand completely erect with only very slight crotch or shoulder snugness.

12309
X-15 PILOT'S SUIT COOLED BY NITROGEN.—Aviation Week, 69 (25): 55. Dec. 22, 1958.

A full-pressure suit to be used by X-15 pilots of North American Aviation will be cooled by expanding liquid nitrogen passing through it. Gaseous nitrogen exhausted from the suit will serve as a cockpit pressurizing medium at high altitudes. Pressure in the helmet will be kept slightly higher than in the suit to ensure passage of oxygen from the lungs into the blood stream. (Quoted in part)

c. Bailout and Bailout Equipment

12310
Adams, R. M., 1961
and J. R. Dickey
STUDIES OF ESCAPE FROM BALLISTIC SPACE VEHICLES. II. INSTRUMENTATION. — School of Aviation Medicine. Aerospace Medical Center, Brooks Air Force Base, Texas. Report no. 61-29 [Part II], April 1961. 16 p.

Biomedical information on primates successfully flown through programed escape profiles was obtained in conjunction with the NASA project "Little Joe." The instrumentation utilized to gather this information consisted of devices for (a) sensing the life cell temperature, the humidity, the atmospheric pressure, and the oxygen partial pressure; (b) detecting and measuring the subject's respiratory rate, pulse, eye movements, vectorelectrocardiogram, and psychomotor performance; and (c) photographing the facial area of the animal during flight. Specific details of the instrumentation system are discussed, as well as the design philosophy underlying the approaches used. Illustrations are included which indicate the scope and accuracy of data return. (Authors' abstract)

12311
Beer, M., 1961
R. M. Jayson, V. E. Carter, and F. H. Kresse
SURVEY OF ESCAPE TRAINING IN THE AIR FORCE. — Wright Air Development Division. Aerospace Medical Lab., Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71748). WADD Technical Report no. 60-792, March 1961. iv+71 p.

The present state of the Air Force ejection training was studied and its contribution to the overall ejection problem was considered. Relevant information was obtained from the literature on ejection training, training films, aircrew personnel, aircrew personnel who have ejected, accident statistics, and escape training instructors. The results showed that ejection training is inadequate in content and frequency. There is a lack of standardized regular training programs. Furthermore, training media, such as ejection seat trainers and films, leave much to be desired in both quantity and quality. Even more important, training to reduce fear of and anxiety about ejection is needed. In general, aircrew personnel "know" when to eject; but hesitate to take action because of an inadequate knowledge of procedures and an anxiety produced by unfamiliarity with the ejection experience. Ejection training in the Air Force is inadequate and needs to be improved. (Authors' abstract)

12312
Beson, E. E. 1958
DESIGN CONSIDERATIONS OF A BALLOON-BORNE PRESSURIZED CAPSULE FOR HIGH ALTITUDE BAILOUT STUDY.—Jour. Aviation Med., 29 (7): 516-525. July 1958.

Design considerations are discussed for the Project High-Dive balloon capsule used for the study of bailout at high altitudes. The nature of the project required a capsule which would provide an artificial environment for a two-man team, one of whom would jump from an altitude of 90,000 feet, and the other descend by parachute in the capsule. Design problems encountered involved the physical shape of the capsule for stability in the parachute descent, resistance of the sealed capsule to pressurization, and a suspension system able to withstand high shock loads during parachute opening. Provision of an artificial environment was accomplished by a 5-liter liquid oxygen converter which released a slow-stream of breathing oxygen in the capsule atmosphere, stabilization of pressurization at an equivalent altitude of 27,000 feet to minimize the danger of explosive decompression, chemical absorption of water vapor and carbon dioxide with lithium chloride and lithium hydroxide, and control of temperature by painting the lateral surfaces of the capsule white and the bottom black. An instrument console for flight control was designed to provide easy access and an unobstructed view from either seat.

12313
Bloom, H. L., 1961
and J. H. Quillinan
EMERGENCY ESCAPE FROM THE MANNED SATELLITE. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 244-271. 1961.

Three classes of equipment for emergency escape from satellites are distinguished from each other by the missions they are intended to perform. The satellite "life jacket" enables the wearer to exist in an unfriendly environment for a short time while utilizing mainly his own capabilities to reach a more friendly environment. A satellite "life raft", analogous to the seagoing life raft, not only permits existence in the unfriendly environment for a longer period, but also provides auxiliary equipment to extend the occupant's capabilities and chances of survival. Finally, the satellite "lifeboat", as in the case of the shipborne lifeboat, provides relatively long-term existence capability, maneuvering, and propulsive capability enabling choice of landing site, and auxiliary equipment for supplementing or even replacing (in some functions) the occupant's capabilities to reach a chosen landfall. The systems approach to the emergency escape of man from an earth satellite is discussed. Technical problems and illustration of results are presented, along with typical examples of the three classes of survival equipment. (Author's abstract, modified)

12314
Alexander, S. E., 1961
and J. G. Fraser
FUNDAMENTAL CONCEPTS IN RCAF ARCTIC SURVIVAL TRAINING.—In: Escape and survival, p. 30-45. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

The Royal Canadian Air Force Training Program for survival in the Arctic is described. Following demonstration of the necessity of such a training program, 10-day survival tests were carried out to accustom men to arctic conditions and to determine the effectiveness of the equipment, supplies, and clothing provided. Psychological responses to the stressful situation are surveyed and characterized into three periods: impact, recoil, and post-trauma. The argument is presented that if the white man can but adopt the ways of the Eskimo and equally adapt himself to the changed environment, there is no reason whatsoever why he should not survive and live effectively in the Arctic.

12315
Beckman, E. L. 1960
ESCAPE FROM DITCHED AIRCRAFT. I. TIME REQUIRED BY AIRCREW FOR ESCAPE FROM A DITCHED AIRCRAFT WHILE USING THE AIRCRAFT OXYGEN EQUIPMENT FOR BREATHING.—RAF Institute of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1074, Jan. 1960. 16 p.

The 17D regulator and oxygen equipment were found to function adequately during pilot escape trials from ditched aircraft in all attitudes. All subjects required a short training period to master the underwater demand breathing technique. Subjects required 51% more time to escape from the aircraft when upright in water, and 87% more time in the inverted position in 8 feet of water than was required for escape in air (9-30 seconds). Calculation of the sink rate of the F86-D type aircraft indicated that the manual system of escape from ditched aircraft provides little chance of survival in ditching accidents.

12316
Beckman, E. L., 1959
D. C. McNutt, and J. S. P. Rawlins
ESCAPE FROM DITCHED AIRCRAFT. III. AN INVESTIGATION INTO THE FEASIBILITY OF USING THE STANDARD MARTIN-BAKER EJECTION SEAT SYSTEMS FOR UNDER WATER ESCAPE FROM DITCHED AIRCRAFT.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1093, July 1959. 21 p.
Also published in: Aerospace Med., 31 (9): 715-732. Sept. 1960.

Investigations and evaluations are presented of using the standard Martin-Baker Ejection Seat System for escape from submerged aircraft with reasonable safety. Ejection through the canopy is recommended for aircraft with frangible canopies. The inherent dangers of injury when using the ejection seat under water are accepted as a reasonable risk for a life-saving procedure. Recommendations are made for modifying the present ejection seat systems so as to improve their performance under water and to decrease the danger to the aircrew in the use of the equipment. (From the authors' summary)

12317
Beckman, E. L. 1959
ESCAPE FROM DITCHED AIRCRAFT. IV. EVALUATION OF THE FACTORS WHICH AFFECT SURVIVAL IN A DITCHING ACCIDENT IN CURRENT OPERATIONAL AIRCRAFT WITH RECOMMENDATIONS FOR INCREASING THE RATE OF SURVIVAL.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1094, March 1959. 25 p.

The methods by which various factors affect survival from a ditching accident are reviewed and their significance is discussed. Manual escape procedures used by an aircrew for making a safe escape after a ditching accident are shown to be inadequate for escape from modern jet aircraft. The use of an ejection seat to assist escape is evaluated and recommended. A research program is proposed for accumulating data on ditching accidents. This includes measurement of accelerations to which the aircrew are subjected during ditching and the measurement of the sinking characteristics of aircraft when subjected to realistic ditching conditions. The results obtained should permit an accurate evaluation of the effectiveness of the present methods of escape from ditched aircraft. An engineering development program is proposed for providing a buoyancy system for the entire airframe in some cases, for the ejection seat in others, and for modifying the ejection seat firing system so as to ensure that it functions under water in addition to providing a slower ejection velocity, when used for escape from a ditched aircraft. (From the author's summary)

12318
Billingham, J. 1961
SNAIL HAEMOLYMPH: AN AID TO SURVIVAL IN THE DESERT.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1155, April 1961. 10 p.

The white snails, Eremina ehrenbergi Roth, which are abundant in the Libyan desert, yield about 2 cc. hemolymph (contaminated with small amounts of fluid from other organs) when the shell is smashed. The hemolymph was tested as the sole source of water for survival in the desert. Rats and one human who ingested hemolymph (contaminated) as their sole source of water for four days apparently suffered no ill effects. The results demonstrate that the availability of snails in quantity during survival in the desert would enable a man to remain reasonably fit and well for at least four days in an environment with a daily maximum air temperature of 40° C. (104° F.). Under survival circumstances where water is abundant, the snails may still serve as a source of food.

12319
Campbell, P. A. 1959
ESCAPE AND SURVIVAL DURING SPACE OPERATIONS.—Air Univ. Quart. Rev., 10 (4): 85-90. Winter 1958-1959.
Also published in: Man in space, p. 190-195. New York: Duell, Sloan and Pearce, 1959.

Among the most serious and complex problems in manned space operations are escape and survival from a damaged or malfunctioning vehicle. Hazardous situations which may arise at the launch pad, during acceleration, in orbit, or during re-entry and pick-up are mentioned.

12320
Carter, C. V., 1959
and W. W. Huff
THE PROBLEM OF ESCAPE FROM SATELLITE VEHICLES.—North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development. Report no. 242, May 1959. v+15 p.

Certain problems associated with the design of escape systems for manned satellite vehicles are presented. Specific problem areas considered are: escape prior to take-off, during boost at high dynamic pressure, during exit from the atmosphere and entry to the atmosphere, and during orbit. Design procedures are presented which can be employed to determine a satisfactory escape system configuration. Lifting or non-lifting escape system configurations are technically feasible, and the optimum configuration must be selected on the basis of compatibiltiy with the parent vehicle design and operational characteristics. Certain basic requirements must be satisfied: a satisfactory environment must be maintained for the occupant,

adequate stability and control characteristics must be provided and a means of initiating descent from orbit is required. (Authors' abstract)

12321
Chaffee, J. W. 1961
ANTHROPOMETRIC PHOTOGRAMMETRY AS APPLIED TO ESCAPE CAPSULE DESIGN. —— Human Factors, 3 (1): 36-52. March 1961.

An experimental investigation was made of the location and spatial requirements of salient anatomical features of the human operator of a high-performance air weapon system when simulating the use of an escape capsule-type of emergency abandonment system. Twenty-four subjects representative of the Air Force flying population were measured using a new system of anthropometric assessment which employs a nonstereographic photogrammetric treatment requiring two to three ordinary 8-in. x 10-in. view cameras together with adequate stroboscopic illumination. Data on the x, y, and z co-ordinates of sixteen anatomical features of the operators when positioned in six body attitudes representative of the escape system's use are presented in the form of figures. (Author's abstract)

12322
Cumming, F. G. 1961
ESCAPE FROM AIRCRAFT AT HIGH SPEEDS AND LOW ALTITUDES.—In: Escape and survival, p. 5-9. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

In considering escape from an aircraft by means of an ejection seat, the height, speed, aircraft behavior, and attitude are the significant factors, and when dealing with escape at high speed and low level, the latter is of fundamental importance. A series of dummies were ejected from a Meteor aircraft at 50 ft. above ground at 600 m.p.h. and their behavior was recorded by photographs. The dummies traveled approximately 1100 ft. before hitting the ground. During ejection, quick action is of utmost importance, and so is protection against blast at high speeds. Once away from the aircraft, the speed of ejection must be reduced rapidly, but with acceptable deceleration, to a speed at which it is safe to deploy the parachute and, at the same time, prevent explosive opening of the canopy which is so damaging and which in itself can be fatal.

12323
Ernerot, E. 1960
[EJECTION ARRANGEMENTS FOR CATAPULT SEATS IN SWEDISH MILITARY AIRCRAFT] Utskjutningsanordningar för katapultstolar i svenska flygplan. —— Meddelanden från flyg- och naval-medicinska nämnden (Stockholm), 9 (1) : 9-14. 1960. In Swedish.

A review is given of the development of the combustion processes utilized in ejection seat mechanisms and of the effects that the accelerations of ejection have upon the pilot. The first ejection system, using fast-burning powder, produced accelerations up to 60 g, measured on the pilot, or 27 g, measured on the seat. The fact that no back injuries occurred at this high acceleration is explained by the short distance (1 cm.) the pilot moved by the time maximum acceleration was reached (0.02 seconds after ignition). The use of slow-burning powder reduced acceleration to 14 g. A three-pressure-chamber system employed in the Tunnan-series aircraft produced acclerations of 20-34 g, and caused spinal-compression fractures; the system was later modified to give a maximum acceleration of 13-15 g. In the succeeding Lansen-type aircraft, with a mechanism producing 16-18 g, back injuries were again reported and the charge was lowered to produce about one g less acceleration. A further reduction of the acceleration force is still required, however.

12324
Fabre, J. 1959
[MEDICAL ASPECT OF THE FIRST HUNDRED EJECTIONS EFFECTED IN FRANCE WITH DIFFERENT TYPES OF EJECTION SEATS] Aspect médical des cent premières éjections pratiquées en France sur différents types de sièges éjectables.—Médecine aéronautique (Paris), 14 (3): 223-236. 1959. In French, with English summary (p. 236).

A review is presented of the various ejection seats used in France (E.86 manual, E.92 automatic, E.95 manual and automatic, Martin Baker, Lockheed manual, Republic (R.A.C.) manual and automatic) from 1951 to 1957. Included is a survey of 100 ejections with reference to the effects of altitude and speed on ejection, percentage of fatalities, degree of minor and severe injuries, successful ejections rendering no injuries, as related to the type of seat used and any modifications added to the seat. Consideration is given to spinal injuries incurred during the ejection procedure. The hazards are stressed of seats using non-telescopic guns which produce in a short time g values which often exceed the tolerance threshold of the spine. (Author's summary, modified)

12325
Fabre, J. 1961
[MEDICAL ASPECT OF EJECTIONS OCCURRING IN FRANCE ON DIFFERENT TYPES OF EJECTION SEATS] Aspect médical des éjections pratiquées en France sur différents types de sièges éjectables.—In: Escape and survival, p. 18-29. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961. In French, with English summary (p. 18).

Over a period of seven years, a wide diversity of ejection seats were used in France. This study of 100 ejections deals with the influence of altitude and speed, percentage of fatalities, major and minor injuries, and of intact pilots, in relation to the type of seats used and the improvements made. Specific injuries to the spine resulting from ejections are considered in the second part of the paper. The drawback of seats using nontelescopic guns is emphasized, since such seats involve values of g which are too high, too fast, and often exceed the tolerance threshold of the spine. (Author's summary, modified)

12326
Forbes, A. R. 1959
PREFERRED LOADS FOR THE AUXILIARY FIRING HANDLE OF THE MARK 3 EJECTION SEAT.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 999, April 1959. 7 p. AD 229 169

Six male subjects were tested under static conditions and three male subjects exposed to positive acceleration of 5 g to determine the optimum load on an ejection seat auxiliary firing handle. The range of loads investigated was from 65 pounds to

95 pounds, using the techniques of absolute judgments and paired-comparisons. The maximum load on this handle should not exceed 75 pounds for a two-handed pull. It is recommended that aircrew should be given training in its use to acquaint themselves with the amount of force required to pull it. (Author's abstract)

12327
Francesconi, A. 1961
[PARACHUTE JUMPING FROM THE MEDICAL VIEWPOINT] Il paracadutismo dal punto di vista medico. — Annali di medicina navale e tropicale (Roma), 66 (2): 251-260. March-April 1961. In Italian, with English summary (p. 260).

Historical, technical, physiological, and psychological aspects of parachute jumping are briefly discussed. Consideration is given to medical selection and supervision of parachutists and to training procedures.

12328
Fryer, D. I. 1961
THE EFFECTS UPON MAN OF EXPOSURE TO HIGH RAM PRESSURE LOADS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1177, July 1961. iii+47 p.

Subjects were moved through water in an ejection seat in order to simulate the effects of movement through air at an equivalent load. Equipment and instruments for the series of experiments are described and illustrated. Petetechial hemorrhages were the most common type of injuries observed. The mechanism of eye hemorrhage is also discussed.

12329
Fryer, D. I. 1961
OPERATIONAL EXPERIENCE WITH BRITISH EJECTION SEATS: A SURVEY OF MEDICAL ASPECTS. — RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1166, July 1961. ii+56 p.

This is a statistical survey of experience with the emergency use of British ejection seats and believed to constitute a complete list of ejections from aircraft flown by the British armed services and aircraft industry from 1949 to July 1, 1960. Tabulations are presented of the total number of ejections; annual rate; seats used; unintentional, voluntary, under-water, and in-flight ejections; major ejection injury of the spine, and mortality rates. Factors contributing to mortality are altitude, air-speed, and the combination of speed and altitude at the time of ejection. Spinal fracture appears to be the main injury sustained by ejection and due either to mechanical factors (aircraft attitude and behavior, loose harness, ejection velocity, seat pack), or to human factors (body weight and height, age). Injury may also occur after separation from the aircraft but before landing due to spinning and tumbling, wind blast, or flailing; and upon landing due to parachute entanglement and human factors. Consideration is given to preparation for ejection and seat firing.

12330
Gatling, F. P. 1959
EJECTION SEAT STUDY.—Naval Aviation Safety Center, Norfolk, Va. Report no. AM 2-59, [1959]. 41 p. AD 220 667

The ejection rate for calendar 1958 was the highest in the history of Naval aviation, but there is an indication that the rate of increase is slowing. Lack of altitude is still the greatest factor in unsuccessful ejections. There was a large increase in on-the-deck ejections in 1958, and the mean altitude at which ejections were made in 1958 was the lowest yet recorded, 7474 feet. There was a substantial increase in fatal ejections that began above 3000 feet. The mean speed at which ejections are made continued to decrease to 217 knots. Attitude data again failed to reveal any connection between attitude and fatal injury. Among aircraft that had at least 20 ejections, the FJ series aircraft had the smallest percentage of fatal injuries. (Author's abstract)

12331
Gładkov, N., 1958
and L. [M.] Kadyshin
[CATAPULTING AT HIGH ALTITUDES AND SPEEDS] Katapultowanie na dużych wysokościach i przy dużych prędkościach.—Wojskowy przegląd lotniczy (Warszawa), 11 (4): 25-31. April 1958. In Polish [Original in Russian, in: Vestnik vozdushnogo flota, 1957 (12)].

The effects of catapulting on the human body are discussed on the basis of data obtained in the Soviet Union since the summer of 1947 when the first ejections from the Pe-2 bomber were made at an altitude of 2.5 km. and a speed of 270 km./hr. The forces developed during fall are characterized, and conclusions are drawn on the position most favorable to the human body during fall.

12332
Glaister, D. H. 1961
PROPERTIES OF POLYURETHANE FOAMS IN RELATION TO THEIR USE AS EJECTION SEAT CUSHION MATERIALS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 1184, Aug. 1961. i+23 p.

Polyester and polyether grades of polyurethane foams were subjected to a number of tests to determine their physical properties in relation to their suitability for use as cushions on ejection seats. Properties measured were density, compressibility, permanent deformation following prolonged compression, rates of recovery following brief compression, and measures of damping under lightly and heavily loaded conditions. (Author's summary)

12333
Grandpierre, R., 1961
F. Violette, J. Fabre, and Y. Houdas
[PHYSIOLOGICAL PROBLEMS PRESENTED BY SUPERSONIC EJECTIONS. I.] Problèmes physiologiques posés par les éjections supersoniques. I. — Forces aériennes françaises, no. 175: 667-678. Nov. 1961. In French.

At equivalent speeds of 1,100 km./hour many types of ejection seats now in use do not afford enough protection to the pilot, and the mortality of ejection at these speeds is high. The disturbances produced by the different physical parameters of high-speed ejection and the relationships between spin of the seat, the mass of the seat, altitude, and

deceleration are analyzed. The rotation of the pilot after his release from the seat during the free-fall period and the control of rotation by the parachutist are discussed. A final section deals with the mechanical and physiological effects of ejection and rotation upon equipment and areas of the body.

12334
Green, C. D., 1961
B. E. Welch, W. Lynn Brown, L. E. Lamb, P. C. Tang, D. B. Gisler, and H. C. Blodgett
STUDIES OF ESCAPE FROM BALLISTIC SPACE VEHICLES. I. BIOMEDICAL EVALUATION. —— School of Aviation Medicine. Aerospace Medical Center, Brooks Air Force Base, Texas. Report no. 61-29 [Part I], April 1961. 24 p.

Biomedical information on primates successfully flown through programed escape profiles was obtained in conjunction with the NASA project "Little Joe." Animal response during acceleration, deceleration, re-entry, and water impact demonstrated survivability. Also recorded and evaluated were: (a) environmental data (i.e., relative humidity, total gas pressure, O_2 partial pressure, and gas temperature); (b) physiologic data (i.e., respiratory rate, pulse rate, and cardiac rhythm from ECG tracings); (c) psychomotor performance data; and (d) oculomotor movement. These experiments substantiate, under actual flight conditions, physical and biologic design criteria for biopacks, physiologic sensor response, and performance criteria during all phases of the ballistic trajectory and recovery operations from an impact area. (Authors' abstract)

12335
Hess, J. L., 1958
and C. F. Lombard
THEORETICAL INVESTIGATIONS OF DYNAMIC RESPONSE OF MAN TO HIGH VERTICAL ACCELERATIONS.——Jour. Aviation Med., 29 (1): 66-75. Jan. 1958.

A theoretical model of the human spine consisting of a homogeneous elastic rod was fitted to experimental data from ejection-seat tests by variation of the time factor required for an acceleration wave to travel the length of the rod. The model obtained yielded theoretical acceleration curves which were fairly close to the experimental curves at first, but which later diverged, apparently because of a lack of damping in the model. The theoretical effects of the rise time of the prescribed end accelerations on the maximum values of stress and acceleration at points of the rod were also computed. It is concluded that tolerance limits for the human spine could be established with such a model if the structural strength of the human vertebrae were determined. However, because of the inadequacy of experimental data now available it is suggested that investigation of more accurate models is not justified.

12336
Holcomb, G. A. 1959
NORTH AMERICAN ZERO LEVEL ESCAPE SYSTEM.——Soc. Exper. Test Pilots Quart. Review, 3 (3): 10-18. Spring 1959.

Descriptions and working mechanisms for two emergency ejection escape seats for subsonic and supersonic aircraft are recorded. The ejection sequence in both systems is comprised of three stages. The use of a drogue parachute maintains the stability of the seat in flight.

12337
Holmqvist, N. B. 1959
[PRINCIPLES OF CONSTRUCTION OF CATAPULT SEATS] Konstruktionsprinciper för katapultstolar. —— Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 8 (2) : 7-12. 1959. In Swedish.

The ejection seat used in the Swedish Lansen aircraft is described and illustrated, and problems in the design and development of this and similar units are discussed. A major objective is to insure that the pilot clears the tail fin of the vehicle when ejected at maximum flying speed (1100 km./hr.) without exceeding the permissible ejection acceleration of 25 g (preferably 20 g). A time breakdown of events by ejection from various Swedish aircraft types is given. The possibility of safe escape (average 85 per cent) increases with increasing altitude. An important task is to improve the current safety margin on escapes from below 100 meters; the solution of high-speed problems thus takes secondary priority.

12338
Hopkin, V. D. 1959
PREFERRED LOAD AND POSITION FOR A HOOD JETTISON HANDLE.——RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 992, April 1959. 4 p. AD 229 168

Fifteen suitable male subjects were tested to find the preferred restricting load on a hood jettison handle. Several components of the load were varied, and a satisfactory position was found for the handle. The consistent results obtained allow definite conclusions to be drawn. A friction load of 15 lb. and a maximum load at the apex of the sear of 35 lb. are recommended, this maximum to occur when the handle has been pulled between four and five inches. The preferred position of the handle is specified. All possible users should know beforehand what it feels like to pull a load with these components. (Author's summary and conclusions)

12339
Kittinger, J. 1961
PROJECT EXCELSIOR: PERSONAL EXPERIENCES IN HIGH ALTITUDE ESCAPE SITUATIONS.——In: Psychophysiological aspects of space flight, p. 50-54. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

The purpose of Project Excelsior is to conduct research concerning the physiological actions and reactions during high-altitude escape situations. The first problem solved was that of finding an adequate pressure suit with electrical heating of hands and feet. Physical and psychological reactions during the two descents from high altitude are recorded.

12340
LeVier, A. W. 1959
PILOTS' VIEWPOINT ON EMERGENCY ESCAPE.—— Soc. Exper. Test Pilots Quart. Review, 3 (3): 3-9. Spring 1959.

A personal view of automatic emergency escape systems for piston and jet aircraft is presented, and the great need for such systems is emphasized.

12341
Lewis, C. 1958
SPACE VEHICLE ESCAPE METHODS STUDIED.—Aviation Week, 69 (21): 49, 51. Nov. 24, 1958.

An escape unit from a space vehicle should have structural integrity, stability, automatic control, and self-contained propulsion to separate, stabilize its path, and decelerate and protect its crew during and after landing. Its location should permit explosions to aid in separating the unit rather than trapping it. Shape controls, such as blunting, and absorption of heat by endothermic chemical reactions should be used. Surface materials should be properly selected. The units must provide protection against radiation and meteoroids. Because of the uncertainties of the human reaction to emergencies, it might be best to have the escape carried out automatically or at least semi-automatically. An encapsulated seat might be useful during the first minute after launch or during the terminal phase after the space vehicle had slowed down to Mach 2 or less, but it could not stand up under re-entry loads. The best refuge for the crew during re-entry should be the final stage of the space vehicle itself; it could be provided with a parachute for landing.

12342
Mason, J. K. 1958
PATHOLOGICAL FINDINGS FOLLOWING UNSUCCESSFUL EJECTION FROM HIGH SPEED AIRCRAFT.—Jour. Forensic Med. (Johannesburg, S. Africa) 5 (4): 173-184. Oct.-Dec. 1958.

Operational and performance features of the standard British ejection seat are outlined. Post-mortem examinations of victims of unsuccessful escapes during flight are analyzed. The findings suggest human or instrumental failure in the preparatory stage or during actual ejection. Potential pathological findings are correlated with various ejection stages. Illustrations are included showing how the post-mortem examination may disclose the circumstances surrounding the unsuccessful escape. On the basis of the degree of pulmonary fat embolism and of local reaction to injury, general observations are made with regard to timing of injuries. The role of post-morten examinations in preventive medicine is stressed with particular regard to the uncommon causes of death encountered in unsuccessful ejections.

12343
Miller, A. E., 1959
and E. H. Replogie
DEVELOPMENT OF AN EMERGENCY PRESSURIZATION SYSTEM FOR AN ESCAPE CAPSULE.—Scott Aviation Corp., Lancaster, N. Y. (Contract AF 33(616)-5005); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6352, Task no. 63105). WADC Technical Report no. 58-397, May 1959. iii+ 41 p. AD 216 307

An Emergency Pressurization System for an Escape Capsule was developed. It included its own "bottled" high pressure air supply and a sequential system of controls whereby, after being armed either manually or by separation from the aircraft, the system automatically (as a result of the sensing of the drop of cockpit pressure) releases its air at the rate required for fast repressurization. It then cuts short the fast repressurization as soon as the capsule pressure has again returned to a safe level, and directs the air through an absolute pressure regulator which maintains this level, compensating for capsule leakage. (From the authors' abstract)

12344
Mohrlock, H.F. 1959
"THIS WAY OUT, PLEASE" (AN EJECTION SEAT FOR SUPERSONIC AND LOW ALTITUDE ESCAPE).—Soc. Exper. Test Pilots Quart. Review, 3 (3): 19-32. Spring 1959.

The working mechanism of the "B" type automatic ejection seat is described, with the aid of photographs. The seat can remain aerodynamically stable while maintaining accelerations within human tolerance. The supine position of the seat in flight provides for favorable parachute deployment. The present seat is designed for the maximum dynamic pressure and Mach number of the Century Series aircraft.

12345
Pletcher, K. E., 1961
and S. E. Neely
USAF EMERGENCY ESCAPE EXPERIENCE — 1950-1959.—Aerospace Med., 32 (6): 524-534. June 1961.

Ten years' experience of escape from U. S. Air Force tactical aircraft is reviewed and tabulated. The main problem has always been and continues to be the lack of sufficient altitude to complete the escape sequence. This is often complicated by a rapid rate-of-closure with the terrain. Water landing, rather than land survival, is the most serious post-ejection problem. Many of the hazards of ejection escape which were forecast have not materialized. Among these are g-forces, hypoxia, parachute-opening shock, and high speed. (Authors' summary, modified)

12346
Potor, G., 1960
and A. R. Marko
PHYSIOLOGICAL INSTRUMENTATION IN HIGH ALTITUDE BAILOUT (PROJECT EXCELSIOR).—American Rocket Society, Publication 1427-60. 5 p. New York, 1960.

During a parachute descent from over 102,000 feet a test was carried out to evaluate special clothing and equipment for protecting a man when he enters and escapes from a vacuum at low temperatures and to evaluate the physiological and psychological response in this situation. The reactions were measured both during ascent by conventional communications and during descent by equipment attached to the subject. A description of the technique for recording voice, heart rate, and respiratory rate is given.

12347
Roxburgh, H. L. 1961
BIOLOGICAL PROBLEMS OF ESCAPE AT HIGH ALTITUDES.—In: Escape and survival, p. 1-4. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

Experimental work of a biological nature on escape at high altitudes is difficult to undertake, for stresses are involved which cannot be simulated in combination on the ground. Flight experiments are extremely costly and are limited in that they can seldom be done up to the limits to which contemporary aircraft are operating. The ejection seat, at present the most important means of escape from aircraft,

is likely to remain essential for many years. Escape from aircraft at high altitude involves the dangers of cold and anoxia. An incident of successful escape from an airplane at 54,000 feet is presented.

12348
Sandborg, H. 1959
[EJECTION SEAT FOR SUPERSONIC SPEED] Katapultstol för överljudsfart. — Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 8 (2): 22-23. 1959. In Swedish.

A description is given of the "B" Supersonic Seat Escape System developed by the Air Research and Development Command of the United States.

12349
Skogland, H. 1959
SIMPLE MOD BOOSTS EJECTION SAFETY FACTOR. — Aircraft (Toronto), 21 (6): 42. June 1959.

In experimental aircraft ejections at the Central Experimental and Proving Establishment of the Royal Canadian Air Force, it was observed that the initial catapult force and inertia forces create a movement which tends to turn the seat and pilot forward as they move upward at high acceleration, resulting in a violent forward tumbling action and a subsequent bending of the catapult tubes. The attachment of two extension bars to the seat increases the distance of the guided portion of the ejection, thereby reducing the forward tumbling. The modified seat decreases tube bending by 50%, increases tail clearance throughout the speed range, and reduces tumbling by 30%. Some of the factors which affect the trajectory of the ejected seat, but which are not consistent from ejection to ejection, are enumerated.

12350
Stanley, R. M. 1960
DESIGN FEATURES OF THE B-58 ESCAPE CAPSULE.—Aero Space Eng., 19 (1): 42-45. Jan. 1960.

New escape capsules for Convair B-58 supersonic bombers eliminate the necessity of wearing or carrying restrictive protective gear by seat encapsulation with automatic pressurization, self-contained oxygen supply, protection from wind blast, provisions for landing in the capsule, and inclusion of survival equipment. The design allows operation at either high or low altitude. Acceleration loads at ejection at high or low speeds and upon impact will be within the limits of human tolerance. The pre-ejection phase includes leg and torso positioning, encapsulation by means of door closure and pressurization by aircraft air supply or air bottle. The pilot is capable of flight operations after encapsulation. The pre-ejection cycle can be repeated if necessary. The ejection system is completely independent of the pre-ejection system and automatic once it is activated. A deceleration bag will compress upon impact with ground or water absorbing part of the deceleration force. The capsule doubles as a life raft. Specified over-all reliability is 0.97 at 80% confidence level.

12351
Stanley, R. M. 1960
ESCAPE AT LAUNCHING AND IN THE ATMOSPHERE FROM A SPACE VEHICLE.—In: Physics and medicine of the atmosphere and space, p. 497-504. New York, etc.: John Wiley and Sons, 1960.

Various means of providing a crew with ways of escape and survival at the launching pad and during space flight are discussed. The characteristics required in the design of an ejection seat or capsule are presented. The degree of automation which an escape vehicle should have depends somewhat on the duties expected of the crew; it is determined that, other than a panic button, the remainder of the cycle should be fully automatic.

12352
Stapp, J. P. 1959
ESCAPE FROM AIRCRAFT.—In: Medical aspects of flight safety, p. 213-221, 2 unpaged leaves. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Based on U. S. Air Force experience since 1949, the relation of flight conditions to effectiveness of escape from aircraft with the ejection seat is reviewed by means of representative figures. Included are the following: (1-2) graphs showing percent survival, major and minor injury and fatalities in relation to altitude and speed respectively; (3) computed probable wind-drag decelerations and tumbling forces experienced by George Smith's ejection at Mach 1.05, 6000 ft. altitude; (4) resultant of vertical, horizontal and lateral accelerations, head and lower torso, with dummy at 671 knots during rocket sled ejections; (5) graph of resultant forces at center of gravity of the chimpanzee and seat; (6) sled deceleration data with chimpanzee seated facing forward; (7) parameters of human tolerance to deceleration; (8) composite diagram of the orders of human reaction to deceleration; (9) photograph of human subject on Wright Field spin table during 120 revolutions/ minute, 5-second experiment (10) photograph of take-off of 632 mile/hour human experiment, Holloman Track, December 1954; and (11) photograph of windblast experiment Holloman Track, August 1955 with canopy being jettisoned in 50 milliseconds for exposure to windblast at maximum sled speed.

12353
Stone, I. 1960
ENCAPSULATED B-70 EJECTION SEAT TESTED. —Aviation Week, 72 (8): 87, 89, 90. Feb. 22, 1960.

The encapsulated cabin seat developed for the North American Mach 3 B-70 intercontinental bomber can be sealed airtight, thereby eliminating the oxygen mask and pressure suit during flight. In emergency, the seat converts to a capsule which is propelled through an escape hatch and lowered to the ground by a nylon parachute. Impact at landing will be absorbed by a gas-filled rubber bag at the bottom of the seat. The capsule doubles as an emergency raft on sea. Ejection is possible at 120,000 ft. altitude, as well as on the runway at speeds of 70 to 90 knots. The capsule has been tested in unmanned parachute drops.

12354
Sutter, R. 1959
EVALUATION OF EJECTOR FOR PARACHUTE, PERSONNEL, ULTRAFAST OPENING, XMP2, BACK STYLE. — Frankford Arsenal, Philadelphia, Pa. (Project no. DA-502-06-001). Memorandum Report no. M59-12-1, Jan. 1959. 17 p. AD 216 724

Frankford Arsenal conducted evaluation studies and mechanical tests of the XMP2 ultrafast opening personnel parachute ejector. Although the ejector

operated properly in all firing tests, it is recommended that the following changes be made to improve reliability and safety: Replace the precocked firing mechanism with a mechanism similar to that used in the M3 initiator. Replace the projection and ejection cartridges with cartridges of standard design. Modify the ejection cartridge firing mechanism by integrating the firing pin with the hammer. (Author's summary)

12355
Walchner, O., and F. M. Sawyer 1960
PARACHUTIST'S SPIN PROBLEM.—Air Force Research Division. Aeronautical Research Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1366, Task no. 70855). ARL Technical Report no. 60-150, Dec. 1960. iv+3 p. PB 171 048
Also published in: Escape and survival, p. 10-17. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

After it is known that the flat spin can be fatal to man at high altitudes, efforts must be made to avoid these hazardous conditions. Tests were conducted to study autorotation characteristics inherent in different configurations, including man. The tests indicate that spin can be controlled by proper orientation and attitudes of the feet or other limbs. However, controlling a flat spin in this way would require extensive training and would suppose that the man is conscious, a condition which cannot be relied on for a man bailing out at high altitude. Also, the pressure suit worn at high altitudes probably will not allow sufficient freedom to steer the body with the limbs. Small asymmetries, of which the limbs of man offer many possibilities, may lead to autorotation. The idea of eliminating these asymmetries in shape by placing the man in a capsule is not encouraging after the flat spinning cylinder has been observed in a vertical air flow. Perhaps the only efficient approach to a solution to the parachutist's spin problem is to develop means of preventing a man from assuming a flat position during the fall, i.e., to stabilize the man with the body aligned parallel to the trajectory. (Authors' conclusions, modified)

d. Survival and Rescue
(On Sea, Land, in Desert, Arctic, etc.)

12356
Buckley, J. L., and W. L. Libby 1959
THE DISTRIBUTION IN ALASKA OF PLANT AND ANIMAL LIFE AVAILABLE FOR SURVIVAL.—Univ. of Alaska, College, Alaska; issued by Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-10, May 1959. v+43 p.

This project was undertaken to determine the abundance of native foods, both plant and animal, available for survival in the Alaskan subarctic. In general, forest types produce the greatest amounts of edible materials; however, no single type is as productive as the ecotone between types. The supply of wild foods available fluctuates seasonally and between years. In good years, especially during late summer, native foods would probably be sufficient to prevent starvation in a well-trained individual. In poor years the chances of finding adequate foods would be greatly reduced. Recommendations for equipment for procuring native foods are given. (Authors' abstract)

12357
Bulban, E. J. 1958
H-43B TAILORED TO USAF RESCUE CONCEPT.—Aviation Week, 69 (25): 71, 73-75. Dec. 22, 1958.

Studies of Air Force crashes have indicated that helicopters, because of their ability to rapidly cover territory that would be difficult or impassable for ground-rescue and fire vehicles, could save many crew personnel. The Kaman H-43B Huskie turbine-powered helicopter, equipped with 1000 lb. of fire fighting and rescue gear, was designed to be used throughout the U. S. Air Force commands as crash vehicle. Tests have confirmed the helicopter's efficiency in fire-fighting and rescue roles. Heavy rotor downwash is used to beat flames away from crew quarters, permitting the helicopter rescue workers to enter the wreck unharmed. The cool downwash keeps crews from being exposed to high heat while rescue operations are being carried out. This is quite important because the effects of heat rather than fire itself have often been the cause of fatalities.

12358
Drury, H. F., D. A. Vaughan, and J. P. Hannon 1959
ARCTIC SURVIVAL RATIONS. III. THE EVALUATION OF PEMMICAN UNDER WINTER FIELD CONDITIONS.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-6, Jan. 1959. i+34 p.

Pemmican, a dehydrated high-fat, high-protein, carbohydrate-free meat preparation was fed, with and without an isocaloric supplement of sugar, to 10 human subjects undergoing simulated survival in a severely cold environment for 9 days. No ill effects were noted that could not be attributed to caloric restriction, and the performance of the subjects was considered adequate for survival situations involving moderate activity. An isocaloric supplement of 40 grams of sugar increased the fasting blood-sugar levels, decreased the nitrogen balance, and decreased the excretion of ketones. During the 3 days following initiation of the dietary regimen, fasting blood-sugar levels and daily nitrogen balances fell precipitately, while ketone excretion rose. After this, however, the blood-sugar levels rose somewhat and leveled off, the nitrogen balance increased appreciably, and excretion of ketones fell gradually to quite low levels irrespective of the isocaloric supplement of sugar. These results are interpreted to mean that the subjects were becoming adapted to the combination of pemmican and restricted caloric intake. (Authors' abstract)

12359
Ireland, R. G. 1958
A NEW DEVICE FOR HELICOPTER RESCUE OF SURVIVORS AFLOAT.—Jour. Aviation Med., 29 (5): 358-365. May 1958.

Analysis of helicopter sea rescue reports and fields tests revealed the following principal causes of rescue failure: (1) physical forces of wind and water exceeding the performance limitations of the aircraft and rescue equipment; (2) disastrous accidents resulting from the failure of actions taken with calculated risk against environmental hazards; and (3) physiologic failure of the survivor under conditions of stress (hypothermia, exhaustion). Criteria for an ideal appliance for the rescue of helpless survivors were developed from an 18-month field evaluation of various pick-up devices, and a device meeting all the criteria was designed, constructed, and

tested. The "clam net" rescue device consists of an elliptical, tubular steel-rimmed nylon cord net, with the frame hinged to fold in half on contact. Pickup with the device may generally be made on the first helicopter pass. The pickup load can be hoisted and transferred to the interior of all types of helicopters in a single operation. The device weighs only 13 pounds, and is virtually indestructible.

12360
Karmiol, E. D., 1961
and J. S. Youtcheff
SURVIVAL IN SPACE. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 230-243. 1961.

This paper presents a treatment of the relationship between man and equipment in assuring mutual survival and adequate functioning of the space system complex. Man is here presented as a vital component that must function in the equipment loop as an integral part of the overall space vehicle. Equipment reliability is a necessity in providing an adequate artificial environment for man in space. Man can contribute toward this relationship by enhancing equipment reliability through maintenance action. The factors influencing the survival of both man and equipment in space are investigated as a function of the operational requirements in the time-stress environment. The various phases of space operation are discussed relative to the operational environments associated with each phase. The environmental stresses are detailed as a function of time in each of the operational periods. Assuring survival in space necessitates the overall integration of the biological and technical requirements in the design of the space vehicle. Methodology is presented for the design, test, and analysis necessary to achieve and demonstrate adequate space system reliability. (Authors' abstract)

12361
Lalli, G., 1959
and E. Franconi
[ON THE VALUE OF USING SEA WATER AS A BEVERAGE IN EMERGENCY CONDITIONS] Sull' utilità dell'impiego dell'acqua di mare come bevanda in condizioni di emergenza.—Rivista di medicina aeronautica e spaziale (Roma), 22 (1): 113-147. Jan.-Mar. 1959. In Italian, with English summary (p. 144).

The composition of sea water, body water distribution and balance, fluid balance during water and food deprivation, renal function and maintenance of water-electrolyte balance, and human and animal experiments with ingested sea water are reviewed. The author states that although ingested sea water provides the body with a moderate fluid gain (about 280 ml. per liter of ingested water) several unfavorable effects are manifested. (1) Ingested ions are not excreted in equal quantity with the urine because they are partially replaced by body ions. Chlorine anions are retained in parts and SO_4 and HPO_4 are excreted in larger amounts, whereas Mg cation is accumulated with a loss of K and a moderate retention of Na cations, thus inverting the balance between the two elements. (2) Body water losses after the ingestion of hypertonic fluids usually originate within the cells which demonstrates the possible passage of cations different from K into the cells. The author concludes that the ingestion of sea water is not advantageous to the body and that additional research on the concomitant effect of food, especially carbohydrates, since they play a role in restoring the Na and K distribution of internal fluids, is necessary.

12362
McNaughtan, I. I., 1959
D. J. Day, and E. Beckman
INVESTIGATIONS INTO THE PROBLEM OF CANOPY OPENING IN ESCAPE FROM DITCHED AIRCRAFT.—Royal Aircraft Establishment (Gt. Brit.), Farnborough. Technical Note no. Mech. Eng. 299, F.P.R.C. Paper no. 1091, Sept. 1959. [36] p. AD 230 055L.

Preliminary trials were conducted to evaluate the factors which prevent jettisoning of the canopy of a submerged aircraft. The time required for a subject to jettison a test Meteor 9 canopy manually at a depth of 30 feet varied from 30 to 240 seconds depending on aircraft attitude. In the 60° nose-up attitude, manual jettison was found to be impossible until some time after the differential pressure had fallen to zero through valve leakage. Mild canopy implosion was observed at a differential pressure of 7.2 lb./sq. in., and violent implosion was observed at 12.0 lb./sq. in. A simplified theory for the establishment of the pressure-time relationship in a cockpit during ditching proved to be adequately accurate. The need for reevaluation of the problem of underwater canopy jettison in naval aircraft is strongly indicated.

12363
Mangelsdorf, J. E. 1959
LOGISTIC SUPPORT TO MAN'S ECOLOGY IN SPACE [Abstract].—Mechanical Eng., 81 (7): 79. July 1959.

Man's ecology in space—the total environment adequate to the maintenance of sound physical and mental health and the accomplishment of assigned missions—is an essential factor in the success of a manned-satellite mission. Logistic support—a program which will furnish timely replenishment of certain elements of the ecology—is therefore necessary. Space stations will operate in an essentially closed-system, closed-loop fashion, and most of the internal loops must be carefully balanced if the crew is to perform its assigned tasks in addition to its survival efforts. This paper discusses the ecological elements with which the system must provide the satellite crew. Provision for potable water and nutriment and a means of ingestion; gases for breathing; disposal of body wastes; protection from thermal, noise, radiation, psychological, and g-stresses are treated in some detail. It is shown that the solution of the problem of man's ecology in space requires talent from a number of technical areas. The author briefly examines the Lockheed Ecological Model, first as a means of illustrating man's metabolic exchange, and second, as a tool for solving some of the problems of designing for long-endurance, manned satellites. (Quoted in full)

12364
Mickelson, W. F., 1961
B. J. Mills, J. B. Graves, R. S. Huey, and P. F. Kiehl
EMERGENCY ESCAPE CAPSULE STUDIES. II-IV. — Aeronautical Systems Division. Directorate of Operational Support Engineering, Wright-Patterson Air Force Base, Ohio (Project no. 6325, Task no. 63752). ASD Technical Report no. 59-247, Part II, Dec. 1961. v+33 p.

This report consists of three individual papers: II. Flotation and survival tests in warm-water environment; III. Flotation, survival, and habitation tests in cold-water environment; and IV. Survival and habitation tests in cold-land environment. The individual facets of the program included: the design of capsule clothing, donning of clothing in confined space, stowage of emergency survival items, air exchange requirements, flotation, inhabitation, and communication studies. As long as the capsule occupant can conduct physical exercise when discomfort is detected, keep the seat cushions from becoming saturated with salt water, and use the survival equipment normally and reasonably, he can survive for 72 hours after landing in cold or warm water. Findings also indicated that a human subject can use the capsule as a basic survival item for 72 hours in a cold-land environment. (Authors' abstract)

12365
Milan, F. A. 1961
AN EVALUATION OF WINTER SURVIVAL SHELTERS USED BY THE U. S. AIR FORCE IN ALASKA. —Arctic Aeromedical Lab., Fort Wainwright, Alaska, Technical Report no. 60-8, Jan. 1961. ii+31 p.

The thermal environments of six winter survival shelters with wood-burning fires were investigated at Ladd AFB, Alaska, in the winter months of 1954. Ambient temperatures ranged between 0° and -41 F. The survival shelters included a one- and six-man lean-to, two types of paratepees, a willow shelter, and a moss-covered shelter. A glass-cloth fireplace utilized in the tests proved to be a lightweight and portable substitute for a Yukon stove and allowed a fire to be kindled in an enclosed shelter. The willow shelter, paratepees, and moss covered house provided adequate and similar thermal environments. The lean-tos were inadequate and it is recommended that teaching of their construction be discontinued in the Arctic Survival School. It is further recommended that consideration be given by the Arctic Survival School to the construction of moss covered shelters, as moss mats are abundant in the arctic taiga. (Author's abstract)

12366
Milan, F. A. 1960
SWEDISH LAPPLAND: A BRIEF DESCRIPTION OF THE DWELLINGS AND WINTER-LIVING TECHNIQUES OF THE SWEDISH MOUNTAIN LAPPS.— Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 60-7, Oct. 1960. 16 p.

Extensive literature has been collected concerning the folkways, physical anthropology, and language of the Lapps. This literature dates from the Germania of the Greek historian Tacitus, and includes references to the Lapps in the 13th Century Icelandic Sagas, works by Linnaeus (Karl von Linne), and the autobiographies: Muittalis samid birra, by Johan Turi, and En Nomad och Hans Liv, by Anta Pirak. From the foregoing description, it can be seen that some of the Lapps, especially the nomadic ones, are a meat-eating people, living an arduous life in the cold. In contrast to the Eskimos, who live under similar conditions, little is know about the physiology of the Lapps. This knowledge could be obtained through physiological field investigations. Both the Lapps and the Eskimos have adjusted culturally to their environment. Possibly the former have adjusted their physiology as well. (Author's abstract)

12367
SURVIVAL IN SPACE. — Interavia (Geneva), 16 (12): 1651-1653. Dec. 1961. In English.

In a space vehicle, the following problems are met with which do not arise with either a jet aircraft or a submarine: (1) the absence of any medium which can be used for propulsion or in the life support system cycle; (2) new environmental influences, e.g., cosmic radiation, reduced magnetic fields, meteoritic storms; (3) re-entry into the Earth's atmosphere; and (4) weightlessness. Despite extreme stresses, such as high accelerations, noise, vibration, heat, reduced external pressures, and emotional stress, astronauts can undertake an impressive work program of making decisions, carrying out observations, and executing repairs. Included are a tabulation of the present state of knowledge in the life sciences, a picture of the Mercury capsule, and a record of astronaut Shepard's pulse and respiration rate during Mercury flight.

12368
Torrance, P. E. 1958
SENSITIZATION VERSUS ADAPTATION IN PREPARATION FOR EMERGENCIES: PRIOR EXPERIENCE WITH AN EMERGENCY RATION AND ITS ACCEPTABILITY IN A SIMULATED SURVIVAL SITUATION. — Jour. Applied Psychol., 42 (1): 63-67. Feb. 1958.

The issue of sensitization versus adaptation in preparation for emergencies was studied in a specific field situation. Four hundred and sixteen aircrewmen undergoing a realistically simulated survival experience were issued eight meat bars (pemmican) as a part of their emergency ration for the seven-day exercise. Ratings for five methods of preparation, number of bars consumed, reports of having been "made sick", and attitude toward future use were used as criteria of the subjects' acceptance of the ration. Subjects with previous experience with the ration, regardless whether they had liked it or disliked it, responded more favorably to it on all four criteria than those who had never tried it. These results are interpreted in support of realistically simulated training as preparation for adaptation in emergencies. (Author's summary, modified)

12369
Vaughan, D. A., 1959
J. P. Hannon, and L. N. Vaughan
ARCTIC SURVIVAL RATIONS. IV. ASSOCIATED EFFECTS OF DIET, ENVIRONMENTAL TEMPERATURE, AND DURATION OF EXPOSURE ON THE MAJOR CONSTITUENTS OF THE LIVERS OF RATS. —Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 59-5, Sept. 1959. 13 p.

The effects of feeding pemmican, and of exposure to an environment of 5° C. for periods of 1 month or 5 months, on the percentages of glycogen, total fat, phospholipid, protein, and water in the livers of rats were studied concomitantly. Cold exposure had the following significant effects: (1) a reduction in percentage of glycogen of both dietary groups, (2) a reduction in percentage of total fat of the pemmican group, (3) an increase in phospholipid (percentage of total fat) of both dietary groups, (4) an increase in percentage of water of both dietary groups. The ingestion of pemmican had the following significant effects: (a) a reduction in percentage of glycogen, (b) an increase in percentage of total fat, (c) an increase in phospholipid (percentage of total fat) at 27° C., (d)

a decrease in percentage of water. A statistical analysis revealed that the effects of cold exposure and diet were to a certain extent interdependent, and that the duration of exposure modified the effects of both of these experimental treatments in several cases. (Authors' abstract)

12370
Vaughan, D. A., 1959
H. F. Drury, J. P. Hannon, L. N. Vaughan, and A. M. Larson
ARCTIC SURVIVAL RATIONS. VI. THE PHYSIOLOGICAL EFFECTS OF RESTRICTED DIETS DURING SUCCESSIVE WINTER FIELD TRIALS.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-8, Aug. 1959. 24 p.

Two out of three different 1000-calorie combinations of pemmican and sugar were fed to each of 12 subjects during a two-phase, winter field study. The diets tested consisted primarily of pemmican, with the sugar contribution ranging from 0 to not more than 32% of the calories. The 5-day experimental phases were separated by a 7-day "recovery period". In both periods, on all diets, performance was considered adequate for survival situations involving moderate activity. The isocaloric substitution of pemmican with 40 g. of sugar raised the fasting blood sugar levels, decreased the nitrogen balance, and, in some cases, reduced ketonuria. However, a further increase in the proportion of sugar in the ration of 80 g. had no additional effect. In the second period, the magnitude of all the above responses was strikingly reduced. In most cases, the degree of reduction did not appear to be related to differences in the composition of the Period I diets. The fasting blood sugars during the second period, however, did bear an inverse and highly significant relationship to the levels of carbohydrate intake during the first period. Thus, the data suggest that the adaptation to caloric restriction which developed during the first period, persisted throughout the recovery period, permitting the subjects to respond more favorably to the second dietary stress. (Authors' abstract)

12371
Vaughan, D. A., 1959
H. F. Drury, J. P. Hannon, L. N. Vaughan, and M. A. Larson
SOME BIOCHEMICAL EFFECTS OF RESTRICTED DIETS DURING SUCCESSIVE FIELD TRIALS IN WINTER.—Jour. Nutrition, 67 (1): 99-108. Jan. 10. 1959.

The adequacy of pemmican as an emergency ration for short-term survival was confirmed in 12 men exposed to environmental temperatures ranging from -10° to -48° F. and from +10° to -10° F. The isocaloric substitution of pemmican with sugar in amounts over 40 grams was found to have little, if any, effect on fasting blood sugar, nitrogen balance, and ketonuria. Evidence is presented that caloric restriction per se and the composition of diet during caloric restriction have effects which last well beyond the end of the period of the dietary stress. Even after an interval of a week of ad libitum dietary intake, these effects may modify responses to a second stress period, manifesting themselves in higher fasting blood sugars, lower nitrogen excretion and a decreased production of ketone bodies. (Authors' summary, modified)

e. Accidents and Accident Prevention

12372
Air Dept. (Wellington, New Zealand) 1961
SUMMARY OF ACCIDENTS: AERIAL WORK, 1 JANUARY 1960 - 30 JUNE 1960. —Air Department. Accidents Investigation Branch, Wellington, New Zealand. Report no. 13, [1961]. [24] p.

Details are summarized of nineteen accidents which occurred in New Zealand in aerial work operations in the first six months of 1960. Two of the accidents reviewed caused the deaths of the pilots concerned. One accident resulted from structural failure in the air and was beyond the ability of the pilot to avoid; the other resulted from exhaustion of fuel in flight. Pilot pre-occupation with the job at hand is a factor in this type of accident. Mention is made of safety precautions in the prevention of accidents.

12373
Alexander, J. D. 1958
PILOT ERROR 48%?—Canad. Air Line Pilot, 14 (4): 26-33. Oct. 1958.

It is asserted that, regardless of country in which investigations were carried out or methods of accident investigation, 48% is the lowest statistical figure attributed to pilot error. Some contributory factors are cited, which include the following: neuropsychiatric disorders, emotional instability, fatigue, psychosis, digestive disorders, kidney stones, diabetes, and disorientation. The employment of trial-and-error practices instead of direct learning, as well as interference with established habit patterns account for a number of accidents. The physiological effects of heat, cold, and other stresses are also mentioned among causative factors. The importance of rest, of a good diet, and of exercise is discussed, and the adverse effects of tobacco and alcohol are stressed.

12374
ALPA'S STATEMENT ON AIR SAFETY BEFORE SENATE AVIATION SUBCOMMITTEE. — Air Line Pilot, 30 (2): 4-11, 20. Feb./March 1961.

The Air Line Pilots Association, International (ALPA) points out problems in air traffic control, training requirements, navigational aids, air terminal facilities, and airports. A statistical breakdown of the air safety record of 1960 is presented, including causes of fatal and non-fatal accidents. Some of the common causes of crashes are collisions, poor conditions of runways, lack of landing aids, bird collisions, and faulty training of pilots. The results of the Association's airport survey of 257 of the nation's 569 airports certified by the Civil Aeronautics Board reveals that many of the airports are inadequate in many types of facilities. The Association urges that improvement of various safety measures be legislated by the Congress.

12375
Amato, A., 1961
and M. Albanese Ginammi
[PATHOGENETIC CONSIDERATIONS ON THE LESIONS SUSTAINED IN A PECULIAR FLIGHT INCIDENT] Considerazioni patogenetiche sulle lesioni riscontrate in un singolare incidente di volo. — Rivista di medicina aeronautica e spaziale (Roma), 24 (3): 353-360. July-Sept. 1961. In Italian, with English summary (p. 360).

Several minutes prior to landing and at an altitude of 2000 meters an aircraft unexpectedly dropped 300 meters but returned on course and landed without damage. Upon arrival 25 passengers presented various lesions (cervico-dorsal contusions, fractures of cervical and costal vertebrae and nasal bone). These lesions were possibly due to (1) the passengers' delay in observing the order to fasten their seat belts which led to a certain degree of jarring within the aircraft; (2) the natural descent of the aircraft hastened by an air-pocket causing a degree of deceleration; or to (3) the rapid recovery of altitude after the drop.

12376
Bergeret, P., and R. Marchesseau 1959
[FLIGHT SAFETY AND AIRCRAFT ACCIDENTS OF UNDETERMINED ORIGIN IN THE FRENCH AIR FORCE] Sécurité en vol et accidents aériens d'origine indéterminée dans l'Armée de l'Air française.—In: Medical aspects of flight safety, p. 135-148. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

Thirty-nine accidents of unknown causes are reported which occurred in the French Air Force between 1948 and 1956. While the types of aircraft, pilots' ages, flying experience, and flying conditions (including maximum altitude and flight duration) are listed synoptically, the statistical compilation does not provide a definite picture of the underlying cause of unexplained accidents. A great incidence of loss of control in flight was found upon making a detailed study of the circumstances surrounding each flight, the physical and psychological characteristics of the pilots involved, as well as by investigating non-fatal accidents and incidents. Loss of control appears at times to be due to physical indisposition but mostly to anomalous behavior aggravated by lack of practical and theoretical experience. It is recommended that: (1) initial psychotechnical selection procedures (psychomotor test batteries) be increased during instruction and training in the squadrons to include psychophysiological observation of the pilot in the various flight simulators by the flight surgeon; (2) special psychological indoctrination be given to flying instructors; and (3) more detailed psychophysiological indoctrination be given to flying personnel than is the case at present.

12377
Berry, F. B., and V. A. Stembridge 1958
THE HUMAN ELEMENT IN AIRCRAFT ACCIDENTS. —Annals Surg., 147 (5): 590-593; discussion, p. 594-595. May 1958.

Human failure leading to aircraft accidents may be ascribed to the following basic factors: (1) environmental factors, (2) traumatic factors, and (3) preexisting diseases. The drastic changes in pressure and air-oxygen content at high altitudes, the wide variations in temperature, and the forces exerted on the individual during high-speed maneuvers are among the most influential environmental factors. Their impact on the human operator is in proportion with his tolerance levels. Thus, vestibular tolerance may be exceeded resulting in vertigo or spatial disorientation, or, at very high speeds, visual perception limits may be exceeded. As to traumatic factors, death may often be the cause of an accident rather than its result; and there is an urgent need to gather information on the causes of death, so that adequate evaluation may be made regarding aircraft design and protective equipment. In a number of incidents preexisting diseases may have induced sudden incapacitation or death; among them, heart attack is the most frequently occurring. Colloidal cysts, astrocytoma, sickle cell anemia with splenic infarction, and fat emboli have also been reported to cause incapacitation or death. Careful observation and examination of pilots from physical, psychologic, and physiologic standpoints must be a constant requirement.

12378
Brown, H. N. 1961
PRIVATE FLIGHT SAFETY. —In: Accident prevention: the role of physicians and public health workers, p. 249-277. Ed. by M. N. Halsey. New York: McGraw-Hill Book Company, 1961.

Nearly 64.5% of aircraft in use are general aviation, i.e. non-airline civil aviation. The rate of private aviation accidents resulting in either injury or death is much too high. Most collisions occur in conditions of good visibility and are due to inattentiveness. The greatest problem for private aviation safety is posed by instrument conditions without instrument training. Since the private pilot's training usually does not acquaint him to any extent with visual problems posed by lack of clues for adequate depth perception and by deceptive perception from the proprioceptive and vestibular senses, he is liable to enter clouds inadvertently, panic, and dive in a "graveyard spiral". There also is insufficient indoctrination on the dangers of hypoxia as it affects vision, mental processes, and judgment. Smoking, fatigue, carbon monoxide poisoning from exhaust leak, and flying at altitudes above 10,000 feet increase the degree of hypoxia. Promoting safety in general aviation is seen as a duty of the physician in screening and advising pilots at the time of the physical examination.

12379
Christy, R. L. 1959
NAVAL AVIATION MEDICINE VIEWPOINT ON THE FLIGHT SAFETY PROBLEM.—In: Medical aspects of flight safety, p. 32-40. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Safety is emphasized on all levels throughout the Navy with particular emphasis through the Aviation Safety Division in the Chief of Naval Operations, the U. S. Naval Aviation Safety Center, and the Aviation Safety officers who are assigned to operational commands and individual squadrons. Safety information and crash investigation data are used in aircraft and aircraft component design and development to improve safety with minimum limitation on operation performance aircraft. Fifty to sixty-five percent of aircraft accidents are attributed to pilot-error. A study of this factor led to the institution of preventive measures. The University of Southern California established a Naval Aviation Safety Officer Course including 264 hours of lessons. In 1955, 125 officers graduated from the course. The Navy's accident rate was 5.5 for 10,000 flying hours in 1953, 4.42 in 1954, and 3.56 in 1955. A critical analysis is presented of the reports from 177 emergency ejections occurring between August 9, 1949-January 1, 1956. Out of 136 ejections below a speed of 400 knots, 90% of the pilots survived, with 15% having severe injuries. Representative statistical figures of Navy ejections are included. Improvement on design of ejection seats are

recommended to reduce fatalities at high speed and at low altitudes, where most ejection accidents appear to occur.

12380
Cicala, A., 1961
and C. Sciarelli
[CONTRIBUTION TO THE STUDY OF VERTEBRAL FRACTURES IN FLIGHT ACCIDENTS] Contributo allo studio delle fratture vertebrali negli incidenti di volo.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 312-328. Roma, 1961. In Italian.

Eighteen cases of vertebral fracture following aircraft accidents without fatal consequences are reviewed. The type of fracture sustained during the following five characteristic types of aircraft accidents is discussed: crash, collision, violent landing or takeoff (distinguished as to bouncing and landing or water belly landing), capsizing, and yaw. A table is presented showing the type of accident, type of aircraft flown, and the type of fracture, along with schematic and radiographic figures illustrating the type of fracture sustained. It is concluded that the spine is frequently damaged in survivors of aircraft accidents, especially the dorsolumbar area. A general relationship exists between spinal fracture and the type of accident. A graph is included which indicates that the maximum incidence of fractures occur in the 12th thoracic vertebrae and in the first two lumbar vertebrae.

12381
Davis, D. R. 1958
HUMAN ERRORS AND TRANSPORT ACCIDENTS.—Ergonomics (London), 2 (1): 24-33. Nov. 1958.

The role of three psychological processes—"false hypothesis," "preoccupation" and "emergency mechanisms"—in causing airplane crashes is discussed. Two actual crashes, the Avro accident in the Solent (Aug. 6, 1955) and the Viscount accident at Blackbushe (Jan. 20, 1956) are thought to be attributable to the fact that the pilot entertained a false hypothesis about the part of equipment on which he was concentrating and failed to notice or misread signals which did not fit this hypothesis. It is concluded that if a signal is to be perceived correctly, its strength, duration, or insistence has to be much greater when it is contrary to expectation. One of the effects of increasing anxiety is to produce a degree of perceptual disorganization, in which the attention is directed at a particular component of the task which has gained special importance at the cost of neglecting other components. This preoccupation is held to be responsible for the Argonaut accident near Idris Airport (Sept. 21, 1955). When confronted with imminent danger, certain emergency mechanisms come into play, eliciting more forceful, more extensive, and more rapid responses to less intense and less specific stimuli. At the same time, such responses tend to be less regular, less organized, and less coordinated. In an airplane emergency situation, these processes would impair the efficiency in the cockpit, intensify the sensation of danger, and, finally, induce a vicious circle. An Italian Airline accident near Idlewild Airport (Dec. 18, 1954) is discussed in detail as resulting from such type of behavior.

12382
Dominguez, A. M., 1960
J. R. Halstead, H. I. Chinn, L. R. Goldbaum, and F. W. Lovell
SIGNIFICANCE OF ELEVATED LACTIC ACID IN THE POSTMORTEM BRAIN.—Aerospace Med., 31 (11): 897-900. Nov. 1960.

The post-mortem chemical changes observed in aircraft fatalities must be interpreted cautiously. Hypoxia is only one of many possible factors which might cause changes in the levels of blood glucose. The blood sugar response of individuals exposed to a given stress or nutritional regimen is known to vary widely. Both physical and psychological stresses encountered during flight may cause hyperglycemia as profound as that caused by hypoxia. The time required for descent prior to crash would cause variable changes in the blood and brain chemistry. The time and nature of the last meal are known to modify blood sugar concentrations. The lactic acid content of one part of the brain differs from that of another, so care must be exercised in sampling. Thus, the diagnosis of hypoxia during flight should not be based upon an arbitrary level of lactic acid, per se, in post-mortem tissue as the sole criterion, but should be correlated with the history and circumstances of the accident. (Authors' summary, modified)

12383
Evrard, E. 1959
[BLINKING AS A POSSIBLE CAUSE OF AIRCRAFT ACCIDENTS] Le clignement des yeux, cause possible d'accidents aériens.—In: Medical aspects of flight safety, p. 65-72. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

In order to verify the validity of some objective data on blinking during execution of sensorimotor tasks similar to flying, 50 pilot candidates took the coordination test for the M.S.A. cockpit (used in the Royal Air Force). Sixty-four percent of all subjects did not blink for the first 15 seconds, 42% did not blink during the first 30 seconds, etc. The Bourdon-Wiersma test (stipple test) administered to 449 candidates also showed that after being very low during the first two minutes, blinking frequency increased as the test was carried on and that individuals with the greatest fluctuation of attention showed maximum blinking frequency. The plateau which followed was characterized by a blinking frequency smaller than that of normal conditions not involving great attention. Extrinsic factors, such as conditions of the cornea, conjunctiva, etc., can affect blinking frequency in the absence of special psychological influences. It is assumed that in flight, blinking seldom takes place during critical phases (as in approach). Anticipation of both types (receptor and perceptual anticipation) compensates sufficiently for the temporary lack of information caused by a blind period. These periods seldom exceed 55 seconds. Although it is not possible to discard blinking entirely as a possible cause of accidents it is a factor found in unusual circumstances, when anticipation is lacking. (Author's summary, modified)

12384
Fabris, L. 1961
[STUDY OF AN ANTI-SHOCK DEVICE IN RELATION TO THE PROBLEM OF PROTECTION IN AIRCRAFT

ACCIDENTS] Studio di un dispositivo anti-urto in relazione al problema della protezione negli incidenti aerei.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 493-505. Roma, 1961. In Italian.

An anti-shock device consisting of three concentric cylinders is described along with its mechanism of action when used as a protective device in aircraft accidents. A picture and diagrams are included. Experimental tests were performed on a crash tower, with the device attached to the base of seats. The device, when attached to seats, appears to protect from direct decelerations resulting in frontal and rear shocks, and from decelerations resulting during forced landings. Additional study and evaluation of the device is needed.

12385
Flickinger, D. [D.] 1959
FUTURE TRENDS IN PROTECTING AIRCREWS.—In: Medical aspects of flight safety, p. 230-238. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Analysis of existing biophysical data indicates that: (1) the present ejection-seat escape system is inadequate for uniformly safe crew escape at speeds in excess of 600 knots; (2) current fighters are in an operational speed range which results in 26% fatalities in all attempted escapes; (3) no escape system has yet been tested above 47,000 ft. altitude; (4) the greatest number of fatalities result from ejections made below 2000 ft. altitude; and (5) multiple and cumbersome protective equipment seriously hinders effective and safe ejections. Solution of these problems may be possible if the aircraft speed is decreased at the time of ejection, and if the deceleration curve of the ejected mass be flattened out by increasing its total weight and density. A review of accident statistics reveals that: (a) human error was responsible for two-thirds of all major Air Force accidents in 1958; (b) the accident rate since 1930 has decreased, however, one of every five major accidents is fatal; (c) jet trainers and fighters account for 68% of major accidents and 66% of minor ones, yeilding a total of 73% of the aircraft destroyed; and (d) landings and take-offs account for 61% of accidents in jets and 66% in non-jets. It appears impossible to determine by means of accident analysis, reconstruction of events, and postmortem studies what the functional steady state of the operator was at the time of the accident, and what the sequence of demands place upon him by the system and environment were. Included are discussions on system design for optimal crew safety and effectiveness and future trends in reducing operator-system malfunction.

12386
Franks, W. R. 1959
THE POST HOC DIAGNOSIS OF LOSS OF USEFUL CONSCIOUSNESS IN THE AIR.—In: Medical aspects of flight safety, p. 184-194, 1 unpaged leaf. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Where loss of useful consciousness while flying does not prove fatal, a rare opportunity for diagnosis presents itself. Recognizing that medical examination must be post hoc, particular attention should be directed towards those findings which tend to give an integrated result, thus indicating past performance. Such conditions are met by various body secretions. In addition to urine and blood, these include sweat, saliva, lachrymal, nasopharyngeal, bronchogenic, and gastric secretions which can be readily examined and which vary in character according to cause (hypoxia, hyperventilation, hypoglycemia, cold, anxiety, alcoholism, etc.). In cases of post-mortem diagnosis of loss of consciousness, various procedures are mentioned to determine possible causes, including hemoglobin determinations, tissue irrigation, study of cranial fractures, signs of vestibular congestion, vomiting, incontinence, rigor; and the diagnosis of hypoxia by cerebral lactic acid determination.

12387
Fryer, D. I. 1959
PASSENGER SURVIVAL IN AIRCRAFT CRASHES.—Aeronautics (London), 40 (2): 31-37. April 1959.
Essentially the same in: Indian Aviation (Calcutta), 33 (6): 114-117, 123-124. June 1959.

Medical and physiological data concerning factors affecting human survival in aircraft crashes are reviewed and discussed. Recommendations are made for protecting passengers against crash forces in the direction most commonly involved: forward and downward. This includes appropriate aircraft design and positioning of passenger accommodations as near to the rear of the fuselage as is possible, strengthening of floor for attachment of seats and harnesses, and strengthening of seat attachments in the direction of commonest stress (forward). Seats should also resist major accelerations in the downward, lateral, and rearward direction, since aircraft commonly bounce, slew, and cartwheel after initial impact. Harness and additional protective devices should be simple to use, rapidly unfastened or disposed of, and capable of adjustment to fit all ages, shapes, and sizes of passengers. Particular reference is made to the advantages of the backward-facing seat over even the most improved forward-facing seat as a safety device in crashes.

12388
Frykhölm, A., and G. Ström 1958
ON HEART DISEASE AS A POSSIBLE CAUSE OF MILITARY AIRCRAFT ACCIDENTS.—Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 7 (2): 31-33. 1958. In English.

Evidence gained from autopsies has suggested that clinically undetected cases of coronary arteriosclerosis or carditis in flying personnel may contribute to the causes of military aircraft accidents. Due to the lack of data collected on Swedish air personnel up to this time, Swedish pathologists have not been able to confirm autopsy reports by U.S. service pathologists indicating a high incidence of coronary arteriosclerosis among soldiers killed in action during the Korean War. Four case histories are presented which indicate incidence of carditis in three Swedish aviators killed in accidents. Routine medical examinations for air personnel appear justified so that suspected heart cases can be detected and the proper precautions exercised.

12389
Giesecke, A. H., 1960
J. F. Hill, and R. C. Halverson
SPATIAL DISORIENTATION AS A CAUSE OF ACCIDENTS IN ARMY CARGO HELICOPTERS.—Aerospace Med., 31 (3): 200-203. March 1960.

Due to the increased number of training schools for helicopter pilots, there is a greater number of pilots and crew exposed to conditions of spatial disorientation. The mechanisms leading to disorientation are: (1) the inherent instability of the aircraft, (2) pilot fatigue, (3) reliance on extravisual perception, (4) poor instrument location and excessive head movements, and (5) engineering factors, such as shape and distribution of cockpit glass and position of landing lights. Two cases of helicopter accidents are reported in which severe spatial disorientation is believed to have been the major cause.

12390
Glantz, W. M., 1959
V. A. Stembridge, A. M. Dominguez, L. R. Goldbaum, H. E. Christensen, F. W. Lovell, T. L. Gleason, and F. M. Townsend
CARBON MONOXIDE DETERMINATION IN AIRCRAFT ACCIDENT FATALITIES.—Aerospace Med., 30 (10): 711-715. Oct. 1959.

Over a period of two years, investigators at the Armed Forces Institute of Pathology studied 747 cases of aircraft accident fatalities for the presence of carbon monoxide in post-mortem tissues. Of these, three cases are presented. All victims showing carboxyhemoglobin levels over 10% saturation were carefully analyzed, evaluated by autopsy protocols and accident histories, and were shown to have been alive at the time of the fire. Carboxyhemoglobin levels between 6% and 9% saturation indicate the possibility that the subject was alive at the time of exposure to fire. Extensive fragmentation and post-mortem incineration of tissues subsequent to explosive impact forces do not elevate the carboxyhemoglobin saturations. No individual was found in which carbon monoxide intoxication was implicated as the cause of the aircraft accident. (Authors' summary, modified)

12391
Gregg, L. W., 1961
and R. G. Pearson
FACTORIAL STRUCTURE OF IMPACT AND DAMAGE VARIABLES IN LIGHTPLANE ACCIDENTS.—Human Factors, 3 (4): 237-244. Dec. 1961.

A conceptual framework, through which accident variables are defined and certain cause-and-effect relationships are established, is confirmed through application of the technique of factor analysis to a set of lightplane accident data. Relationships between aircraft structural damage and injury to the occupant were seen to increase as a function of proximity. Individual measures of the consequences of impact were found to intercorrelate higher than the implied cause-effect relations from impact to damage. (Authors' abstract)

12392
Hasbrook, A. H. 1959
CRASH INJURY RESEARCH, A MEANS FOR GREATER SAFETY IN ACCIDENTS.—In: Medical aspects of flight safety, p. 241-252, 2 unpaged leaves. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The philosophy and reasons behind crash-injury research are presented. It is shown that some accidents will occasionally occur, despite the most exacting effort toward accident prevention, and that a percentage (perhaps 20% or more) of airline crashes will be of a survivable nature. Actual survival will depend on whether or not crash-survival design was used in the aircraft. The fact is stressed that increased seating capacity of new jet transports will increase the number of persons exposed to death and injury per accident, and that this may increase the fatality rate. Noted also is the need for accurate and exhaustive accident investigations to find the specific causes of injuries, and the need for integration of these data with medical data and other information normally obtained during the course of aircraft-accident investigations. A reconstruction is presented, with diagrams and photographs, of kinematics of a transport crash, and a table listing the degrees of injuries sustained during accidents which is used by Aviation Crash Injury research is included.

12393
Hasbrook, A. H. 1959
GREATER AIR SAFETY THROUGH CRASH INJURY DESIGN.—Aviation Crash Injury Research, Phoenix, Ariz. Report no. Av-CIR-59-0-102, April 1959. 13 p.

(a) Crash safety design is becoming an increasingly important consideration in the design of modern aircraft; (b) many crash safety improvements are incorporated in our current piston and jet aircraft; (c) a major improvement yet to be made is the increase of tie-down strength, compatible with the structural integrity of the fuselage itself; and (d) crash safety design concepts and developments must keep abreast of future space and air transportation needs. (From the author's summary)

12394
Hasbrook, A. H. 1959
HUMAN FACTORS: THE BASIS FOR CRASH SAFETY DESIGN.—Aviation Crash Injury Research, Phoenix, Ariz. (Contract Nonr 2883(00)). Report no. Av-CIR-63-0-108, Sept. 1959. [19] p.

Given optimum support, the human body can survive greater magnitudes of crash force than current aircraft cabin and cockpit structures are capable of "surviving" without collapse or disintegration. The ability of the human body to resist crash force without serious injury is not only dependent on the direction from which the force is applied, but is also related to the area over which the force is distributed, as well as the points of the human frame to which the force is applied. One area of the body very susceptible to injury, regardless of load distribution, is the lower abdomen. Before the human factors engineer can do an effective job of designing for crash safety, answers must be found to questions such as: What is an accident? What is a survivable crash? What is a non-survivable crash? Attempts are being made to answer the questions in terms of severity of damage to aircraft and to persons within the aircraft. Explanations of the terms used to describe the six degrees of survived injury are appended.

12395
Hickey, J. L., 1958
and V. A. Stembridge
OCCURRENCE OF PULMONARY FAT AND TISSUE EMBOLISM IN AIRCRAFT ACCIDENT FATALITIES. —Jour. Aviation Med., 29 (11): 787-793. Nov. 1958.

A comparative study was made of the incidence of fat and tissue embolism in specimens of lung tissue obtained from 50 patients dying of medical disorders, 50 cases of violent death, and 236 victims of aircraft accidents and decompression sickness. Pulmonary fat embolism was observed in one routine autopsy, in 11 cases of violent death other than aircraft fatality, and in 120 aircraft accident victims. Pulmonary bone marrow embolism was demonstrated in 17 aircraft accident cases, cerebral tissue embolism in 3 cases, and hepatic tissue embolism in 2 cases. Bone marrow embolism was found in one other case of violent death. Several aircraft accident cases are described which are representative of pulmonary fat and tissue embolism occurring under circumstances of temporary survival, possible momentary survival, and instant death. The occurrence of pulmonary fat embolism in cases of complete instantaneous disruption of the cardiovascular system suggests agglutination of blood chylomicrons as an etiologic factor in fat embolism.

12396
Howell, W. K. 1961
THE DANGERS OF STRIKING BIRDS. —Air Line Pilot, 30 (2): 13-14, 20, 23. Feb./March 1961.

An incident of collision of a DC-3 aircraft with a flock of geese is reported. Damage to the windshield, fuselage, and one crew member and the subsequent events after impact are described. The windshield construction (glass and plastic) appears to be inadequate for collisions involving large birds at high speeds. One fragment of glass pierced a metal bulkhead in the cabin wall. Heavier glass, an inner-glass of plastic, or a metal grill in front of the windshield are suggested as remedies. The captain of the plane in a supplementary report suggests ten precautions to be taken, including wearing protective eyepieces, protective helmet, and emergency flying instructions.

12397
Jones, G. Melvill 1959
DISORIENTATION DUE TO RAPID ROTATION IN FLIGHT (A CAUSE OF UNEXPLAINED AIRCRAFT ACCIDENT ?).—In Medical aspects of flight safety, p. 92-101. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

An incident is reported in which the pilot became disoriented and lost control of the aircraft during recovery from a very rapid roll. The aircraft was equipped with automatically recording instruments and was flown back to the base normally when control was regained. Several factors were responsible for the difficulty encountered by the pilot in rapid rotation during flight: (1) the rates of change incurred could have been too great for human neuromuscular mechanisms to follow the sequence of events; (2) the effects of the physical violence of the maneuver; and (3) vestibular interference with vision, by causing involuntary response in the extrinsic eye muscles. Further investigation of these factors is needed to prevent the increasing number of incidents which although attributable to disorientation arising from rapid rotation, will be placed in the category of the unexplained accident.

12398
Knowles, W. R. 1959
THE IMPORTANCE OF DESIGNING FOR CRASH SAFETY IN ROTARY WING AIRCRAFT.—Aviation Crash Injury Research, Phoenix, Arizona. Report no. Av-CIR-60-0-103, May 1959. 17 p.

Crash injury findings resulting from the investigation of recent survivable type helicopter accidents are reviewed. Causation factors regarding dangerous and fatal injuries to crew members and passengers are discussed along with recommendations for preventing similar injuries in future survivable accidents. In addition, suggestions for integrating crash safety design criteria into the overall design of new rotary wing aircraft are presented. (Author's abstract)

12399
Kraus, R. N. 1959
DISORIENTATION: AN EVALUATION OF THE ETIOLOGIC FACTORS.—School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 59-90, Aug. 1959. 8 p.
Also published in: Aerospace Med., 30 (9): 664-673. Sept. 1959.

A brief history of the development of instrument flight is presented. The physiologic mechanisms involved in maintaining aerial orientation are reviewed. Each of three subjects flying in F-100F aircraft completed transition from VFR to IFR in an average time of 24, 27, and 26.5 seconds, respectively. No abnormal changes in the attitude of the aircraft or in the flight path took place during the transition. An aircraft flying at 10,000 feet can assume an attitude from which recovery is impossible in as little time as 20 seconds if the pilot does not have a visual reference. The period of time that the pilot deliberates—from the instant when he loses his outside visual reference until he initiates transition to IFR —is the critical factor in disorientation accidents. A jet aircraft can assume an attitude from which recovery is impossible while the pilot is completely unaware that a change in attitude has occured. (Author's summary)

12400
La Marca, L. 1961
[EXAMINATION OF VARIOUS CASES OF AIRCRAFT ACCIDENTS AND DISCUSSION OF THE LESIONS OBSERVED] Esame di vari casi di incidenti aerei e discussione delle lesioni costatate.—In: IInd World-IVth European Aviation and Space Medicine Congress (Rome, 1959), Papers, vol. 2, part 1, p. 350-361. Roma, 1961. In Italian.

Eighteen cases of aircraft accidents are analyzed which occurred between December 1955 and June 1959. The accidents resulted from crash, collision, or violent landing. Tabulations are included for both jet and conventional aircraft of the type and percentage of lesions found (also for one helicopter); classification and percentage of lesions according to the various types of accident; types and percentages of lesions in cases of seat ejection; and types and percentages of accidents according to cause. Analysis of jet aircraft accidents showed that spinal fracture constituted the most severe injury in non-fatal cases and was caused by a movement of hyperflexion of the trunk during ejection or

by vertical forces acting at the time of impact with the ground. The mortality rate in jet plane accidents was higher than in conventional aircraft. For conventional aircraft, severe injuries were chiefly leg fractures; however, spinal fracture was found in a helicopter accident. Mention is made of safety measures with relation to the type of aircraft (ejection seat, parachute).

12401
Lazo, J., 1961
and R. A. Bosee
VISIBILITY FACTORS IN AIRCRAFT COLLISION AVOIDANCE.—Aerospace Med., 32 (7): 634-638. July 1961.

A summary is given of several investigations of the interrelationships among the various parameters involved in the visibility and detectability of airborne vehicles. The investigations were performed with the intent of reducing the frequency of mid-air collisions and near-misses. Emphasis is placed on the distance between aircraft, respective speed, relative approach angles, and the effects of color, brightness, and contrast on aircraft detectability. A continuing laboratory and field study program is described which investigates the applicability of high-visibility fluorescent color to the problem of conspicuity of aircraft and aircraft parts. The effects of such colors on the requirements of formation flight and possible camouflage needs are considered. (Authors' summary, modified)

12402
Lederer, J. 1961
A NEW LOOK AT AIR NAVIGATION AND AIR TRAFFIC CONTROL. — Navigation, 8 (3): 249-252. 1961.

The majority of mid-air collisions might be avoided if the pilots looked, could see, and took evasive action. This is because most collisions occur in VFR (visual flight rules) conditions at slow closing speeds. There are ways to induce the pilot to look, to improve his ability to see despite cockpit limitations. Regulations that affect the collision potential, including evasive maneuvers, should be reconsidered in the light of aircraft capability and human limitations. In addition, the use of monitoring systems should be encouraged to expose departures from good practice that increase the collision hazard. A systems type of approach is highly desirable to reduce the collision potential. There have been excellent piecemeal studies and fine research on vision, lighting, and physiological and psychological limitations, but to my knowledge no broad approach to the problem as a whole, encompassing regulations, the special developments which would provide the pilot with more opportunity to look, to see, to avoid or to evade collisions. (Author's summary)

12403
Lennox-Buchthal, M., 1960
F. Buchthal, and P. Rosenfalck
CORRELATION OF ELECTROENCEPHALOGRAPHIC FINDINGS WITH CRASH RATE OF MILITARY JET PILOTS. — Epilepsia (Amsterdam), 1 (4-5): 366-372. June 1960. In English.

The crash rate among 576 Royal Danish Air Force jet pilots was three times higher in pilots with marked and paroxysmal EEG abnormalities than in those with normal or slightly abnormal EEG's. The correlation was somewhat closer when only those crashes were considered which were attributed to pilot error. Electroencephalograms rendered abnormal only during photic stimulation were as significant as those with marked or paroxysmal abnormalities at rest or during hyperventilation. As a consequence of these findings, an EEG is now taken of all applicants for jet pilot training in the Royal Danish Air Force, and individuals with marked or paroxysmal abnormalities at rest, during hyperventilation, or during photic stimulation are rejected without regard to the clinical findings. There was no correlation between the EEG and the attrition rate, most of which was due to inaptitude for flying. (From the authors' summary)

12404
Lomonaco, T. 1961
[THE HUMAN FACTOR, CAUSE OF FLIGHT ACCIDENTS] Il fattore umano, causa di incidenti di volo. — Rivista di medicina aeronautica e spaziale (Roma), 24 (1): 5-28. Jan.-March 1961. In Italian, with English summary (p. 26-27).

Human factors account for 45% of all flight accidents. Major causes are attributed to (1) psychophysiological unfitness of flying personnel or of ground and traffic-control personnel; (2) the general physiological effects of decompression, high speed, accelerations, vibrations, temperature and humidity changes, etc., encountered during flight; (3) operational fatigue; and (4) deficiencies of aptitude or flight training. The prevention of such accidents is based on (a) the control of flying personnel, both at the time of selection and during active service by periodic check-ups, and (b) the indoctrination of flight personnel on the principles of flight physiology and human limitations. The collaboration of the flight surgeon and the aviation engineer in the design of aircraft and flight equipment may serve to minimize the severity of injuries inflicted during accidents.

12405
Lovell, F. W., 1961
and F. B. Berry
THE MEDICAL PROFESSION IN AIR SAFETY. — Annals Surgery, 153 (5): 625-638. May 1961.

Contributions of pathologists to aircraft accident investigations and accident prevention are discussed, and several accident reconstructions are described. The increasing evidence of coronary disease as revealed by autopsy and electrocardiographic findings in asymptomatic adult men emphasizes the importance of careful periodic medical examinations for pilots.

12406
Lovell, F. W., 1960
H, McMichael, and F. M. Townsend
PATHOLOGY AS AN AID TO RECONSTRUCTION OF AIRCRAFT ACCIDENTS.—Aerospace Med., 31 (9): 745-748. Sept. 1960.

Complete autopsy examination, including photographs, toxicology, and X-ray studies should be performed on all fatalities of aircraft accidents. The person doing the autopsy should make observations which might aid the accident-investigating board in reconstructing the sequence of events. A number of such investigations are presented to il-

lustrate the value of a thorough investigation. The cases deal with level of carbon monoxide in the body, examination of aircraft structure for small fragments of material which might be human, X-ray examination of the body especially for metal objects embedded in the body, reconstruction of overwater accidents, timing of lesions by histologic examination, and determination of the position of crew members at the time of the accident.

12407
MAKING THE AIRCRAFT EASIER TO SEE.—Soc. Exper. Test Pilots Quart. Review, 3 (2): 5-45. Winter 1959.

In this group of short papers, the Air Force flying safety program for better visual detection of aircraft is outlined, and basic items tested to increase conspicuity of aircraft are described, such as lighting devices and various patterns of fluorescent paint.

12408
Martimonov, P. D. 1961
[REACTIONS OF THE AIRPLANE CREW TO A FLIGHT ACCIDENT] Reaktsii ekipaza samoleta na letnoe proisshestvie. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (4): 55-58. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (4): 86-90. Washington, U. S. Joint Pub. Research Serv., no. 9786 (1374-N/41), July 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Fliers who suffered a flight accident without serious bodily injuries may be classified into three groups on the basis of their emotional reactions to the accident: (1) no definite changes in the motor nervous system or sensory processes, a general feeling of well-being, and undisturbed behavior and attitude toward flying; (2) moderate motor and speech excitement, general preservation of judgment of their actions, difficulties in maintaining control over emotional components, and physical symptoms (pupil dilatation, palor, finger tremor, and increased blood pressure, pulse rate, and sweating); and (3) reactive depression coupled with feelings of guilt and anxiety about future flying. The prognosis is the poorest for the third group. Medical examination and follow-up should be directed at uncovering vasomotor disturbances, coronary spasm, gastrointestinal disorders, or a negative attitude toward flight duty. Biological emergency reactions coupled with guilt and inadequacy feelings against a backgound of autonomic nervous system weakness are considered to be the origin of functional nervous system disorders developing after accidents.

12409
Mason, J. K. 1959
THE UNEXPLAINED AIRCRAFT ACCIDENT: SOME PROBLEMS IN POST-MORTEM DIAGNOSIS.—In: Medical aspects of flight safety, p. 174-183, 4 unpaged leaves. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The pathologist plays an important role in the investigation of aircraft accidents by demonstrating the large number of pathological conditions at autopsy examinations which might arise in a pilot in flight and precipitate an aircraft accident. Cases and discussion are presented of the post-mortem diagnosis in young adults of coronary disease, perforation of peptic ulcer, and decompression sickness induced pulmonary fat emboli. These conditions may have been responsible for the aircraft accidents involved. It is stressed that caution is necessary before ascribing an unexplained accident to human pathology.

12410
Mishurin, V. M. 1961
[PSYCHOLOGICAL STUDY OF ERRORS MADE BY FLIERS AND THE FLIGHT MEDICAL EXPERT EVALUATION] Psikhologicheskoe izuchenie oshibok letchikov i vrachebno-letnaia ekspertiza. —— Voenno-meditsinskii zhurnal (Moskva), 1961 (7): 60-63. 1961. In Russian.
English translation in: Military Medical Journal, 1961 (7): 98-103. Washington: U. S. Joint Pub. Research Serv., no. 10316 (1374-N), Oct. 4, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Expert evaluation of pilots referred for gross errors during flight has frequently uncovered an underlying pathological condition which is expressed in neurotic disturbances, and autonomic nervous system, cardiovascular, or vestibular disorders. In flight these contribute to rapid deterioration of the subjective well-being resulting in a reduction of efficiency and adequacy of performance, memory lapses, fatigue, lack of self-confidence, anxiety and tension, rigidity, and delayed or premature motor reactions, or in some cases a complete blocking of action. In addition to medical history, a study of the flier's past performance in flight training and flight work, as well as his personality has been found helpful for making decisions in an individual case. Several such cases are described.

12411
Montagard, F., and R. Papet 1959
[LUMBAR INCIDENTS CONCERNING THE EJECTION SEAT AND TRAINING RAMP (CONSIDERATIONS ON THE SYSTEMATIC RADIOGRAPHY OF THE VERTEBRAL COLUMN)] Incidents lombaires du siège éjectable et de la rampe d'entraînement (réflexions à propos de la radiographie systématique de la colonne vertébrale).—Médecine aéronautique (Paris), 14 (4): 377-383. 1959. In French, with English summary (p. 382).

The history and radiologic implications of three cases of lumbar injury are discussed, two of them encountered in jet pilots after ejection from airplanes.

12412
Moseley, H. G. 1961
AIRCRAFT ACCIDENTS AND FLIGHT SAFETY.—In: Human factors in jet and space travel, p. 214-236. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

It is probable that one of the most significant deterrents to future progress in jet and space flight will be losses through accidents. Such accidents will be disastrous as far as loss of life is concerned, because increasing velocities will provoke increasing destruction when mishaps occur. Human factors have been and will probably continue to be the primary cause of most accidents. There are four different ways in which an aircraft operator may commit or become responsible for an act or omission leading to an aircraft accident: (1) He may be physically unable to meet the demands of operating the vehicle in a particular situation. (2) He may be the victim of physiolog-

ical compromise. (3) He may be unable to make an appropriate adaptive response requiring intellectual application. (4) The demands of the flight may exceed the fundamental limitations of his capacity to respond to stimuli encountered. The successful prevention of operator-factor accidents in future jet and space travel will depend directly upon how well accident-causing factors are understood and eliminated.

12413
Moseley, H. G., 1958
F. M. Townsend, and V. A. Stembridge
PREVENTION OF DEATH AND INJURY IN AIRCRAFT ACCIDENTS.—A.M.A. Arch. Indus. Health, 17 (2): 111-117. Feb. 1958.

A review of the major aircraft accident reports for the years 1953 and 1955 accumulated by the Directorate of Flight Safety Research, United States Air Force, was accomplished with particular reference to the occupant and his injuries, the cause of the injuries, and the role of protective equipment. A total of 8,416 occupants were involved in major aircraft accidents, of whom 18.7% (1,572) sustained lethal injuries, 5.2% (439) sustained major non-fatal injuries, and 76.1% (6,405) minor or no injuries. The forces of deceleration were predominantly responsible for the injuries, and in accidents classified as survivable and in certain high-impact accidents death was ordinarily due to localized trauma, especially head injury, while the commonest forms of major nonlethal injuries were vertebral fractures, head trauma, and injuries to the extremities. In accidents with impact forces exceeding the design limits of the aircraft, death was most frequently due to generalized trauma. Other causes of injuries included burns and hurled or intruding objects. The burns were usually localized and often could have been prevented by more rapid rescue, while many injuries from hurled or intruding objects could have been prevented by a seat which affords more head protection in the form of a seat back with greater height. Evaluation of various items of protective equipment suggests that adequately stressed rearward-facing seats have a greater protective role than forward-facing seats in the prevention of death and injury. Head injuries and vertebral fractures were less frequently encountered when the protective equipment functioned properly than when it failed. (Authors' summary)

12414
Moseley, H. G., 1958
and A. F. Zeller
RELATION OF INJURY TO FORCES AND DIRECTION OF DECELERATION IN AIRCRAFT ACCIDENTS.—Jour. Aviation Med., 29 (10): 739-749. Oct. 1958.

A review was made of all major cargo and transport type aircraft accidents in the U. S. Air Force during a two-year period to determine the path followed after initial impact in relation to variations of aircraft attitude. Of 118 accidents involving impact forces compatible with the survival of at least some occupants, most involved a straight deceleration course, with only minor lateral deviation of the aircraft. Severe deviation was often associated with attempts to continue flight after impact. Large angles of pitch at impact resulted in substantial damage to the forward section, or disintegration of the aircraft. When impact occurred at minor angles, the aircraft established a constant course level with the terrain. Significant roll occurred only when the wings were torn off during impact. The most frequent directional deviation was yaw, resulting most frequently from skids. In most cases, major yaw deviation occurred close to the end of deceleration, subsequent to the major impact and resulting injury. Of 1740 occupants, 105 were fatally injured, 104 received major non-fatal injuries, and 1531 received minor or no injuries. Injuries usually occurred at the time of greatest impact, when significant deviation from normal flight attitude was unusual. The most frequent factor producing injury was dislodgement of the occupant due to failure of the seat or its moorings. Other factors frequently associated with injury were crushing of the airframe, fire, and failing and resultant impact of the head and extremities. It is concluded that structural strength, seat facing, and object tiedowns should be designed to provide maximum protection against fore-to-aft deceleration, with some consideration for relatively small yaw deviation.

12415
Neely, S. E., 1958
and R. H. Shannon
VERTEBRAL FRACTURES IN SURVIVORS OF MILITARY AIRCRAFT ACCIDENTS.—Jour. Aviation Med., 29 (10): 750-753. Oct. 1958.

A review of aircraft accidents which occurred in the U. S. Air Force in 1955-1956 revealed that 533 occupants (7%) received major non-fatal injuries. Vertebral fractures were the most frequent type of major non-fatal injury, occurring in 29% of all cases, and in 44% of jet aircraft cases. Back injuries were received by 127 occupants in non-disintegrating ground impact accidents, 22 during ejection, and 8 during conventional bailout. Vertebral fractures were the cause of death in only 6 cases, each in association with transection of the cervical cord. Trauma to the spinal cord with survival was reported in 6 instances. The majority of fractures were located at the dorso-lumbar junction, and one-third were qualified as minimal injuries. The duration of hospitalization ranged from one week to 18 months, with an average of 2 months. The most frequent mechanism producing vertebral fractures was a vertical force applied from below, followed by a horizontal force applied from the front. No significant relationship was found between the occurrence of injury and the type of seat or seat cushion used. In tandem seat jet aircraft, all fatalities occurred in the front seat, and 80% of uninjured occupants were in the rear seat. It is concluded that the incidence of vertebral fractures in aircraft accidents could be reduced by improvement of upper torso restraint, improved seat design, parachute support, shock absorption, and better seat retention.

12416
Nikitin, I. M. 1961
[WORK IN THE PHYSIOLOGICAL ANALYSIS OF CERTAIN REASONS FOR FLIGHT ACCIDENTS] Opyt fiziologicheskogo analiza nekotorykh predposylok k letnym proisshestviiam. —Voenno-meditsinskii zhurnal (Moskva), 1961 (4): 58-62. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (4): 91-97. Washington, U. S. Joint Pub. Research Serv., no. 9786 (1374-N/41), July 27, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce)

Procedures in approach to land and landing operations are described to elucidate the formation of a dynamic activity stereotype. Case histories are

cited which show that interference at any point in the chain of operations may disrupt the movement stereotype and cause an accident. In one case extraneous stimuli suggestive of danger caused omission of a routine motor response. In three other cases the pilots performed operations opposite to what they intended to do. Reasons for such behavior may be found in the Pavlovian concepts of phasic inhibition and negativism as active processes occurring in the cerebrocortical areas in the wake of prior strong excitation. In these cases the excitation was provided by unsuccessful bombing, appearance of smoke in the cockpit, and realization that the plane was about to land on the wrong airport.

12417
Nuttall, J. B., and W. G. Sanford 1959
SPATIAL DISORIENTATION IN OPERATIONAL FLIGHT.—In: Medical aspects of flight safety, p. 73-91. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

A total of 685 pilots were surveyed by the questionnaire method to obtain information regarding the incidence and significance of pilot's vertigo in operational units. A series of labyrinthine sensitivity tests were conducted on vertigo-susceptible pilots, vertigo non-susceptible pilots, and non-pilot controls. A review of United States Air Forces in Europe Command major aircraft accidents from 1954 to 1956 was made to determine the relative importance of pilot's vertigo as a primary causative factor in aircraft accidents. This study indicates that spatial disorientation of varying degrees is universally experienced by pilots. Spatial disorientation and related factors constitute a significant flight-safety problem area in operational units. It is a complex problem area involving many diverse factors such as physiological status of the pilot, flying techniques, flight tactics, training and proficiency requirements, cockpit layout, and flight instrument design which collectively overshadow in importance the central core of pilot vertigo per se. Further studies are needed to evaluate the role played by all involved factors contributing to spatial disorientation as a significant flight-safety problem in operational flying. (Authors' summary, modified)

12418
O'Bryan, T. C., and H. G. Hatch 1959
LIMITED INVESTIGATION OF CRUSHABLE STRUCTURES FOR ACCELERATION PROTECTION OF OCCUPANTS OF VEHICLES AT LOW IMPACT SPEEDS.—National Aeronautics and Space Administration, Langley Research Center, Langley Field, Va. NASA Technical Note no. D-158, Oct. 1959. 24 p.

A limited investigation was made to determine the characteristics of three materials to see how they can be applied for human protection against accelerations encountered at low impact speeds. As a result, if given man's physiological tolerance to abrupt acceleration, which has not yet been well defined, an alleviation system can be designed. Foamed plastics require considerable depth to provide a given stopping distance for impact alleviation and their use would require some control of rebound. They can be made soft enough to obtain the low onset of acceleration that may be necessary for man where depth is not limited. Aluminum honeycomb is an efficient material for impact load alleviation from the standpoint of usable material depth and it exhibits very little rebound. The stiffness of the material results in a very high initial onset rate of acceleration. For many installations this may be controlled by reducing the initial loading area of contact to get the material to start failing. (Authors' summary)

12419
Onesti, R. 1958
[RELATIONSHIPS BETWEEN TECHNICAL AND PSYCHOLOGICAL PREVENTION IN FLIGHT ACCIDENTS] Rapporti tra prevenzione tecnica e prevenzione psicologica negli incidenti di volo.—Rivista di medicina aeronautica (Roma), 21 (2): 264-270. April-June 1958. In Italian, with English summary (p. 269).

An investigation was made of flight accidents which occurred during a five-year period, covering pilot training schools, air force units, air force instructor training centers, and flight refresher course centers. It was determined that 3% resulted from physiopathological causes; 25% from technical causes; 7% caused by weather; 53% attributable to psychological factors; 6% to accidental causes; and 6% remained unsolved. During the last two years of the period studied, accidents resulting from psychological causes decreased because of improved medical facilities and more extended periods of leave and rest for military personnel. Upon closer analysis, the following seven factors emerged as most significant in the occurrence of accidents due to psychological causes: (1) negligence; (2) imprudence; (3) lack of discipline; (4) distraction or forgetfulness; (5) insufficient self-control; (6) inability to make a decision; and (7) error of judgment. An attempt to determine the most common errors committed during the various phases of flight (taxiing, take-off, flight, and landing) and to examine means of technical and psychological prevention revealed that, while some errors were purely psychological in nature, others were due to inadequacy of mechanical devices. As a matter of fact, 21% of the accidents probably could have been avoided if better mechanical devices would have been installed in the craft.

12420
Pearson, R. G. 1961
IMPACT-INJURY RELATIONSHIPS IN LIGHT-PLANE ACCIDENTS, 1942-1952.—Arch. Environmental Health, 3 (5): 514-518. Nov. 1961.

The relationship between primary impact variables and injuries sustained by 248 front-seated occupants of light planes involved in spin-stall crashes or in ground collisions are evaluated. Seat tie-down and seat-belt restraint were considered to be effective for this sample, and structural collapse was generally not extensive, yet approximately 1 of every 4 occupants was killed. As one would expect, mean degree of injury and fatality rate were directly related to impact velocity and to angle of impact but inversely related to stopping distance. Incidence of injury to all areas of the body, except the lower torso and thoracic-lumbar spine, followed the same trends. Lumbar and thoracic spine injuries occurred more frequently in low-angle, long deceleration crashes. It was concluded that crucial injuries — those to the skull and its contents, the cervical spine, and the upper torso — largely stem from flailing of the body against

injury-producing structures within the occupant's environment. Belt restraint is seen to play only a moderate role in reducing injury severity; thus the need for shoulder-harness installations and incorporation of energy-absorption principles in cockpit design is emphasized. (From the author's summary and conclusions)

12421
Pletcher, K. E. 1961
HUMAN FACTORS IN AEROSPACE PATHOLOGY.—Aerospace Med., 32 (1): 6-11. Jan. 1961.

Thyroiditis, onset of latent malaria, and sickle cell disease are relatively rare conditions which have been implicated in aircraft incidents. The more commonly occurring conditions include the sudden severe incapacitation of myocardial infarction or coronary insufficiency, cerebrovascular accidents, and incapacitation from inhalation of noxious fumes. There is a need for more information on the effects of stress, excessive smoking, various drugs, larval idiopathic epilepsy, dysbarism, fatigue, hypoxia, disorientation, vertigo, and human judgment.

12422
Senegas, R., and G. Cantoni 1959
[CONTRIBUTION TO THE STUDY OF ACCIDENTS OF UNDETERMINED ORIGIN DEMONSTRATING THE IMPORTANCE OF THE "PILOT-AIRCRAFT" COMPLEX] Contribution à l'étude des accidents d'origine indéterminée mettant en valeur l'importance du complexe "pilote-avion".—In: Medical aspects of flight safety, p. 149-154. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959. In French.

Ten aircraft accidents of undetermined origin which occurred in the French Air Force between 1954 and 1956 are reviewed. All accidents involved single-seater jet aircraft and were characterized by loss of control of the aircraft during which time the pilot did not eject or ejected himself too late. The importance is noted of the pilot-aircraft complex confronted with aerial hazards in the frequency of accidents with certain types of aircraft. Adaptation of man to the aircraft remains a perennial problem due to the rapid evolution of modern aircraft.

12423
Silliphant, W. M., and V. A. Stembridge 1958
AVIATION PATHOLOGY: THE ROLE OF THE PATHOLOGIST IN INVESTIGATING AIRCRAFT ACCIDENT FATALITIES.—U. S. Armed Forces Med Jour., 9 (2): 207-223. Feb. 1958.

A discussion is presented of the role of the Armed Forces Institute of Pathology in the pathologic investigation of aircraft accidents. A Joint Committee on Aviation Pathology composed of representatives of the armed forces of the United States, Great Britain, and Canada was established in 1955, with the Armed Forces Institute of Pathology as the central coordinating investigative facility. The functions of the Aviation Pathology Section of the Institute include the processing of pathologic specimens sent to the Institute and interpretation of findings, field investigation of selected aircraft accidents, research, and indoctrination of local personnel in support of the program. Major factors considered in the pathologic study of fatalities are environment, with testing for the presence of hypoxia (elevation in brain and spinal cord lactic acid) and carbon monoxide; traumatic factors; and pre-existing disease, particularly coronary sclerosis. Research activities have included studies of explosive decompression, acceleration and abrupt deceleration, hypoxia, and methods for the detection of therapeutic amounts of drugs in post-mortem tissues.

12424
Smiley, J. R. 1958
RELATION BETWEEN TIME OF DAY AND AIRCRAFT LANDING ACCIDENTS.—Jour. Aviation Med., 29 (1): 33-36. Jan. 1958.

The relationship between rates of landing accidents, defined as any reported deviation from a normal landing, and time of day was studied for one type of aircraft during one year at a Canadian Air Force flying school. It was found that the daily lows in number of accidents occurred 1-2 hours after the lows in landing frequency. Since minimal landing frequencies occurred at meal hours, it is concluded that food and rest effected a decrease in the accident rate.

12425
Stembridge, V. A., W. M. Crafft, and F. M. Townsend 1958
MEDICAL INVESTIGATION OF AIRCRAFT ACCIDENTS WITH MULTIPLE CASUALTIES.—Jour. Aviation Med., 29 (9): 668-675. Sept. 1958.

A discussion is presented of the procedure developed by the aviation pathology section of the Armed Forces Institute of Pathology for the investigation of aircraft accident fatalities. Subjects considered include obtaining permission for post-mortem examinations, handling of bodies at the scene of the accident, identification problems, external examination, autopsy with histopathologic and toxicologic studies, and liaison with other accident investigators. A representative commercial airline accident case is described to demonstrate the investigation procedure.

12426
Strollo, M. 1961
[CONSCIOUS AND UNCONSCIOUS FACTORS IN THE DETERMINATION OF AIRCRAFT ACCIDENTS] Fattori consci ed inconsci nel determinismo dell' incidente aereo. —Rivista di medicina aeronautica e spaziale (Roma), 24 (4): 569-585. Oct.-Dec. 1961. In Italian, with English summary (p. 583-584).

From the psychological viewpoint, aircraft accidents appear to be caused by human disadaptation to the requirements of the flight situation as determined by conscious and unconscious factors. Among the factors are those concerned with inadequate training or mental fatigue, affective-emotional factors (activation of old conflicts, acute anxiety, etc.), external factors (related to the machine and the physical environment), social factors (related to the group with which the subject associates), and personality factors (conscious and unconscious).

12427
Sutton, J. 1958
"PILOT ERROR": HANDY STATISTICAL STIGMA.—Air Line Pilot, 27 (9): 5, 20-23. Sept. 1958.

It is asserted that the pilot is usually a link in the aircraft-accident causal chain. To minimize accident proneness as much as possible, several suggestions are advanced: (1) instruments bearing unneces-

sary information should be removed from the panel, and those remaining should be simplified to save the pilot the task of interpolation; (2) air personnel operating a new type aircraft should undergo intense training; (3) pilots should be given concentrated instruction and demonstrations in how to counteract vertigo; and (4) proximity warning devices should be installed to feed the pilot anticipatory information and to compensate for the time lag between visual stimulus and change in performance of the fast-moving aircraft.

12428
Talbot, J. M. 1959
FACTORS RELATED TO UNEXPLAINED ACCIDENTS IN THE U. S. AIR FORCES IN EUROPE.—In: Medical aspects of flight safety, p. 155-161. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The major aircraft accidents (1955-1956) in the category of "undetermined cause" were studied in order to evaluate the proportion in which aeromedical factors were or could have been the primary or secondary causes of accidents. A questionnaire survey was made of 865 U. S. Air Force flyers who had physiological training between September 1955 and July 1956. The questionnaire covered six areas of interest: hypoxia, spatial disorientation (pilot's vertigo), hyperventilation, rapid or explosive decompression, decompression sickness, and personal protective equipment. Six tables are included to show the gross results of the survey. The reported experiences show that hypoxia and spatial disorientation, and, to a lesser extent, decompression sickness and hyperventilation were important and continuing threats to flight safety and crew effectiveness. Regarding individual flight protective equipment, complaints were aimed at maintenance and supply, related logistical difficulties of personal equipment, and lack of trained personnel.

12429
Talbot, J. M. 1958
UNEXPLAINED AIRCRAFT ACCIDENTS IN THE U. S. AIR FORCES IN EUROPE.—Jour. Aviation Med., 29 (2): 111-116. Feb. 1958.

A questionnaire survey was made of 865 Air Force flyers to evaluate the importance in flying experience of aeromedical hazards. Of 620 flyers who reported the occurrence of in-flight incidents, 30.3% had experienced hypoxia, 4.4% hyperventilation, 17.2% rapid or explosive decompression, and 11.8% decompression sickness. Analysis of the severity of the episodes revealed that hypoxia and spatial disorientation (experienced by all pilots at some time) occurred most frequently with severe consequences. Views were also sought concerning the condition and problems of personal protective equipment. Of 450 flyers submitting comments, only 16% gave favorable opinions. Complaints dealing with maintenance and supply, related logistical difficulties of personal equipment, and lack of trained personnel (but not the design of equipment) were made by 82% of the flyers.

12430
Townsend, F. M., and W. H. Davidson 1961
EXPERIENCE OF THE ARMED FORCES INSTITUTE OF PATHOLOGY IN AIRCRAFT ACCIDENT INVESTIGATION, 1956-1960. — Military Med., 126 (5): 335-339. May 1961.

The relationships of environmental factors, traumatic factors, and pre-existing diseases to aircraft accident fatalities are discussed. Important among the environmental factors are hypoxia and the toxic concentration of air pollutants (e.g., carbon monoxide). Methods for the postmortem detection of these conditions in tissue samples are discussed. Other environmental factors which may contribute to aircraft accidents are g forces, spatial disorientation, blast, temperature and humidity extremes, and noise and vibration. Autopsies have shown that crash victims have suffered traumatic injuries which could be traced to failures in the protective equipment within the aircraft, in the escape mechanisms, or to faults in the aircraft design. Investigators have been able to reconstruct entire accident sequences from the physical condition of the bodies, articles of clothing, and the aircraft. Some type of coronary artery atherosclerosis is cited as the most frequent pre-existing disease process in fatal aircraft accidents.

12431
Townsend, F. M. 1959
THE UTILIZATION OF PATHOLOGY IN AIRCRAFT ACCIDENT INVESTIGATION.—In: Medical aspects of flight safety, p. 165-173. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The necessity for a supplementary study of human factors in aircraft accidents is illustrated by the number of increasing accidents due to pilot error, or to undetermined causes associated with the high accident rate of jet aircraft. Cases and discussion are presented to demonstrate the contribution made by the pathologist during investigation of fatal aircraft accidents. The pathologist studies the contributing environmental factors such as altitude hazards, the effects of speed and accelerative forces, the toxic effects of carbon monoxide, fuels, and hydraulic liquids, the temperatures extremes, excessive noise and vibrations, and the role of stress. The traumatic factors are also closely examined to evaluate the efficiency of protective equipment, escape mechanisms, and aircraft characteristics. As examples of preexisting diseases capable of incapacitating the pilot during flight, cases are cited of coronary arteriosclerosis, brain tumors, and anemia that were discovered during autopsy. The U.S. Air Force has issued a directive concerning the medical investigation of aircraft accident fatalities which includes procedures for postmortem studies including toxicology, radiology, and photography.

12432
Urquhart, D. R. H. 1959
FLIGHT SAFETY—A NEW APPROACH.—In: Medical aspects of flight safety, p. 23-31. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

Within the Royal Air Force a new organization for the prevention of aircraft accidents has been established, the Directorate of Flight Safety. It is directly responsible to the Air Council and consists of flight instructors, fighter, bomber, coastal, and transport pilots, technical officers, a flight surgeon, scientists and statisticians. The Directorate investigates major

and minor aircraft accidents and is grouped into four branches which are concerned with (1) the flying aspect, (2) the technical aspect, (3) the scientific and statistical aspect, and (4) education, propaganda, and the preparation of reports and summaries for distribution throughout the Air Force. Two accidents are reported in detail, the one due to pilot-error, the other to technical failure, to illustrate the usefulness of the new organization. A new feature of investigation now being performed is the automatic full post-mortem examination of all fatalities by an aviation pathologist. The Directorate of Flight Safety is currently revising the methods of selection and training, coordinating efforts to improve cockpits and instrument panels, improving the procedures for evacuating the aircraft when necessary, etc.

12433
Webb, W. B., 1958
E. E. Miller, and L. M. Seale
FURTHER ATTEMPTS IN CODING AIRCRAFT ACCIDENTS.—Jour. Aviation Med., 29 (3): 220-225. March 1958.

An attempt was made to improve the reliability of coding of aircraft accidents by restricting the code to a specific accident event and by deriving code factors from intensive interviews with accident participants. The following causative factors were derived from interviews of 60 students involved in carrier qualification accidents: errors in speed-distance perception, faulty technique, failure to take corrective action, confusion, and faulty division of attention. Three aviation psychologists independently coded 38 carrier qualification accidents on the basis of complete accident reports. After each group of 9 or 10 accidents, reviews of the coding and discussions of differences were conducted. Analysis of the results showed that no improvement in between-coder reliability occurred over previous coding systems or after group discussions of the coding. It is concluded that the differences in coding resulted from an inability to reproduce the mental processes of the pilot and from the fact that a single pilot error could result from any of several psychologic sources.

12434
Wulfften Palthe, P. M. van 1958
PSYCHOLOGICAL CAUSES IN AIRCRAFT ACCIDENTS.—Aeromedica acta (Soesterberg, Netherlands), 6: 69-80. 1958. In English.

Human factors of a psychological character operative in aviation accidents or near-accidents are discussed. Although lipothymia (emotional fainting) is not regarded a rare phenomenon in the field of aviation medicine, it has not been implicated as a causal factor in a statistical evaluation of aircraft accidents. Partial sensory deprivation experienced in solo flight frequently produces the so-called "break-off" phenomenon. Subsequent psychological examination has revealed light symptoms of psychasthenia which, coupled with impaired health or stress-provoking factors, nearly always precedes this isolation syndrome. Since only anxiety-prone individuals experiencing the break-off state constitute a hazard in flight, pre-testing with a simulated isolation test is suggested. All confusional states in flight are presumed to be variations of the sham death and hyperactivity responses to imminent perceived danger. Fatigue and hypoglycemia are conducive to loss of mental alertness combined with automatism. Hyperventilation may enchance anxiety. The emotional effects of light flashes have not yet been explored to the same extent as their epileptogenic influence. In aircraft accident investigations, particularly in propeller planes, the flicker influence should be considered, and where possible the pilot's resistance to flicker investigated. Near-accommodation in an empty visual field culture-habituated in a large percentage of emmetropes may be an essential factor in collision accidents or give rise to perceptual illusions through projection, which may lead to errors of judgment.

12435
Zeller, A. F. 1959
AGE, EXPERIENCE AND AIRCRAFT ACCIDENTS.—Aerospace Med., 30 (10); 736-750. Oct. 1959.

This re-evaluation of trends and past studies by means of graphs and charts expands the scope of the study of age, experience, and accidents in military flying personnel. There has been a marked decrease in the accident rate in all types of aircraft over the past several years. The greatest reduction was in the low-experienced, low-age groups. There is a period of high hazard associated with the early hours of operational flying which follow the initial training period. Jet fighter pilots, on the whole, are younger than pilots flying other types of aircraft. Because of the restricted age range of Air Force pilots, evaluations of age changes are difficult. From a practical accident prevention standpoint, the pilot with less than 1,000 hours, under 30 years of age, is the most profitable focal point for accident prevention effort. (Author's summary, modified)

12436
Zeller, A. F., 1961
G. H. Normand, and J. M. Burke
AIRCRAFT ACCIDENTS AND AIRCRAFT INSTRUMENTS.—Aerospace Med., 32 (1): 42-51. Jan. 1961.

During the period July 1, 1957, to June 30, 1958, 116 major aircraft accidents occurred in the U. S. Air Force. Of these, the greater portion involved jet fighters and trainers. An analysis is made of the relative severity of major accidents occurring under instrument conditions, the factors causing such accidents, the incidence of warning system failures, and the incidence of pilot factor takeoff accidents.

12437
Zeller, A. F. 1959
HUMAN ABILITY AND HIGH PERFORMANCE FLIGHT: AN ANALYSIS OF ACCIDENTS IN "CENTURY SERIES" AIRCRAFT.—Jour. Aviation Med., 30 (2): 126-135. Feb. 1959.

Eleven graphs and diagrams present aircraft performance of F-100's, or Century Series, since 1952. Contrary to many predictions, fighter accident experience has been no worse than that of earlier jet fighter aircraft, and considerably better than the accident history of some. Although the initial accident rate was high, there has been a constant decrease since that time. The high proportion of unsafe conditions, and relatively high ratio of maintenance error, indicates the need for careful consideration of design for maintenance and careful selection and training of maintenance personnel. The high portion of pilot error which relates to some part of the landing phase indicates the need for mechanical aids and improved procedures which will assist the pilot during the critical stage of transition from a 3-dimensional to a 2-dimensional medium. There is no

evidence to indicate that pilots are not able to cope with the new aircraft provided that flying is accepted as a highly technical skill.

12438
Zeller, A. F. 1959
HUMAN ASPECTS OF MID-AIR COLLISION PREVENTION.—Aerospace Med., 30 (8): 551-560. Aug. 1959.

A brief summary of mid-air collisions since the first, in 1917, is given. Mid-air collisions are the result of a combination of human limitations and situational factors. In order of frequency, the human errors committed in collisions are related to perception, inappropriate decisions, judgment, and responses. Some of the limiting factors to optimum human efficiency are complexity of task, cockpit design, experience and training, boredom, fatigue, age, and special hazards such as oxygen deficiency and explosive decompression. Two deterrents to collisions are increased conspicuousness of the aircraft and traffic control. The development of adequate anti-collision equipment, in the form of either a proximity warning indicator or a true anti-collision device, remains in an open status. For collision avoidance, the pilot needs very specific, easily assimilable information presented meaningfully and in time. Presenting this information by means of a visual display which requires cockpit attention and interpretation may aggravate rather than alleviate the problem.

12439
Zeller, A. F. 1958
HUMAN FACTORS IN SELECTED MULTI-ENGINE JET AIRCRAFT ACCIDENTS.—Jour Aviation Med., 29 (3): 197-205. March 1958.

An analysis was made of accident rates during 10 years of Air Force experience with multi-engine jet aircraft. Although the number of major accidents has increased with an increase in flights, the rate of accidents per hours of flying and the number of fatalities per accident have continually decreased. Evaluation of accidents occurring with 3 types of jet aircraft during a 4-year period revealed a higher number of take-off and in-flight accidents than with non-jet aircraft. Collision with the ground was the most frequent type of accident, followed in order by spins and stalls, fire or explosion, and airframe failure in flight, and failure of the landing gear. Pilot error was the primary causative factor in the accidents considered. The most frequent specific unsafe acts resulting in accidents were poor technique in the landing pattern and other errors related to a judgment of rate-of-closure in relation to distance. The most important unsafe conditions contributing to accidents involved the power plant, the landing gear, and the flight controls system. Increased age of the pilot was not associated with the major accident rate, but tended to be related to a higher rate of major and minor accidents and incidents. Increased multi-jet experience tended to be related to a decreased accident rate. It is concluded that with proper consideration of human factors in the man-machine system, no insurmountable difficulties should be encountered in the operation of jet aircraft.

f. Interplanetary Contamination

[*Contamination of Aircraft under 8-g*]

12440
CONTAMINATION BY EXTRA-TERRESTRIAL EXPLORATION.—Nature (London), 183 (4666): 925-928. April 4, 1959.

The Moon's atmosphere contains only a small amount of matter (less than 100 tons) and is therefore extremely vulnerable to contamination. The release on the surface of any amount of volatile material, such as might be given off from explosions for marking purposes or to slow down the vehicle for soft landings is likely to remain on the Moon. A serious danger of altering the Moon's dust may come from nuclear explosions which release fission products and can enter the Moon's atmosphere and be rapidly distributed. The outside of space vehicles need not be sterilized, since exposure to unfiltered solar radiation during flight will destroy all microorganisms which have settled on the shell. It is recommended that methods be formulated for sterilization of space-craft interiors. There appears to be no possibility by which the introduction of cells such as spores or bacteria might give rise to life on the Moon of the same type (containing desoxyribonucleic acid) as on Earth since these grow in the presence of water, and at the high vacuum of the Moon no water exists on its surface. There is a possibility of biological contamination of Mars and Venus since there is reasonable probability that the conditions there are such that some terrestrial organisms might grow. Carbon compounds, light, and probably water and nitrogen are all present.

12441
David, H. 1961
EXPERTS FEAR VENUS CONTAMINATION. —Missiles and Rockets, 8 (8): 30. Feb. 20, 1961.

The implications of the contamination of other planets by earth probes and of earth by returning probes are discussed. Methods of sterilization and recommendations for the establishment of a regulatory authority dictating the use of measures designed to prevent biological contamination are described. A promising method is the use of ethylene oxide in a plastic bag enveloping the vehicle which could be discarded after sterilization of the vehicle surface is completed. Organisms carried in the intestines of animals present a special problem. Walter Reed Army Institute's experiments with producing germ-free animal stocks may point the way in the future.

12442
Davies, R. W., and M. G. Comuntzis 1960
THE STERILIZATION OF SPACE VEHICLES TO PREVENT EXTRATERRESTRIAL BIOLOGICAL CONTAMINATION.—In: International Astronautics Congress, Xth (London, 1959), Proceedings, vol. 1, p. 495-504. Wien: Springer, 1960.

Space probes which have any likelihood of an intentional or accidental landing on either Mars or Venus should be carefully sterilized in order to leave intact the biology of both planets. Four phases of payload sterilization are recommended; they are (1) sterile assembly, (2) built-in or intrinsic sterilization, (3) terminal sterilization, and (4) maintenance sterilization. Of the four phases, the third is the most important. Steam or bactericidal gases are

suggested for this phase. In order to minimize chemical contamination of a kind that might confuse later investigators, it is recommended that a careful molecular inventory be made of each mission together with a replica of each package. It is also recommended that a microbiological survey be made of the launching site area. (Authors' abstract, modified)

12443
Phillips, C. R., and R. K. Hoffman 1960
STERILIZATION OF INTERPLANETARY VEHICLES. — Science (Washington), 132 (3433): 991-995. Oct. 14, 1960.

A discussion is presented of the rationale and methods for the sterilization of interplanetary vehicles. The avoidance of accidental contamination of extraterrestrial bodies with terrestrial forms of life is necessitated by the desirability of obtaining knowledge of the origin of life through search for life on the moon and other planets, and by the danger of the submergence or alteration of native life forms through the introduction of foreign forms. Artificial sterilization of vehicles is made necessary by the probability that spores and other simple life forms may survive the conditions of radiation, cold, and vacuum encountered in outer space. Exposure to ethylene oxide gas, which diffuse readily through many types of porous materials but which may be easily trapped in a plastic bag or tent, is a desirable means for the sterilization of space vehicles. Sterility may be maintained during flight through the atmosphere by use of a protective fairing which can be separated from the vehicle at a high altitude. Design considerations in the construction of a vehicle capable of being sterilized with ethylene oxide include use of paints and adhesives which will withstand treatment with the gas, and sterilization of hermetically sealed components before assembly. Experiments have been conducted to test the internal sterilization of typical electronic components after exposure to ethylene oxide by shattering of the structure before incubation in a sterile broth.

12444
PROCEEDINGS OF MEETING ON PROBLEMS AND TECHNIQUES ASSOCIATED WITH THE DECONTAMINATION AND STERILIZATION OF SPACECRAFT, JUNE 29, 1960, WASHINGTON, D. C. Ed. by J. Posner. 57 p. National Aeronautics and Space Administration. Office of Life Sciences Programs, Washington, D. C. NASA Technical Note no. D-771, Jan. 1961.

A meeting was held of representatives of agencies concerned with the development of space vehicles and those investigating decontamination and sterilization procedures. Recommendations resulting from the deliberations include: (1) a body of related information be accumulated, (2) standard operating procedures be established, (3) acceptable limits of contamination be determined, (4) NASA policy be clarified, (5) new sterilizing agents be developed, (6) compatibility studies be pursued, (7) sterile manufacture of parts be investigated, and (8) a working level group should be formed to implement recommendations and procedures. (NASA abstract)

Appended to this report (p. 43-56) is a reprint of a paper by C. R. Phillips and R. K. Hoffman (see item no. 12443).

12445
Sagan, C. 1960
BIOLOGICAL CONTAMINATION OF THE MOON.— Proc. Nat. Acad. Sci. U.S.A., 46 (4): 396-402. April 1960.

Four possible circumstances under which the Moon may be biologically contaminated via lunar probes are discussed and evaluated. The Moon may contain no indigenous living organisms and may be incapable of supporting terrestrial organisms, but, (1) there may be relics of primitive indigenous organisms and deposited cosmobiota at or near the surface which would be indistinguishable from the terrestrial biological contaminants distributed by hard-landing vehicles. Or (2) sub-surface pre-biological organic matter may exist which would be indistinguishable from deposited terrestrial organic matter, either biological or abiological in origin. (3) The Moon may contain no indigenous living organisms but may be capable of supporting some terrestrial organisms. In the absence of biological competitors or predators, it is possible that a deposited terrestrial microorganism will multiply at a geometric rate limited only by the availability of water and metabolites and in a short time destroy large quantities of organic matter produced in the early history of the Moon. (4) The Moon may contain indigenous living organisms which may have their ecology seriously disturbed by competition with or parasitization by deposited terrestrial microorganisms. The probable survival times of terrestrial living organisms and non-living organic matter in the potentially hazardous lunar environment (high temperatures, corpuscular radiation, and solar electromagnetic radiation) are computed. It is concluded that the probability is very low that deposited terrestrial microorganisms and organic matter will be confused with indigenous lunar organisms or organic matter, but that the explosive reproduction of terrestrial microorganisms in indigenous lunar organic matter, and the disruption of the ecologies of hypothetical lunar organisms are remote but non-negligible possibilities.

12446
Sneath, P. H. A. 1961
DANGERS OF CONTAMINATION OF PLANETS AND THE EARTH. — In: The biology of space travel, p. 95-105; discussion, p. 106. Symposia of the Institute of Biology, 10. London, 1961.

Contamination of planets such as Mars and Venus by Earth micro-organisms would make it impossible to discover indigenous life forms. The possibility of destroying life on Earth by introducing exobiota such as denitrifing micro-organisms or forms that would produce some highly toxic material is discussed. A discussion of resistance and longevity of Earth organisms and exobiota is related to disinfection of spacecraft. Decontamination can be by various methods, and it is suggested that craft returning to Earth be abandoned or destroyed by a nuclear bomb. Various sites for landing spacecraft on the Earth to lessen contamination are discussed. It is suggested that adequate experiments to find the effects of any exobiota could be carried out on space stations carrying simulated Earth environments. (34 references)

12447
Wynne, E. S. 1961
STERILIZATION OF SPACE VEHICLES: THE PROBLEM OF MUTUAL CONTAMINATION. — In: Lectures in aerospace medicine, 16-20 Jan. 1961, [section] 16. 29 p. Brooks Air Force Base, Texas: School of Aviation Medicine, 1961.

The author reviews the problems of spreading Earth microorganisms to other planets and the Moon. The adverse effects this would have on the study of extraterrestrial life, the possible use of extraterrestrial organisms for the benefit of man, and the study of the origin of life on earth are pointed out. The possible contamination of the Earth by extraterrestrial forms is also discussed. Methods of sterilization of various space vehicle components by heat, radiation, or chemicals are debated. For studying the bacterial content of hermetically sealed components, the author presents a technique utilizing ethylene oxide and heat. Using Pseudomonas aeruginosa as the test organism, small electric components were subjected to heat and ethylene oxide. Ethylene oxide proved sufficient for sterilizing the exteriors of the components, while the interiors of most types could be treated at 121° C. for 16 hours. Other components that failed to function after heat treatment can probably be treated by radiation.

g. Meteorites and Aerospace Debris

12448
Kasparek, C. F., 1961
and A. Graybiel
AEROMETEORISM: A FOLLOW-UP REPORT. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 5, Report no. 2). Jan. 16, 1961. 7 p.
Also published in: Aerospace Med., 32 (6): 516-519. June 1961.

As a follow-up to one published in 1954, this report presents the trend in aerometeorism since that time. Death has occurred to 287 persons and injury to 622 as a result of falling aircraft or falling fragments of aircraft in the period 1953-1959. Various examples of the accidents which caused the aerometeorism are cited. (Authors' abstract)

12449
Whipple, F. L. 1958
THE METEORITIC RISK TO SPACE VEHICLES. — In: International Astronautical Congress, VIIIth (Barcelona, 1957), Proceedings, p. 418-428. Wien: Springer, 1958.

Consideration is given to the distribution of meteoritic materials and its rate of fall on the earth as functions of mass and velocity. With a simple theory, the probabilities are calculated that surfaces in space in the neighborhood of the earth may be punctured by meteoric action. A table of data and probabilities is given. It is calculated that a near-earth satellite of radius 20 inches and skin thickness 0.5 mm. will be punctured on the average of once in five days. Upper limits to the effects of skin erosion on a space-exposed surface are calculated on the basis of erosion by meteoritic dust, by corpuscular radiation from the sun, and by gases of the extended solar corona. The erosive effect from meteoritic dust is comparable to the combined effects from the other two causes and gives a rate of skin erosion of the order of 2×10^{-13} g./cm.^{2}/sec. or less. Optical surfaces exposed to space should not be affected functionally by erosion over periods less than about a year. Attention is given to the expected degree of accuracy of the observed data and the conclusions, particularly for the meteoritic material. The uncertainties arise from combined theoretical and observational limitations. (Author's abstract)

h. Other Hazards

12450
Kidera, G. J., 1959
and J. P. Marbarger
EFFECT OF OXYGEN ON FRESHLY APPLIED LIPSTICK OR CHAPSTICK. — Aerospace Med., 30 (6): 431-432. June 1959.

In testing a representative list of six lipsticks and eight chapsticks, spontaneous combustion of the samples did not occur in 100% oxygen either at ground level or at simulated altitude of 32,000 feet. The risk of spontaneous combustion after donning an oxygen mask in aircraft appears no greater than the possibility of the occurrence of spontaneous combustion of fats and oils from human skin. (Authors' conclusions, modified)

12451
Naugle, J. E. 1961
SPACE RADIATION LEVELS. — Nucleonics, 19 (4): 89-91. April 1961.

Van Allen radiation (protons and electrons) and solar flares are the major radiation hazards in space travel. Solar flares are the principal producer of protons, but the probability of arrival and intensity of these can be predicted by data from balloons, satellites and rockets. Data on energy and intensity of cosmic radiation are tabulated. Steps can then be taken to shield the space craft while in flight. The amount of shielding depends on many factors, and the shielding data and radiation levels presented are based on a single solar flare. With the proper use of fuel and other materials preliminary estimates show that shielding of about 8 g./cm.^{2} will be used on craft such as Apollo. (22 references)

12452
Nowell, W. R., 1958
and J. Rizzolo
A BIZARRE HAZARD TO FLYING SAFETY. — Jour. Aviation Med., 29 (4): 325-326. April 1958.

Air Force B-57 aircraft parked on hardstands for three months pending a structural modification were found to be infested with larvae of the wasp family. Nests consisting of dirt had been built in the tubing leading to outside vents of the static system, blocking the vent orifices. A review of flight reports and maintenance records for the aircraft at the base revealed a history of entries describing delayed or erratic operation of cabin instruments tied to the aircraft static lines. As a result of the investigation, all static lines and vents of B-57 aircraft were cleaned out, plant growth surrounding the hardstands was cut back, and all small external orifices were plugged with golf tees. The experience demonstrates the necessity for periodic inspection of certain aircraft parts and orifices for evidence of insect infestation.

11. MAN-MACHINE INTEGRATION AND LIFE-SUPPORT SYSTEMS

a. General

12453
Altman, J. W., 1961
A. C. Marchese, and B. W. Marchiando
GUIDE TO DESIGN OF MECHANICAL EQUIPMENT FOR MAINTAINABILITY.—American Inst. for Research, Pittsburgh, Pa. (Contract AF 33(616)-6124); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). ASD Technical Report no. 61-381, Aug. 1961. x+226 p.

This guide contains human engineering recommendations and suggestions for designing mechanical equipment to increase overall ease, speed, and accuracy of maintenance job performance. It is written for engineers responsible for mechanical subsystems and components and is intended to serve as a convenient reference to help insure the integration of maintainability design into mechanical subsystems and components. It treats both design features common to all mechanical equipment as well as those features unique to certain classes of equipment. (Authors' abstract)

12454
Bamford, H. E. 1959
HUMAN FACTORS IN MAN-MACHINE SYSTEMS.—Human Factors, 1 (4): 55-59. Nov. 1959.

A circular figure is divided into areas to illustrate the scope and organization of the field of human factors in a man-machine system (utilizing aircraft operations as an example). The circle is divided into two general sections, one representing factors which affect the job behavior of the crew and the other representing factors which affect the condition of the crew and passengers. Each of these is further divided into systemic, functional, and general factors. The functional zone is divided into an inner region consisting of functional specifications for equipment and an outer region consisting of the operational environment and tasks of the crew. Eight mutually exclusive fields are thus delineated: those of (1) human utility to the system, (2) behavioral characteristics of crew stations, (3) behavioral demands on crew, (4) behavioral characteristics of crew, including selection, training, and group processes and organization, (5) ecological characteristics of crew and passengers, including metabolic and psychological interactions, (6) ecological characteristics of the operational environment, including the pressure and chemical characteristics of the medium, acceleration climate, toxicity of the environment, temperature ranges, radiation, moving environmental objects, natural ambient lighting, and noise and vibration, (7) ecological demands of the life support system, and (8) human cost to the system.

12455
Beauchamp, G. T. 1961
ADVERSE EFFECTS DUE TO SPACE VEHICLE ROTATION. — Astronautical Sci. Rev., 3 (4): 9-11. Oct.-Dec. 1961.

In a satellite rotated to create an artificial gravitational field, the effects of Coriolis forces are considerable upon occupant movements, his performance at the controls, and on the operation of machinery. Careful consideration of the vehicle size, magnitude of the simulated gravity, and deliberate slowing of movements will lessen the adverse effects of Coriolis forces. The following recommendations are made: (1) The optimum vehicle radius at floor level should be from 45 to 50 feet, since smaller radii are conducive to intolerable Coriolis forces and gravity gradients. (2) At low simulated gravity levels the rotational radius of the vehicle for satisfactory human performance should be extended to several hundred feet to balance the Coriolis forces.

12456
Bond, A. C. 1961
MERCURY SPACECRAFT SYSTEMS.—In: Conference on Medical Results of the First U. S. Manned Suborbital Space Flight, p. 15-27. [1961 ?].

A brief review, with diagrams and photographs, is presented of the Mercury spacecraft and its primary systems. Described are the spacecraft and escape system, communications system, attitude control system, landing and recovery systems, the instrument panel, and acceleration and impact attenuation.

12457
Bouisset, S., 1961
and H. Monod
[TRIAL DETERMINATION OF ANTHROPOMETRIC CHARACTERISTICS IN VIEW OF EQUIPMENT AT WORK POSTS: STUDY OF 110 SUBJECTS FROM THE PARISIAN AREA] Un essai de détermination de caractéristiques anthropométriques en vue de l'aménagement de postes de travail: étude de 110 "cadres" de la région parisienne. — Travail humain (Paris), 24 (1-2): 35-50. Jan.-June 1961. In French, with English summary (p. 50).

The principal anthropometric characteristics necessary for the dimensional setting of sitting workplaces was determined for 110 subjects. The limited examination protocol, bearing on lightly clad subjects, includes special anthropometric measurements concerned with the equipment design and space allotment. The reliability of measurements is satisfactory for most characteristics. For each characteristic, the mean standard deviation, coefficient variation, amplitude of variations and 5th and 95th centiles were computed. (Authors' summary, modified)

12458
Bowen, H. M. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. VII. HUMAN SKILLS AS SYSTEMS CONSIDERATIONS. — Electro-Technol., 67 (5): 123-126. May 1961.

The proficient performance of a psychomotor task such as may be encountered in a complex man-machine system, involves some overt movements of the person under the guidance and control of psychological mechanisms. The nature of operational physical movements are reviewed under three headings: (1) static movement, (2) positional movement, and (3) adjustive movement. The development and structure of skills, the procedures

and problems in their measurement, and various theoretical and design factors related to skilled activity within systems are analyzed.

12459
Bowman, N. J., 1960
E. H. Dingman
AN ENVIRONMENTAL CONDITIONING SYSTEM FOR A MANNED SATELLITE.—— Jour. Brit. Interplanetary Soc. (London), 17 (10): 372-380. July-Aug. 1960.

A specific design is presented for an environmental conditioning system for use in a manned satellite designed to stay aloft for 60 days. Water is recovered by evaporative distillation and refrigeration, oxygen regenerated by electrolysis of water, carbon dioxide removed by use of lithium oxide (non-regenerative), and capacity for radiating 150,000 B.T.U./day from the satellite as a whole provided. With automatic control this system is suitable for use in an animal-carrying satellite. The weight is favourable when compared with other systems that have been suggested, and well within the conditioning allowance of a 5000-lb. manned satellite. (Author's abstract)

12460
Bradley, J. V., 1959
and R. A. Wallis
SPACING OF ON-OFF CONTROLS. II. TOGGLE SWITCHES.—Antioch Coll., Yellow Springs, Ohio (Contract AF 33(616)3404); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7182, Task no. 71514). WADC Technical Report no. 58-475, March 1959. v+21 p. AD 212 270

Thirty-six right-handed male college students performed a standardized control operation in which the center one of three closely spaced toggle switches was operated while avoiding manual contact with the adjacent switches. Four experimental variables were investigated: type of toggle switch, spacing between switches, orientation of the linear array, and direction of throw to operate. Performance measures recorded were: reach-and-operation time, inadvertent touching of adjacent switches and inadvertent operation of adjacent switches. Each experimental variable had a significant effect upon some measure of performance. The results suggest that when on-off controls must be crowded into a given amount of panel space, so that they are closer than one inch between centers, performance may be optimized by using miniaturized toggle switches having considerable resistance to operation. Data obtained with toggle switches were compared with those obtained in a previous, similar experiment using push buttons. (Authors' abstract)

12461
Bradley, J. V. 1959
TACTUAL CODING OF CYLINDRICAL KNOBS.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71581). WADC Technical Report no. 59-182, Sept. 1959. iii+29 p.

Tactual coding of knobs by use of bizarre shapes is frequently achieved at the expense of manipulability and setting precision, which appear, in many cases, to be optimal when knobs are cylindrical. In order to be able to maximize both discriminability and manipulability, certain parameters of cylindrical knobs were investigated as bases for tactual coding. Rim surface, diameter, and thickness were all found to be useful for this purpose. When feeling one of two knobs whose pictures were before them, subjects rarely (less than 1% of the time) identified the wrong picture as the felt knob in any of the following situations: diameters differ by 1/2 inch or more, thicknesses differ by 3/8 inch or more, rim surfaces belong to different ones of the three families: smooth, fluted, knurled. (Author's abstract)

12462
Cameron, C., 1961
and K. G. Corkindale
THE PSYCHOLOGIST'S ROLE IN THE DEVELOPMENT OF MAN-MACHINE SYSTEMS. ——Occupational Psychol. (London), 35 (1-2): 65-70. Jan.-April 1961.

"System-centered" design has replaced the machine-centered and man-centered approach to system design. Implementation of the operational requirement of the man-machine system involves decisions concerning: (1) distribution of tasks between men and machines; (2) designing and planning layout of equipment and working conditions and devising working procedures for the sub-systems; (3) evaluation (usually by simulation methods); and (4) trial runs. The psychologist as an adviser on human factors contributes to the design team specialized knowledge concerning selection, allocation and training programs, human engineering data, the effects of environmental factors on the human operator, and data on the limits of human performance.

12463
Campbell, P. A. 1958
HUMAN LOGISTICS FROM THE VIEWPOINT OF SPACE TRAVEL.—In: Vistas in astronautics, p. 285-287. Ed. by M. Alperin, M. Stern, and H. Wooster. N. Y.: Pergamon Press, 1958.

Before manned space flight, engineers, designers, physiologists, and psychologists must determine optimal requirements for age, weight, and size of pilot, oxygen equilibrium, air conditioning, fluid, food, waste removal, cabin altitude and temperature, minimum work level, clothing, metabolic rate, protection, survival, and many other factors.

12464
Carter, C. W. 1960
INTERNATIONAL LIST OF HUMAN FACTORS FILMS. —— Human Factors, 2 (2): 62-69. May 1960.

This annotated bibliography presents 54 references to films dealing with human factors problems in man-machine design. The subjects covered include emergency escape and survival systems, zero gravity studies, medical aspects of high intensity noise, illumination and dark adaptation, anthropometrical techniques, simulated decompression studies, aircrew fatigue problems, and the effects of whole body vibration on human performance. The references are categorized by source in order to facilitate procurement of certain films desired by the reader.

12465
Carter, E. T. 1959
HEAT PROTECTION FOR SPACE CREWS.—Space Aeronautics, 32 (1): 61-64, 68-72. July 1959.

The basic theory of human heat balance, and the effects of blood circulation and evaporative, radiant, convective, and conductive cooling, as they influence design problems of manned space flight, are discussed. Human performance limits as set by hyperthermia and skin temperature limits are graphically illustrated.

12466
Ceauşu, V. 1961
[THE RELATIONS BETWEEN MAN, MACHINE, AND ENVIRONMENT IN AVIATION] Relatiile om-maşină-ambianţă în activitatea de zbor. — Revista de psihologie (Bucureşti), 7 (3): 353-376. 1961. In Rumanian, with French summary (p. 374-375).

From the psychological viewpoint, the process of piloting is composed of three parts: information, capacity-to-react, and control action. These insure pilot efficiency and form a closed circuit. Interruption of this circuit may cause an accident. The principal psychological consequences of the development of improved airplanes are: (1) there are more elements which furnish the necessary flight information; (2) necessary actions increase in number and difficulty; (3) the aircraft speed tends to overcome that of the information-reaction-control cycle; and (4) the social, political, and moral responsibilities of the pilot are increased. Improvements of the aircraft also affect the pilot, directly, by the physiological changes which they produce, and indirectly by making the pilot conscious of the hazardous high-altitude, high-speed environment. The effect and importance of mental factors during flying are evaluated in relation to the man-machine system.

12467
Celent, C. 1960
HUMAN FACTORS: NEWEST ENGINEERING DISCIPLINE.—Electronic Industries, 19 (2): 85-100. Feb. 1960.

Rapid technological advances have generated problems concerning man-machine compatibility that call for an exhaustive knowledge of human behavior. These problems are especially critical in preparing for space travel, in that the man and the machine must be assigned the function each performs best. The space traveler must be protected against high or complex acceleration forces and weightlessness, and the effects of extremes of pressure, temperature, humidity, radiation, noise, and vibration. Descriptions are given of various programs from industry, government, non-profit organizations, and private consulting firms which are attempting to solve these problems. Included are studies on the effect of motion and vibration on the ability of the pilot to control his craft; the development of telemetric devices for monitoring physiological responses during space travel, and for lunar suit communications systems; the development of a satellite simulator to facilitate the design of living and working conditions in future extended-trip space vehicles; and the development of analog computers to simulate control situations in manned space vehicle re-entry.

12468
Clamann, H. G. 1958
THE ENGINEERED ENVIRONMENT OF THE SPACE VEHICLE.—Air Univ. Quart. Rev., 10 (2): 53-64. Summer 1958.
Also published in: Man in space, p. 69-84. New York: Duell, Sloan and Pearce, 1959.

Also published in: Human factors in jet and space age travel, p. 330-344. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

The article surveys various problems involved in the construction and equipment of a manned space cabin, such as food and waste turnover. The minimum and maximum tolerance levels for oxygen and carbon dioxide are reviewed. The weight and effectiveness of a chemical gas exchanger system is compared with that of a photosynthetic (Chlorella) gas exchanger.

12469
Crampton, G. H., 1960
W. J. Schwam, and S. Warburton
TECHNICAL NOTE: A METHOD FOR RIGID RESTRAINT OF UNANESTHETIZED CAT.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X95-25-001). Report no. 416, Feb. 4, 1960. 5 p.

The cat is particularly difficult to restrain and for studies of the vestibular system it is essential that the head be immobilized. Development of a satisfactory restraint method is an important prerequisite to vestibular experiments with cat. A humane and rigid restraint for unanesthetized cat can be obtained with individually fitted bivalve plaster casts. Readily available and inexpensive materials are employed. Although this restraint method has been employed only in the study of vestibular functions it should also serve for study of other sensory systems. (Authors' abstract)

12470
deCallies, R. N. 1960
HUMAN FACTORS IN SPACECRAFT TECHNOLOGY. — Advances in the Astronautical Sciences, 5: 39-50. 1960.

The goals of space technology research in human factors are defined as follows: (1) to establish an environment in which man can exist in space, and (2) to investigate the man-machine system in terms of an integrated system. The first includes those physiological and psychological factors which would promote a duplication rather than an approximation of the normal terrestrial environment. The second requires task analysis to determine specifically the functions of each member of the crew, the information he will require, the optimum display of information, and the vehicular and equipment control design which will permit him to perform his duties efficiently. A brief review is given of the Navy's research program for achieving a more efficient system of providing information to the pilots of high-performance aircraft. A program for establishing the informational requirements of space flight is discussed.

12471
Donlan, C. J., 1961
and J. C. Heberlig
PROJECT MERCURY: THE PROGRAM AND ITS OBJECTIVES.—In: Psychophysiological aspects of space flight, p. 19-38. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

Project Mercury is the United States' initial program for manned orbital flight. The objectives, basic principles, and method are stated. Diagrams are included of the capsule and escape system. Facts about the instrument panel, environmental control system, automatic stabilization and control system, acceleration and impact attenuation, and

Mercury flight test vehicles are reviewed. The Mercury orbital missions will permit the study of the effects of prolonged weightlessness on physiological reactions, subjective psychological reactions, and performance of the astronaut.

12472
Drake, H. M., 1960
D. R. Bellman, and J. A. Walker
OPERATIONAL PROBLEMS OF MANNED ORBITAL VEHICLES. — National Advisory Committee for Aeronautics. High-Speed Flight Station, Edwards, Calif. NACA Research Memorandum no. H58D21, July 21, 1958. 16 p.
DECLASSIFIED Feb. 8, 1960

Some of the operational problems of escape, piloting, orbit selection, flight termination, and range requirements of three general categories (ballistic, semiballistic, and winged) of manned satellites are discussed. It is indicated that configuration of the vehicle materially affects operations, that survival procedures may preclude optimum procedures, and that use of the pilot may simplify design and thus increase the reliability and safety of the operation. (From the authors' summary)

12473
Dzendolet, E., 1959
and J. F. Rievley
MAN'S ABILITY TO APPLY CERTAIN TORQUES WHILE WEIGHTLESS.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 7184, Task no. 71586). WADC Technical Report no. 59-94, April 1959. iii+28 p. AD 220363

The torque that a maintenance man can exert within a space vehicle while weightless, and hence tractionless, is analyzed, and the consequences of applying these torques while tractionless are calculated. It is tentatively concluded that standard anthropometric data can legitimately be extrapolated to the weightless condition. Suggestions are advanced regarding: (1) the optimum body position for a simple tightening task without using a handhold; (2) the use and location of handholds; (3) maximum torque limitations; (4) the use of impulses; and (5) the design of hand tools. (Authors' abstract, modified)

12474
Eddowes, E. E. 1961
SURVEY OF LEISURE TIME ACTIVITY: IMPLICATIONS FOR THE DESIGN OF A SPACE VEHICLE.—Aerospace Med., 32 (6): 541-544. June 1961.

Eighty male subjects, aged 19 to 56, participated in a survey of leisure-time activity in order to determine which kinds of leisure time activities people engaged in regularly and if adequate facilities could be provided to enable men to carry on the same activities in the crew quarters of a space vehicle. The questionnaire consisted of three open-end questions dealing with the subject's activity and one biographical item. The data show that reading, watching television, musical, manual, education, and miscellaneous work, handicrafts, and social activities account for all the different types of activities reported by more than 10% of the subjects. To permit a space crewman to read and study, a microfilm library could be designed into the space vehicle. Tape-record libraries, perhaps supplemented by a communication system from an Earth base, could supply the crew with TV-type entertainment and music as well as news from home. Supplies of materials, probably of the re-usable variety, could be included in the space vehicle to permit those persons who engage in leisure-time handicrafts and manual activities to continue them during a space mission. If facilities for any type of exercise are designed into a space vehicle, the activity is not likely to be one of those which are frequently participated in and well-liked.

12475
Ehricke, K. 1959
MANNED OUTPOSTS IN SPACE.—Astronautics, 4 (8): 20-23, 42. Aug. 1959.

It is estimated that in view of probable future developments in manned space exploration, an experimental biotechnical space station of the "Outpost" type will be needed before 1963. Operationally the orbital capsules to manned deep-space missions. Its main uses in the field of space medicine will be for selection, training, and conditioning of space crews, permitting a detailed study of the effects of prolonged exposure to zero-g conditions and of the psychological effects of long periods of separation from earth and suspension in the loneliness of space. Also the development of reliable life-support systems will be facilitated by their testing under proper environmental conditions. Three separate concepts of Outpost stations based on the Atlas system are described. Outpost I, weight 15,000 lb., has four-rooms. Its front end is closed by waste disposal and water regeneration systems, its rear closed by an air lock. Both the oxygen cycle and the waste cycle are open. The station can be rotated to provide some artificial gravity for the crew. Outpost II is envisioned along similar line. Outpost III is a combination of four Outpost II units connected in orbit; its overall weight is 50,000 lbs., the maximum crew size 10 persons. It consists of two life-support units at the far end from the reactor, a laboratory for low-g experiments near the hub, and an equipment and storage unit at the reactor end. In contrast to the other two stations, Outpost III would have a closed oxygen cycle (algae/gas-exchange system) and, for experimental purposes, a closed waste cycle (algae/food-waste exchange system).

12476
Ehricke, K. A. 1961
A SYSTEMS ANALYSIS OF FAST MANNED FLIGHTS TO VENUS AND MARS. I. MISSION PHILOSOPHY, LIFE SUPPORT, SCIENTIFIC RECONNAISSANCE, AND PROTOTYPE VEHICLE LAYOUT. — Jour. Eng. for Industry, 83, Series B (1): 1-12. Feb. 1961.

Suitable mission profiles to Venus and Mars are presented. Crew sizes between 12 and sixteen persons were found adequate for fast reconnaissance missions lasting about 1.5 and 1 year, respectively, for the two planets. The requirements for the ecological payload and the supporting systems are discussed, and the resulting weight requirements for the life support system and the scientific payload are determined. The ecological system contains the direct life-sustaining items (food, water, oxygen, and the absorber systems for odors and water) and the related mechanical systems required to contain and operate these items. The supporting system comprises the hull of the living space, furniture, and other equipment or installations, air locks, astrodomes, space suits, and taxicapsules (small one-man capsules for commuting between interorbital space craft).

12477
Elkind, J. I., 1959
and C. D. Forgie
CHARACTERISTICS OF THE HUMAN OPERATOR IN SIMPLE MANUAL CONTROL SYSTEMS.—IRE Trans. on Automatic Control, AC-4 (1): 44-55. May 1959.

The human operator, in a manual control system, can modify his own characteristics in an attempt to match the requirements of the control situation. The characteristics of two different manual control systems (simple pursuit and compensatory) were measured with a family of gaussian input signals having power-density spectra with several shapes, bandwidths, and center frequencies. Experimental results, graphically expressed, show how the human operator characteristics depend upon input-signal characteristics. Simple analytic models that approximate the measured results are derived for both systems, and combined, provide a description of manual control systems that should be useful in design of control systems.

12478
Elkind, J. I., 1961
and D. M. Green
MEASUREMENT OF TIME-VARYING AND NONLINEAR DYNAMIC CHARACTERISTICS OF HUMAN PILOTS. — Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-7397); issued by Aeronautical Systems Division. Flight Control Lab., Wright-Patterson Air Force Base, Ohio (Project no. 8219, Task no. 82163). ASD Technical Report no. 61-225, Dec. 1961. viii+72 p.

A model matching or mimicking technique for measuring linear and nonlinear time-varying dynamic systems is presented. The use of orthogonalized exponential filters for the model is discussed. Relations for estimating the length of samples of system input and output required to determine filter weighting coefficients with given confidence limits are derived. A piecewise linearization technique, based on partition of system input space, is presented for measurement of nonlinear systems. Practical considerations in using the model matching method for measurement of human pilot dynamic characteristics are discussed. (Authors' abstract) (37 references)

12479
Ely, J. H. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. I. THE SYSTEMS APPROACH. — Electro-Technol., 67 (5): 110-111. May 1961.

Descriptions of two evolutionary stages in the application of engineering psychology to human factors engineering are presented: (1) the "knob and dial" period (involving the design of displays that would effectively present information to the operator and of controls that would permit him to manipulate the system with equal effectiveness); and (2) the "system" era (wherein the operator himself is considered as a system and also as a part of a larger system involving himself and the machine or machines with which he interacts); this man-machine system in turn is a part of a larger system comprised of teams of men and complexes of machines. Engineering psychology alone cannot assure that improving the performance of man, and sometimes of man-machine systems, will be of value to a specific designer or user; however, when teamed with systems analysis (whose consequences are a function of the unique requirements of each system and of goals of that system) useful answers are provided.

12480
Ely, J. H. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. II. METHODOLOGY IN ENGINEERING PSYCHOLOGY. — Electro-Technol., 67 (5): 111-112. May 1961.

The following methodological problems encountered in engineering psychology research are discussed: (1) the selection of subjects, (2) the advantages and disadvantages of laboratory and field research, (3) the evaluation of objective and subjective data, and (4) the study of low-probability events, such as errors and accidents. The subjects used in the research must be representative of the total population which is being considered. Thus, a few individuals with normal vision are adequate for studies of such activities as dark adaptation and peripheral vision, but for more complex types of behavior the subjects should conform to the user population in such characteristics as level of skill, motivation, and physical dimensions. The realism presented in field tests cannot always be duplicated in the laboratory (e.g., the weightlessness and anxiety stresses of actual space flight). In the laboratory, variables can be controlled and a variety of conditions can be presented and repeated exactly. Subjective data are advantageous in situations where the precise aspects of the phenomenon to be measured are unknown, such as that of placing value judgments on a given task performance, or in situations involving past critical incidents or general emotional reactions to work conditions.

12481
Fedorov, V. I. 1960
[CONSTRUCTION OF JET AIRCRAFT] Konstruktsiia reaktivnykh samoletov.—266 p. Moskva: Voennoe izdatel'stvo ministerstva oborony soiuza SSR, 1960. In Russian.

Chapter VI deals with the following topics of interest to aviation medicine: (1) construction, equipment, and instrumentation of the cockpit; (2) medical care of the flier (problems of oxygen lack, lowered barometric pressure, and cold); (3) construction of sealed cabins (ventilation, air regeneration, air pressure regulation, and humidity and CO_2 control); (4) oxygen equipment (oxygen apparatus, oxygen masks, and oxygen pressure reducers); (5) diving and pressure suits; (6) escape devices (several types of ejection seats and capsules); and (7) anti-g suits.

12482
Fogel, L. J., 1958
and M. Dwonczyk
ANTICIPATORY DISPLAY DESIGN THROUGH THE USE OF AN ANALOG COMPUTER.—IRE WESCON Convention Record, 1958 (part 4): 67-88. 1958.

Modern high-performance aircraft currently are pressing the limitations of the human operator. The increased speeds compress the allowable reaction time to such levels that logical decisions and even conditioned-reflex actions may no longer be possible. The only way to overcome this human limitation of manned aircraft performance is

through the incorporation of anticipatory displays, displays which offer a prediction of the various parameters so that the human operator is projected ahead of the system. An aircraft was analog-computer-simulated, data reduction was programmed, and the same computer was used to allow biophysical measurement, which furnished correlative measure. The effectiveness of various piloting techniques as well as prediction intervals was explored. The results indicated a first approximation to the design of improved displays through the use of anticipatory information. (Authors' abstract) (31 references)

12483
Folley, J. D. 1961
RESEARCH PROBLEMS IN THE DESIGN OF PERFORMANCE AIDS.—Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171004). ASD Technical Report no. 61-548, Oct. 1961. iv+51 p.

Performance aids are auxiliary devices provided to facilitate on-the-job performance by humans in man-machine systems. They may be included in the system at any stage of development, with their potential contribution greater if they are considered early, diminishing as their inclusion is delayed to later stages of system evolution. A number of research problems identified during preparation of a procedure for incorporating performance aids into systems are presented under five major headings that denote the logical steps involved in designing aids and integrating them into a system. Few of the issues and problems are new. Viewing them from the point of regard of performance aids, however, may provide a new emphasis and a new approach to the problems. Preliminary ideas on approaches to some of the problems are provided. The point is made that programmatic, multivariate research studies are needed to make significant progress on the problems. (Author's abstract)

12484
Gael, S., 1961
and L. E. Reed
PERSONNEL EQUIPMENT DATA: CONCEPT AND CONTENT.—Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171005). ASD Technical Report no. 61-739, Dec. 1961, iv+74 p.

Consideration of the degree of uncertainty surrounding Personnel-Equipment Data (PED), one of the Personnel Subsystem Elements (PSS), led to the present attempt to empirically define the content of PED, and to identify requirements contained in Military Specifications and related documents which can and often do, generate unnecessary duplicative effort. Eighteen documents deemed relevant to the study were scrutinized, and requirements calling for the submittal of data were extracted. A list of these requirements and their locations is presented. The amount of duplication tending to bring about redundant work effort was less than anticipated, but sufficient to provoke a good deal of concern. A few sources of unnecessary duplication of effort are discussed, and suggestions which can help eliminate duplication are presented. (Authors' abstract)

12485
Gaito, J., 1958
and E. C. Gifford
COCKPIT DESIGN STUDIES; STANDARD COCKPIT MOCKUP: DEVELOPMENT OF WORKSPACE AND SIZING CRITERIA THROUGH A FACTOR ANALYTIC TECHNIQUE.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-7052, Part 3). Report no. NAMC-ACEL-372, Feb. 28, 1958. v+8 p.

The eleven morphological features selected as the most important ones relative to workspace dimensions were reanalyzed by the diagonal method. It was determined that five variables would provide a satisfactory representation: height, weight, buttock-leg length, sitting height, and bideltoid diameter. The intercorrelations between measurements on the eight hand features (wrist circumference, hand length, palm length, hand breadth at thumb, hand breadth at metacarpal, thickness at metacarpal III, first phalanx III length, and finger diameter III) were analyzed by the diagonal method also. The results indicate that palm length and first phalanx III length may be discarded. (From the authors' summary and conclusions)

12486
Gerathewohl, S. J. 1959
EQUIPMENT FOR MANNED SPACE CAPSULES AND LUNAR BASES.—Bioastronautics Research Unit, Medical Research and Development Command, Office of the Surgeon General (Army), Washington, D. C. Special Report, Feb. 28, 1959. 28 p.

The construction of second and third generation boosters developing several million pounds of thrust leads by necessity to manned space flight. This not only requires the advancement of engineering capabilities and space technology, but also demands an acceleration of bioastronautical research and the projection of information already available into the region of outer space. Equipment variables which are thought to be significant for man's exploration and survival in space are discussed in this first report, and sets of research task necessary for the accomplishment of manned space missions are proposed. (Author's abstract) (31 references)

12487
Greider, H. R., 1961
and J. R. Barton
CRITERIA FOR DESIGN OF THE MERCURY ENVIRONMENTAL CONTROL SYSTEM, METHOD OF OPERATION AND RESULTS OF MANNED SYSTEM OPERATION.—Aerospace Med., 32 (9): 839-843. Sept. 1961.

In the development of the Mercury environmental control system, simplicity of design was a very important consideration. The decision to use 100% oxygen rather than a more complex gas mixture was made early in the program. Since fire hazard becomes an important consideration as oxygen increases, the minimum pressure for man, 258 mm. Hg or 27,000 feet equivalent altitude, was selected as the final capsule total pressure. The astronaut's metabolic rate during the mission is the real key for determining the quantity of supplies to be stored on board. Carbon dioxide within the capsule is removed by lithium hydroxide, and heat is removed by the system of evaporating water. The humidity is not controlled independently of temperature in the

suit system. The characteristics of the Mercury environment control system are diagrammed, and its functions during flight are described.

12488
Grodsky, M. A., and R. D. Sorkin 1960
MAN'S CONTRIBUTION TO AN OPERATIONAL SPACE STATION CONCEPT. — In: Proceedings of the Manned Space Stations Symposium, Los Angeles, Calif., April 20-22, 1960, p. 114-119. New York: Institute of the Aeronautical Sciences, 1960.

This paper was concerned with evaluating the possible contributions of man in a space station concept. An approach and criteria were developed as possible aids in deciding if this space system should be manned or unmanned. Decision making, maintenance behaviors, and control functions of man were discussed. Some environmental factors which might obviate the full impact of man's contributions to the system were also discussed. (Authors' summary)

12489
Gruber, A. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. III. INFORMATION SENSING AND PROCESSING. — Electro-Technol., 67 (5): 112-116. May 1961.

Descriptions and definitions are given of the stimulus-response activities of human receiving and reacting mechanisms. In complex man-machine systems, as well as in everyday living, information about external events is received primarily through the visual, auditory, and tactual senses. The kinesthetic and vestibular senses, which provide information about the position and motion of the parts of the body, are stimulated by internal conditions. The effects of various stimuli on these information receiving channels are compared (with emphasis on vision and audition), and general recommendations on the selection of the most suitable sensory channel for the input of certain types of information are made. Recommendations are also listed for improving human-information processing.

12490
Gunn, W. H. 1961
HUMAN ENGINEERING. — Air Line Pilot, 30 (5): 4-6, 22-23. July 1961.

An experienced pilot discusses potential hazards built into the design of some aircraft because engineers did not take into account human factors. The majority of these potential hazards lie in visual information presentation, in such areas as instrument design, systems and control design, etc. Other factors lie in comfort factors design where fatigue can result from discomfort. More human engineering is recommended to eliminate these hazards.

12491
Haessler, H. 1961
MAN-POWERED FLIGHT IN 1935-37 AND TODAY. — Canad. Aeronaut. Jour. (Ottawa), 7 (3): 89-104. March 1961.

A review of the flights of the Haessler-Villinger man-powered aircraft is presented along with photographs of the first flight. A description of the aircraft is given including the weight, performance times, the propulsion system and the control surfaces. Pilot specifications are discussed as to seating position, power movements (turning of pedals, as on a bicycle), and available man-power. Horsepower data taken from trained and untrained cyclists indicate that sustained flight of one hour's duration is possible. A proposal for a new man-powered aircraft is made, and the general specifications are given for restricted or unrestricted flights using either a trained cyclist or an average amateur.

12492
Handke, E. 1959
[THE INFLUENCE OF HUMAN CHARACTERISTICS ON AIRPLANE DEVELOPMENT] Der Einfluss menschlicher Eigenschaften auf die Luftfahrzeugentwicklung.—Deutsche Flugtechnik (Dresden), 3 (12): 355-360. Dec. 1959. In German.

A discussion is presented of the development of protective equipment, instrument systems, flight schedules, and flight conditions to meet the physiological needs of man in high-altitude, high-speed, and long-distance flight.

12493
Haviland, R. P. 1961
DESIGNING FOR MAN IN SPACE. — Spaceflight, 3 (3): 81-85. May 1961.

The results of a preliminary design investigation for a "zero g" manned rocket station are presented. This design incorporates principles resulting in the efficient use of volume and weight in consideration of aerospace dynamics and the biological needs of the occupants of the craft.

12494
Henderson, J. G. 1959
THE ESTIMATION OF THE TRANSFER FUNCTION OF A HUMAN OPERATOR BY A CORRELATION METHOD OF ANALYSIS.—Ergonomics (London), 2 (3): 274-286. May 1959.

The transfer-function of a human operator, acting as an element in a closed-loop control-system, was determined experimentally by a method of analysis based on correlation functions. Under certain conditions the transfer-function of the operator can be defined by an integral equation that relates a cross-correlation function of his response to an observed "error", to the auto-correlation function of that "error". It is shown how this integral equation can be solved approximately by a technique which uses an electronic analogue-computer. In this instance such a computer has been used to determine the parameters that will "best fit" an assumed form of transfer-function to the recorded data. The interesting features of the results are: (a) The time delay is fairly consistent, and its average value is 0.16 sec. (b) The reduction in the operator's gain, which occurs after increasing the display gain, results in a reduction of the natural frequency of his response and is associated with approximately a two-fold increase in the derivative of error term T_1; i.e., the operator tends to give more weight to the derivative of the error when his gain is reduced. (c) The damping associated with the "motor" system appears to be such as to give an almost critically damped response. (Author's summary and comments, modified)

12495
Hertzberg, H. T. E. 1960
DYNAMIC ANTHROPOMETRY OF WORKING POSITIONS. — Human Factors, 2 (3): 147-155. Aug. 1960.

The principles, data, and major information sources comprising the anthropological aspects of human engineering are reviewed. Adequate workspace design requires knowledge of the occupant's dimensions in static poses (sitting height, buttock-to-knee length, knee height, arm reach, etc.) and as he performs his work (including both the distances the occupant can move and the forces he can exert). The designer's task is even more complicated when many persons have to occupy the space. The fallacy of relying on the "average man" concept in such a task is indicated, and a more efficient method, the "design limits" concept or "range of accommodation" system, is described. This system employs an anthropometric-statistical approach based on reliable dimensions measured by standardized techniques on the population that will use the workspace. Some of the anthropometric, mechanical, and photographic methods which may be used for gathering static dimensions, and some of the techniques for measuring muscle force capability and mobility are reviewed. A discussion on human muscle strength during weightlessness is also presented. (26 references)

12496
Hoover, G. W. 1959
MAN-MACHINE CONCEPTS.—Astronautical Sci. Rev., 1 (4): 30. Oct.-Dec. 1959.

A rendezvous of space ships may be achieved by an automatic man-controlled system for guiding a vehicle into position. He may control remotely from a ship in orbit, from the ground, or from the rendezvous vehicle. An orientation display will be a paramount factor in the pilot's ability to carry out such a task as well as his experience and skill.

12497
Hoover, G. W. 1958
MAN'S OPERATIONAL ENVIRONMENT IN SPACE. Advances in Astronautical Sciences, 3, p. 4-1 to 4-12. 1958.

Essentially the same: THE MAN-MACHINE SYSTEM IN SPACE VEHICLES.—Advances in Astronautical Sciences, 4: 405-417. 1959.

A discussion is presented on the problems confronting the designer of a space ship with regard to the man-machine system. The operational environment must conform as closely as possible to man's terrestrial environment both physiologically and psychologically. It must be a decision-making environment requiring little training or rehabilitation and provide the operator with the proper display of required information so completely integrated that he can perform as a link in the system. The system must not have redundancy except where redundancy is an asset rather than a liability. It must require an absolute minimum of maintenance and permit inflight repair. In addition, the environment must permit complete survival under any emergency. Given this environment, man can operate his space ship with maximum efficiency and comfort, and a minimum of emotional stress, for long periods of time to almost any distance.

12498
Hopkins, C. O. 1960
DETERMINATION OF HUMAN OPERATOR FUNCTIONS IN A MANNED SPACE VEHICLE. — IRE Trans. on Human Factors in Electronics, HFE-1 (2): 45-55. Sept. 1960.

A practical methodology is described for determining the human operator functions within the context of a space mission. Using a space ferry mission (involving travel in both directions between the earth and a satellite orbiting the earth) as an example, it is indicated that the human operator may be profitably used in the performance of the following general classes of functions: (1) selection from among several sensing devices of the one to be used for providing control information, (2) manual operation of certain sensing devices, (3) transmitting to the system information acquired from auxiliary sensing devices, (4) limited processing of data from sensors by means of tables, graphs, and perhaps a manually-operated calculating machine, (5) manual control of vehicle attitude and main propulsion system in certain modes of system operation, (6) evaluation of the state of system in the light of planned mission requirements and the occurrence of unfavorable events, and (7) designation, and in some cases, execution of alternate basic system programs as a result of the evaluation of the state of the system. (From the author's summary)

12499
Hosken, B. 1959
ENGINEERING PSYCHOLOGY BRANCH BIBLIOGRAPHY. — Naval Research Lab., Washington, D. C. Aug. 1959. 20 p. AD 226 398

This is an up-to-date bibliography on human engineering, containing 134 references. It is a revision of a previous compilation by D. Fallon issued in July 1957.

12500
Huebner, W. J., and B. C. Ryack 1961
LINEAR PROGRAMMING AND WORKPLACE ARRANGEMENT: SOLUTION OF ASSIGNMENT PROBLEMS BY THE PRODUCT TECHNIQUE.— Wright Air Development Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 71619). WADD Technical Report no. 61-143, March 1961. iii+21 p.

The applicability of linear programming to assignment problems which arise in connection with work space arrangment is demonstrated. To solve problems of this nature, a method termed the "product technique" was developed. Compared with other linear programming techniques, the product technique has simplicity and direct relevance to problems in the human factors area. Several modifications of the technique are discussed. (Authors' abstract)

12501
HUMAN FACTORS OF REMOTE HANDLING IN ADVANCED SYSTEMS SYMPOSIUM. — Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab. Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). ASD Technical Report no. 61-430, Sept. 1961. vii+192 p.

This report compiles the 14 papers presented at the Human Factors of Remote Handling in Advanced Systems Symposium, sponsored by the Aerospace Medical Laboratory in April 1961. Human factors in remote handling as viewed by the psychologist and the engineer are discussed. Problems of operator selection and training are presented and manned and unmanned ground support equipment for nuclear-powered aircraft are reviewed. Space environmental constraints on extra-vehicular space operations are assessed. A representative remote-handling system for space operations is described and a 3-dimensional color television system for remote handling is analyzed and evaluated. Human factors in design of remote-handling equipment are discussed. (Author's abstract)

12502
IMPROVING COCKPIT VISIBILITY FROM PRESENT AND PROPOSED AIRCRAFT.—Soc. Exper. Test Pilots Quart. Review, 3 (2): 52-94. Winter 1959.

This section contains five papers by various authors and a discussion on cockpit visibility. Eye movement and visibility within the cockpit were measured in humans and by means of double-lens cameras. In a test to determine minimum tolerable visibility area, approximately 30% of the available windshield area of the L-19 could be masked off before the pilot's flying technique was radically influenced. It is concluded that the pilot should be given as much windshield area as other limiting factors will allow, that the limiting factors be overcome by vision augmentation devices and proximity warning indicators, and that the aircraft should be made as conspicuous as possible. Visibility requirements in supersonic jet transport type aircraft are also listed.

12503
Jackson, K. F. 1958
BEHAVIOR IN CONTROLLING A COMBINATION OF SYSTEMS.—Ergonomics (London), 2 (1): 52-62. Nov. 1958.

An experiment, which employed a multiple control tracking set-up presenting continuously variable information, was designed to reveal how alterations in the characteristics of the task affect the pattern of the operator's performance and to show the extent and means by which he can overcome increases in the difficulty of the task by adapting himself to the needs of the situation. Twenty subjects were tested. An analysis of variance was carried out on the individual results of the following five main measures: the modulus mean error for interruption and for control movements, the average duration of interruptions and control movements, and the number of movements per trial. All measures were shown to differ significantly between different numbers of dials. It is concluded that, although with increased load the over-all standard of work deteriorates, it does not deteriorate as a simple function of the number of systems, since the operator counters it by varying modes of adaptive behavior, e.g., increasing the over-all speed of work. On the other hand, his ability to make useful anticipatory adjustments of the controls fades with increasing complexity of the task.

12504
Javitz, A. E. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. INTRODUCTION: CONCEPTS, THEORY AND APPLICATIONS. — Electro-Technol., 67 (5): 108-110. May 1961.

Human factors engineering is defined as a research and design activity based on the concept that man is an organic component in many systems. Thus, human factors studies are concerned with the totality of man-machine-environment interactions and deal with both the behavioral properties of man and the actual engineering of the total system to achieve optimum performance. Human factors engineering has its structural beginnings in the union of applied information (derived from time and motion studies, communications theory, and control engineering) with scientific data provided by the behavioral sciences (psychology, physiology, anthropology, and sociology) which are supported, in turn, by the classical sciences (biology, physics, and chemistry). Of the behavioral sciences, psychology has become the primary experimental research arm of human engineering: certain fundamentals of engineering psychology as the scientific basis of human factors engineering are briefly summarized.

12505
Johnson, C. W. 1959
ADAPTIVE SERVOMECHANISMS.—IRE Trans. on Med. Electronics, ME-6 (3): 134-140. Sept 1959.

The control engineer's approach to the problem of developing servomechanisms which exhibit some degree of adaptive behavior is presented. Several categories of adaptive systems are discussed and an attempt is made to associate the operating principle of the systems in each category with the behavior of the human being when he acts as a controlling device. A particular system developed for application in the field of automatic flight control is discussed from a functional point of view. The controller, using an analog model which operates on the input information, determines a "standard of performance" for the controlled element which closely approximates the performance desired by an experienced operator. The remainder of the controller, using a very simple passive network as a switching function computer to determine the state of a bistable device, forces the controlled element to operate in such a manner as to minimize continuously the error between the desired performance and the actual performance. The controller exhibits adaptive behavior in the sense that it operates in such a manner as to keep the actual performance of the system practically invariant, although the parameters of the controlled element change over a relatively wide range of values. (Author's summary)

12506
Johnson, R. H., 1961
D. A. Gordon, B. Bergum, and W. E. Patterson
COED — A DEVICE FOR THE EXPERIMENTAL STUDY OF MAN-MACHINE SYSTEMS. — Human Factors, 3 (1): 60-65. March 1961.

A description is given of an experimental facility for investigating man-machine system design problems. The facility is called the COED (Computer Operated Electronic Display). It combines a very large capacity cathode ray tube (Digitron) with a high-speed computer (IBM 704). This device may be used to simulate very broad classes of man-machine systems. It provides programmed feedback, in which the display changes as it would

if controls of the actual system were activated. The components of the COED simulator, as well as its programming and uses, are briefly described. The device may be employed to solve problems of allocation of function (man-machine), and those involved in the design of controls, displays, and procedures of use. (Authors' summary)

12507
Johnston, R. S. 1960
MERCURY LIFE SUPPORT SYSTEMS.—In: Life Support Systems for Space Vehicles, [Article 1], 22 p. Institute of Aeronautical Sciences, New York. Sherman M. Fairchild Publication Fund Paper no. FF-25, [1960].

An environmental control system capable of supporting one man for up to 28 hours of space flight has been developed. The system incorporates a 7500 p.s.i. oxygen supply for breathing and pressurization; a full-pressure suit and suit-control system are installed as a backup to the cabin pressurization system and to control body ventilation and remove metabolic by-products. Temperature control is provided by water evaporator-type heat exchangers. The environmental control system will be utilized in all flights of the Mercury capsule. A man-simulator will be installed in the capsule to load the environmental control system on all nonbiological flights. Primates will be supported by the system in the animal phase of the project. An environmental control test capsule will be obtained for installation in an altitude chamber for astronaut training and additional test programs. (Author's summary)

12508
Kahn, A. 1961
EXPERIMENTAL PSYCHOLOGY...A NEW VARIABLE IN DESIGN. — Westinghouse Engineer (Pittsburgh), 21 (4): 112-116. July 1961.

The application of psychological research techniques to the design of man-operated equipment is considered. Much of the experimental work done in this field is classified into four major categories: (1) the relationship between the characteristics of the eye and radar display design; (2) the relationship between man's perceptive capability and the reconnaissance system design; (3) the human as a processor of information; and (4) man's characteristics as an integral part of a tracking system.

12509
Kelley, C. R. 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. V. MAN AND THE CONTROL PROCESS. — Electro-Technol., 67 (5): 119-121. May 1961.

The following topics are discussed: (1) devices which extend man's capabilities (measuring, transitional, and control devices); (2) important characteristics of controls (location-identification, transmission of energy, and transmission of information); (3) some of the factors which influence the effectiveness of a control in transmitting information from a man into a system; and (4) man and the control system involving open vs. closed-loop control, man as a control system operator, and man as a control system element. This stresses two quite different roles that man plays with respect to the control system: (a) he supplies the system input, and (b) he may serve as an element in the system. Despite his limitations, in many systems man still forms the finest control element available; consequently, the time is not near when the control system director will be the sole focus of attention in human factors engineering.

12510
Klein, S. J., and C. F. Gell 1958
AVIATION HUMAN ENGINEERING IS A SCIENTIFIC SPECIALTY!—Jour. Aviation Med., 29 (3): 212-219. March 1958.

In the past the problem of the increased demands upon aircrews presented by the development of newer aircraft has been met by improved selection and training procedures rather than by improved design. In the future, a bilateral approach is necessary which will determine the human factors involved in a system and train men to operate a machine designed accordingly. Since psychologic methodologies are readily applicable to human-engineering problems, the psychologist has collaborated with other specialists such as the physiologist, biophysicist, and anthropologist in human-factors research. However, because of the shortage of specialists and breakdown of communication between the engineer and scientist, there has been a growing tendency to assign human-factors research to engineers with limited biological and psychological training. A solution to the problem can be found in the recruitment of specialists and in increased efforts by scientists to communicate more effectively with engineers.

12511
Krendel, E. S. 1960
DESIGN REQUIREMENTS FOR MAN GENERATED POWER. — Ergonomics (London), 3 (4): 329-337. Oct. 1960.

A scheme is presented for designing man-powered devices for optimal power transfer from human operator to mechanism. This scheme is a mathematical description of human dynamics in terms of components capable of storing and releasing energy. Such a description provides a notion of the information required for the engineering design of man-machine systems and indicates a possible direction for potentially fruitful research. Studies conducted by other workers, demonstrating that the measurements and theoretical considerations relating to individual muscle fibers can be used to predict the performance of the gross anatomy of the body, are reviewed. Data on the efficiency of muscular work and human power output are discussed. In addition, certain data for human power generation by handwheels and pedals are presented in terms of short duration and sustained efforts. (Author's abstract, modified)

12512
Kurke, M. I. 1961
OPERATIONAL SEQUENCE DIAGRAMS IN SYSTEM DESIGN. — Human Factors, 3 (1): 66-73. March 1961.

Operational sequence diagrams (OSD) pictorially display information-decision-action sequences within a man-machine system. In its various versions as a time-sequence process chart, a spatial flow chart, and as an adjunct to symbolic logic, the OSD can be used in establishing system requirements, allocating man-machine functions, determining sequence of operations, and in evaluating equipment layouts. (Author's abstract)

12513
Kurke, M. I. 1959
PERSONNEL VARIABLES IN THE ANALYSIS OF MAN-MACHINE SYSTEMS.—Ergonomics (London), 2 (4): 349-353. Aug. 1959.

In an experiment comparing the detectability engendered by four optical systems, additional data concerning certain characteristics of the subjects were collected. Analysis of the data led to the conclusion that although variations of equipment design produced significant differences in the performance of a simple psychomotor task, the personnel variables of mental ability and attitude also had significant effects. It is suggested that the design of a man-machine system should take into account both personnel and design considerations if the best human contribution to the system's effectiveness is to be achieved. (Author's abstract)

12514
Loret, B. J. 1961
OPTIMIZATION OF MANNED ORBITAL SATELLITE VEHICLE DESIGN WITH RESPECT TO ARTIFICIAL GRAVITY. — Air Univ. Institute of Technology, Maxwell Air Force Base, Ala.; issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). ASD Technical Report no. 61-688, Dec. 1961. vi+46 p.

A design envelope is established as the result of a human factors analysis of the artificial gravity environment peculiar to rotating space vehicles. The envelope is prescribed by: an upper limit on vehicle angular velocity of 0.4 radian/second to minimize the occurrence of "canal sickness"; a basic upper limit on artificial gravity of 1 g; and a basic lower limit on artificial gravity of 0.2 g as the lowest value of g at which man can walk unaided. Both g-limits are modified to compensate for Coriolis forces which cause variation in g-level for tangential walking inside the rotating vehicle. An upper limit on vehicle radius of 180 feet is established on the basis of engineering practicality. The optimum vehicle configuration is established as a Modified Axially Expanded Dumbbell, characterized by a single, cylindrical, living-working compartment oriented parallel to the spin axis, counterbalanced by other vehicle components. The configuration is illustrated in the conceptual Pseudo-Geogravitational Vehicle, which has a radius of 180 feet and an operational angular velocity of 0.4 radian/second to produce 0.9 g in the living-working compartment. (Author's abstract)

12515
McRuer, D. T., and E. S. Krendel 1959
THE HUMAN OPERATOR AS A SERVO SYSTEM ELEMENT. I.—Jour. Franklin Inst., 267 (5): 381-403. May 1959.

A synthesis of the available data on the dynamic characteristics of human operators in certain continuous control tasks is presented in control engineering terminology. In order to express the human behavior description in terms which are compatible with conventional descriptions of control system components, a quasi-linear mathematical model is used for the human operator. The model is composed of two components: a describing function and a remnant. The describing function, which for a linear system is identical with the conventional transfer function, is established to characterize that portion of the operator's output which is linearly correlated with his input. The input, upon which the describing function is based, is selected on the basis of a priori estimates of the nature of certain human nonlinear behavior. Human output power which cannot be characterized by the operation of the describing function on the input is designated as the remnant. After presenting the analytic basis for measurements of human dynamics, steady-state describing functions measured by various experimenters in the field are discussed and the adaptive, optimalizing behavior of the human operator is demonstrated. The remnants are also discussed, and plausible sources for their origin are postulated. Knowledge of the range of parameter adjustment of which the human operator is capable in his adaptation, as well as knowledge of his criteria for adjusting these parameters, enables the designer to specify input functions and operator-controlled dynamics compatible with both desirable human-operator behavior and good system performance. By judiciously trading off system complexity against operator preferences, while still making proper engineering use of the human operator's adaptability, a control system may be optimized for both performance and reliability. (From the authors' summary)

12516
Matheny, W. G. 1961
HUMAN OPERATOR PERFORMANCE UNDER NON-NORMAL ENVIRONMENTAL OPERATING CONDITIONS.—In: Human factors in jet and space travel, p. 78-111. Ed. by S. B. Sells and C. A. Berry. New York: Ronald Press, 1961.

In sending a man into the hostile environment of space, the first concern is that of protecting him against permanent or even temporary damage. The next question is that of man's effectiveness in performing perceptual, cognitive, and motor functions in his capacity as explorer or in controlling the vehicle. The problem can be studied by employing a servo-model, which serves to facilitate communication among the disciplines in thinking about the problems connected with man-machine operations as well as provide a common frame of reference for formulating both the problems and their solutions. In space the performance of a man may be affected by weightlessness, high positive or negative acceleration, hypoxia, and temperature variations. Man is also peculiarly susceptible to the deterioration of his complex mental processes, sometimes as a function of minor changes in the environment. This fact suggests the exercise of more caution when thinking about the use of human operators in a man-machine system. (35 references)

12517
Matheny, W. G. 1959
CONSIDERATION OF HUMAN FACTORS IN HELICOPTER DESIGN.—North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development. Report no. 28, May 1959. iii+13 p.

This report discusses the human factor problem in helicopter design, mainly those factors affecting operation and control. It consists of two main parts: one dealing with the stability of the vehicle and the other with the display of information to the pilot to enable him to operate the aircraft under instrument conditions. The latter is part of the research being

carried out under the Army-Navy Instrument Program. (Author's summary)

12518
Mayo, A. M. 1958
THE HUMAN FACTOR IN ROCKET AND MISSILE CONTROL. — Fusées (Paris), 3 (4): 196-197. 1958. In English.

Abstract of item no. 8146, vol. VI, 1957.

12519
Mayo, A. M. 1961
MAN-MACHINE SYSTEMS IN SPACE VEHICLES. [Abstract]. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 215-216. 1961.

The selection of a direct or remote-control system for a given space vehicle can be determined by the feasibility of providing the necessary information and control-communication links over the operational distances and in the environment involved. An effective man-machine system for space vehicles requires: (1) adequate definition of the mission; (2) determination of information and control requirements; (3) provision of display and control configuration requirements; (4) design and development of appropriate data for sensing, computing, communication, display, and control equipment; (5) insurance of an environment adequate for the operator; and (6) testing in the operational environment to insure meeting mission objectives. Recent advances in micro-electronics, communication, and control equipment indicate a potential for rapid progress in man-machine systems for space exploration missions. (Author's abstract, modified)

12520
Mayo, A. M. 1958
OUTLINE HUMAN ACTIVITY IN SPACE CABIN DESIGN PERSONAL EQUIPMENT.—In: Syllabus of filmed lectures on space technology, p. 1-12. Univ. of California. Engineering Extension and Physical Sciences Extension [no place]; issued by Diamond Ordnance Fuze Labs., Washington, D. C. [Unnumbered report], April 1958.

An outline is given of the environmental, physiological, and psychological requirements of human operators in space cabins. The requirements comprise the man-machine system, protection and shielding, space cabin environment, and physiological and psychological provisions.

12521
Mayo, A. M. 1959
SPACE CABIN DESIGN.—Astronautical Sci. Rev., 1 (4): 30. Oct.-Dec. 1959.

Data from physiological tests, coupled with information from early orbital operations, will serve as the foundation for detail design criteria for the crew station of the maneuverable satellite and for rendezvous operations. Success of these difficult operations will depend on clear thinking and emotional stability of the crew, and possibly on the use of remotely controlled robot devices in lieu of human movements to perform required tasks.

12522
Morawski, J. 1961
[THE ROLE OF THE HUMAN FACTOR IN CONTROL SYSTEMS] Rola czynnika ludzkiego w układach sterowania. — Archiwum budowy maszyn (Warszawa), 8 (4): 369-409. 1961. In Polish, with English summary (p. 408-409).

The function of the human operator within a man-machine system is described enumerating the advantages of the human brain over the limitations of computers. However, utilization of the human factor is often limited by the delayed reaction time. For the most effective utilization of man within a system the tasks allocated to the human operator should exceed in complexity those of the equivalent proportional link and, due to the limitations of the human sensory system, the maximum transmitted frequency of signals should be within the band of 3 rad./sec. (approx. 0.5 cycles per second). These conditions may be met either by introduction of correction links within the control system or by proper selection of items of information conveyed to the operator. Experimental studies of the compensatory and pursuit systems in instrument landing are described in illustration of the above.

12523
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HAS OUTLINE FOR MANNED SATTELITE PROGRAM.—Science (Washington), 129 (3344): 256-258. Jan. 30, 1959.

The National Aeronautics and Space Administration has released information concerning its manned satellite program ("Project Mercury") and has announced the selection of McDonnell Aircraft Corporation for the final design, development, and construction of a man-carrying space capsule. Preliminary plans for the capsule are presented, and its structure, life support system, instrumentation, control procedures, and mechanism are briefly described. The capsule will be launched by an intercontinental ballistic missile. An escape device will insure safety of the passenger in case of an unsuccessful launching attempt. At any point during the flight of the capsule, it will be possible for either the pilot or ground-control personnel to set re-entry or recovery mechanisms in operation. A drogue parachute will be employed for stabilization in descent, and final safe landing will be achieved by a second parachute, which opens automatically at a given speed. The capsule will be buoyant and stable in water. The principal element of the recovery system is the "impact bag", whose design has not been decided yet. The predicted impact area will be covered by elaborate recovery aids. In conclusion, names of agencies responsible for different aspects of development and control of Project Mercury are listed.

12524
Payne, F. A. 1960
WORK AND LIVING SPACE REQUIREMENTS FOR MANNED SPACE STATIONS.—Aero Space Eng., 19 (5): 34-35. May 1960.

Adequate spatial accommodations for sleeping, eating, cooking, recreation, medical facilities, and clerical activities must be combined with attractiveness of surroundings in order to counteract the monotony and boredom which derive from isolation with an unchanging set of people. Aside from living space efficiency and attractiveness, the problem of artificial gravity is also a fundamental issue in space station design. Certain functions of a station, such as tracking and command communications, will be expedited by having a nonrotating reference at zero g (the hub of the station). Working and living areas are

likely to have different standards of g pressure, regulation, noise levels, safety, and comfort and should be separated. Artificial gravity conditions should be provided in both areas, with greater meteoroid protection in the form of double-wall construction being provided for the "shirt-sleeve environment" of the off-duty area. Such protection for the "space suit environment" of the equipment and maintenance area is not indicated.

12525
Pepler, R. [D.] 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. VIII. ENVIRONMENTAL STRESS. —— Electro-Technol., 67 (5): 126-128. May 1961.

Five examples of human factors research are cited to illustrate some of the problems of the effect of the physical environment on man and his ability to perform skillfully as part of a complex man-machine system. These examples are concerned with the psychological, physiological, and anthropometric effects of such environmental stresses as heat, cold, oxygen lack, noise and vibration, acceleration, weightlessness, and sensory deprivation.

12526
Pogrund, R. S. 1961
HUMAN ENGINEERING OR ENGINEERING OF THE HUMAN BEING – WHICH?—Aerospace Med., 32 (4): 300-315. April 1961.

The complexity of engineering for the comfort of the human being as an astronaut in a space vehicle is emphasized. This complexity is described as a function of mission duration, as well as a function of operational requirements and performance capabilities expected of the human occupant. Where high levels of performance are not required, as during very extended space missions, aids toward "engineering" the human being have been suggested with the aim toward compromising the rigid requirements assigned to the human engineer for space capsule design of internal environment. The aids have been drawn from (1) pharmacological concepts, such as chemical agents for radiation protection and motion sickness; (2) the application of hypothermia for increased tolerance to radiation, and also for psycho-physiological problems; (3) long-term pretraining for adaptation to psychological and physiological stresses; and (4) the use of Yogi practice for voluntary control of certain psychophysiological functions ordinarily considered to be under involuntary or autonomic control for Western man. (Author's summary, modified) (79 references)

12527
Pollack, I. 1959
MESSAGE UNCERTAINTY AND MESSAGE RECEPTION.—Jour. Acoust. Soc. Amer., 31 (11): 1500-1508. Nov. 1959.

The fundamental principle of language engineering – namely, that the probability of a correct message reception is critically dependent upon the size of the set of messages available for communications – was examined experimentally. Accuracy of message reception was found to be independent of the message-source uncertainty, but critically dependent upon the response uncertainty, or more exactly upon the size of the set of relevant response categories. Implications for a conceptual model of the listerner's behavior are suggested. (Author's abstract)

12528
Ross, R. E. 1961
ECOLOGICAL CRITERIA FOR AN INTERSTELLAR ROCKET RELAY STATION. —— Advances Astronaut. Sci., 6: 328-356. 1961.

The problem of assessing the over-all efficiency of men and mechanical equipment confined in a limited space such as an interstellar relay station requires a precise workable approach. The rewards for making the problem accessible to mathematical treatment are several. Not only may a general formula for approximating spatial requirements be derived, but it is also possible to set up dependable functional equations for such seeming imponderables as human caprice, chance interactions between men and equipment owing to externally induced accidents, and system depreciation. By appropriately varying the values of coefficients and weighted exponents in a large-scale factorial design, by testing simulated models of man-machine interface, and by monitoring the analogs of pulsed synapses (varying the time and the induced-effect inputs), one can determine a system's operating potential, information entropy, and economic value. (From the author's abstract)

12529
Sapounov, O. K. 1959
SOVIET EARTH SATELLITES.—Inst. Petroleum Rev. (London), 13 (149): 141-146. May 1959.

The theoretical development, the carrier-rocket design, and the instrumentation of Sputniks I-III are summarily discussed. The discussion of instrumentation includes a general description of the cabin environment surrounding the experimental dog, Laika, in Sputnik II. A rough diagram illustrates the relay of information on the dog's physiological responses to cosmic rays, solar radiation, and weightlessness, from the satellite to registration instruments on the ground.

12530
Saul, E. V., 1958
M. W. Raben, L. B. Seronsy, and L. Weiner
HUMAN ENGINEERING BIBLIOGRAPHY 1956-1957. —Tufts Univ. Inst. for Applied Experimental Psychology, Medford, Mass. (Contract Nonr 434 (13)); issued by Office of Naval Research. ONR Report no. ACR-32, Oct. 1958. [360] p.
AD 205 931, PB 131507S

This bibliography provides a compilation of references to the human engineering literature which reflects acquisitions of the Human Engineering Information and Analysis Service, Tufts University, during 1956-1957. Included are: (1) a topical outline which defines over 300 topic headings established for this bibliography, (2) an index which associates approximately 1400 bibliographic entries with the topic headings, (3) an alphabetic index of the common search terms which would aid those using this bibliography but who are unfamiliar with the topic headings, (4) an annotated bibliography of some 1400 citations, and (5) an index of the authors of these citations.

12531
Shternfeld, A. 1958
[ARTIFICIAL SATELLITES] Iskusstvennye sputniki. —2nd edition. 269 p. Moskva: Gosudarstvennoe Izdatel'stvo Tekhniko-Teoreticheskoi Literatury, 1958.

English translation issued by Technical Documents Liaison Office, Wright-Patterson Air Force Base, Ohio. [Unnumbered Report, 1959.] viii+424 p.
PB 141351 T

This publication attempts to describe the method of launching artificial satellites, their availability for scientific purposes and as interplanetary stations, and the expected conditions of life on such satellites. The eleven chapters consider the laws of motion of artificial satellites, motion of the satellite relative to an observer on Earth, the rocket starter of the artificial satellite, launching requirements, construction and testing of rockets, medical and engineering problems, communication with Earth, descent to Earth, artificial satellites of bodies of the solar system, and the utilization of artificial satellites.

12532
Siegel, A. I., and J. J. Wolf 1961
A TECHNIQUE FOR EVALUATING MAN-MACHINE SYSTEM DESIGNS. —— Human Factors, 3 (1): 18-28. March 1961.

A computer-based method for digitally simulating the performance, in one-operator systems, of operators who possess various characteristics is described. The method is believed applicable for evaluating various system designs while the system is in the early design stage. Two operational tasks, landing an F4D aircraft on a carrier and firing an air-to-air missile, were simulated using the method. The predictions from the model were compared with outside criterion data for the same tasks. The predictions are held to conform generally with reality and to be reasonable. The results of the two applications of the model were in general agreement. It is held that the model may be considered sound and may now be tentatively employed for comparative evaluation of alternative system designs or for predicting system performance. (Authors' abstract)

12533
Smith R. A. 1958
THE MANNED SATELLITE STATION.—In: Space research and exploration, p. 152-163. New York: William Sloane, 1958.

The possibility of constructing a manned satellite station to provide experimental long-term space environments and a high-frequency wave relay station is discussed. The conditions to be met before a manned satellite becomes possible include: construction in space from many loads delivered by a number of rockets; illumination problems due to intense sunlight on one side and darkness on the other; establishment of proper living quarters for the crew; cabin atmosphere maintenance; meteor bombardment and cosmic radiation hazards; and ferry service for the replacement of expendable stores.

12534
Stone, I. 1958
GRAVITY, HEAT, AFFECT SPACE CABIN DESIGN. — Aviation Week, 69 (14): 30-31. Oct. 6, 1958.

Various problems concerning human engineering of space cabins, outlined by E. G. Aiken at the National Aeronautic Meeting of the Society of Automatic Engineers, are reviewed. A non-elastic "immersion suit" filled with water would greatly enhance man's tolerance to g-forces; since the specific gravity of blood is quite similar to that of water, there would be no major blood displacement even under very severe accelerations. To combat weightlessness, constant tension springs would serve to add an artificial pull on the limbs. Firm body restraints attached to the seat would add to the pilot's ability to orient himself and prevent uncontrolled movements during sleep. Instruments indicating air temperature and radiant heat levels in the cabin are necessary to compensate for man's inability to recognize dangerous temperature changes. Chemical oxygen systems and chemical CO_2 absorbers are no longer sufficient to maintain an adequate atmosphere. Instead, regenerative systems (biological photosynthesis by algae and photolysis of CO_2 with the production of O_2) will be required. Two types of heat pumps for heat transfer to and from external radiation surfaces are mentioned: one in which a working fluid absorbs the heat and transfers it at an elevated temperature to a radiating surface; the other in which heat is absorbed in a cold junction by passage of electric current through the junction. Storage of gases in chemical form ready for rapid development would provide for pressure-loss emergencies. Finally, provision of duplicate systems and accessible equipment for maintenance purposes is recommended.

12535
Stubbs, R. A. 1960
SOME ENGINEERING CONSIDERATIONS FOR THE MANNED ORBITING VEHICLE. —— Canad. Aeronaut. Jour. (Ottawa), 6 (9): 375-379. Nov. 1960.

A discussion is given of the pressure, temperature, and atmospheric requirements of the cabins of manned space vehicles. Human tolerances to acceleration, noise, and vibration during launch, to zero gravity during the orbital phase, and to heating and deceleration during re-entry, are also discussed. Consideration is given to radiation hazards and shielding requirements during space flight.

12536
Taylor, F. V. 1959
THE HUMAN AS AN ENGINEERING COMPONENT. —A.M.A. Arch. Indus. Health, 19 (3): 278-282. March 1959.

When the operator of a machine is viewed as a system component, it becomes apparent that he possesses both useful and limiting properties. The former includes: flexibility, self-adjustment, response to meta-information, modal redundancy and homeostasis, mechanical independence, and energy storage. A few of the human's more important limitations are: lack of standardization, limited bandwidth, transport delay, imprecision, variability, and noise. When designing man-operated machines these properties are considered in order to produce an instrument of great power.

12537
Thompson, G. V. E. 1961
HOW TO MAKE A MAN FEEL AT HOME IN SPACE. —— Engineering (London), 191 (4959): 623. May 5, 1961.

Design requirements for the manned space capsule include provisions for: (1) satisfaction of basic human needs; (2) protection against unfavorable environments; and (3) adaptation of the passenger to the stresses associated with take-off, the

weightless state, and landing. Brief consideration is given to the orientation of the pilot's couch, the use of seat belts, size and cushioning of the cabin, possible additional living quarters, oxygen, temperature and humidity levels, food provision, space suit design, and the difficulties associated with adequate protection against radiation.

12538
Tolcott, M. A., and A. P. Chenzoff 1961
ENGINEERING PSYCHOLOGY AND HUMAN FACTORS IN DESIGN. 4. FACTORS IN DECISION MAKING. —— Electro-Technol., 67 (5): 116-119. May 1961.

The designer of a man-machine system must select the decision-making steps which should be pre-programmed for machine execution and those steps which should be taken by humans operating at various levels within the system. Current basic research on the two main approaches to the subject of decision making is reviewed: (1) the "prescriptive" approach (adopted by mathematicians, economists, game theorists and statistical-decision theorists) which emphasizes what a completely rational decision maker should do when presented with a set of alternatives, among which he must choose, and (2) the "descriptive" approach (adopted by the psychologists and sociologists) which is concerned with how humans actually behave when faced with a decision situation. A detailed discussion and schematic diagram of the steps in the logical decision-making process, which combine the two approaches, are presented. It is predicted that humans will continue to be utilized in several roles which are essential in the decision-making process in man-machine systems, such as (a) estimation of the likelihood of future contingencies, (b) assignment of values (or losses) to each possible outcome, (c) establishment of a risk philosophy, (d) recognition of indications of low-probability events, and (e) review of selected actions before they are implemented.

12539
Trapp, R. F., M. W. Hunter, and E. B. Konecci 1960
MANNED NUCLEAR SPACE SYSTEMS. II. LOW-THRUST NUCLEAR SYSTEMS.—Aero Space Eng., 19 (2): 49-54. Feb. 1960.

A low-thrust nuclear space vehicle is suggested for the performance of certain space-travel functions. The unattractive features of the system are its low escape velocity, longer mission time, and resultant greater exposure to radiation hazards. Permissible radiation levels are discussed on the basis of literature data. Radiation hazards are encountered in leakage from the nuclear reactor and in exposure to the Van Allen belts, to solar flares, and to corpuscular streams. Problems of shielding are discussed. For a Martian mission of three years' duration allowing a payload weight of 85,000 lbs., a nonregenerative ecological system of 49,000 lbs. is indicated. Atmospheric cooling and content control, combined with a water recycling system, would reduce the sustenance requirement to about 9 lbs./man/day. The use of algae as a gas exchange mechanism and partial regenerative scheme could reduce the food requirement to 2 lbs./man/day.

12540
Welch, L. 1961
GLIDING AND MAN POWERED FLIGHT. —— Jour. Royal Aeronaut. Soc. (London), 65 (612): 807-814. Dec. 1961.

The relationship between man-powered flight and gliding is presented in sections on the use of man as an auxiliary engine on a glider, the configuration of a man-powered aircraft, and the piloting of the aircraft. The performance of the modern glider and the application of available manpower are discussed as to speed, weight, and rate of climb. The size and weight of the plane, the wingspan, the wingtip heights, controls and instrumentation are given in the design aspects of the craft. Methods of handling the airplane on the ground and during flight tests are discussed. Six types of launching methods are evaluated and some brief aspects of pilot selection are given. The design of the flight course as given in the rules for the competition for the Kremer prize are stated and criticisms of these rules are discussed.

12541
Wells, R. 1961
ALIVE IN SPACE: THE SCIENCE OF BIO-ASTRONAUTICS. —— 180 p. Boston: Little, Brown and Co., 1961.

This is an illustrated treatise on space flight dealing with the following topics: space instruments, space mechanics, space vehicle, weightlessness in space, living in space, safety in space, crewmen in space, man's mind in space, training for space, science in space, and the will to space.

12542
Wells, W. G. 1961
MAN-POWERED FLIGHT. —— Canad. Aeronaut. Jour. (Ottawa), 7 (5): 221. May 1961.

Reference is made to H. Haessler's paper (item no. 12491) in which it is stated that the ideal crew for a man-powered aircraft is one. The author feels that for a man-powered airplane three men are the ideal crew. By distributing the body weights across the length of the wing there is a reduction in the over-all structural weight. The power for propulsion from the three men is synchronized by cables. The three landing-gear wheels could be replaced by skates for use on frozen lakes.

12543
Westbrook, C. B. 1959
THE PILOT'S ROLE IN SPACE FLIGHT.—Wright Air Development Center. Flight Control Lab., Wright-Patterson Air Force Base, Ohio (Project no. 1365, Task no. 13554). WADC Technical Note no. 59-31, Feb. 1959. iii+16 p. AD 210 228
Also published in: Aero Space Eng., 18 (11): 51-54, 67. Nov. 1959.

Man's basic capabilities as a control element and his capabilities as an actuator, sensor, computer, and as a part of a complete control system are discussed and conclusions formed as to man's strong and weak points. Several factors which contribute to a change in thinking regarding flight control in space missions are reviewed briefly. These are reliability, the changed dynamic characteristics of the vehicles, and the new control systems required. The phases of a lunar soft landing mission are then reviewed to determine what functions should or must be performed automatically and what should or could be

performed by the man. It is concluded that man has a place in certain missions not merely on the basis of curiosity or even as a scientific observer but on sound engineering reasons as a flight control element. (Author's abstract)

12544
White, S. C., 1961
R. S. Johnston, and G. J. Pesman
REVIEW OF BIOMEDICAL SYSTEMS AND MR-3 FLIGHT.—In: Conference on Medical Results of the First U. S. Manned Suborbital Space Flight p. 29-46. [1961?]

The major systems of the manned ballistic flight of MR-3, the environmental control system (pressure suit and cabin system) and astronaut acceleration protection system, are described including diagrams, photographs, and test results. A brief review is presented of astronaut training in body physiology, and dynamic testing and training, along with a discussion on the animal program preceding the manned flight. Chimpanzees were subjected to physiological training, and acceleration and psychomotor stress during an MR-2 flight.

12545
Wilson, W. S. 1960
MAN-MACHINE SPACE COMPLEX. — Aircraft and Missiles, 3 (7): 22-26. July 1960.

In order to fully utilize the flexibility of man as a component in the man-machine space complex, the designers of space vehicles are charged with the responsibility of providing everything necessary to sustain and protect the life of the astronaut. This can be best accomplished through an intimate knowledge of human morphology and tolerances. The workspace required for operators in various positions and at various tasks, and the design of space suits and control devices are all dependent upon anthropometric data. Human tolerances to accelerations, pressure changes, temperature changes, atmospheric contamination, radiations, and weightlessness must be considered in order to provide optimal support and positioning of the astronaut within the vehicle, and in order to provide proper insulation, shielding and sealing to the vehicle itself. For extended trips, longer than that envisioned for Project Mercury, a closed ecological system and protection from the impacts of micrometeorites must be included in the design of the vehicle.

12546
Wood, C. C. 1958
HUMAN FACTORS ENGINEERING: AN AIRCRAFT COMPANY CHIEF ENGINEER'S VIEWPOINT.—Ergonomics (London), 1 (4): 294-300. Aug. 1958.

Essential features of successful work on human factors in machine and equipment design are summarized and discussed. Stress is laid on the fact that objective, quantitative knowledge of these factors must not only be obtained by research but must also be applied; that it must be incorporated during the design stage of equipment development; and that the worth of such knowledge and the incorporation of it into equipment design must be assessed in terms of effectiveness and cost. This type of knowledge has application not only to the operation and use of equipment, but also to support activities such as maintenance, training and repair. (Author's abstract)

12547
Wright, G. O. 1960
A GENERAL PROCEDURE FOR SYSTEMS STUDY. —Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 71619). WADD Technical Note no. 60-18, Jan. 1960. iii+13 p.

This paper deals with the creation of an abstract system model. The model is developed around the concepts of process, data input, system output, function, data transformation, mediation, and operation, outcomes and the output criteria, feedback control, and data flow. The system model also is considered in cultural terms. The thesis is set forth that the man-machine complex is a cultural system whose limits are set by culture. The paper also proposes a methodology for system study. The general procedure is to locate appropriate places in the system to manipulate selected variables and to evaluate the resulting changes in the system performance. A set of principles is developed to assist in the choices of the place to intervene as well as the kinds of variables to be manipulated. (Author's abstract)

12548
Zinser, L. M., 1961
W. J. Farley, and F. H. Rohles
A ZOOMETRIC STUDY TO DETERMINE THE OPTIMUM MANUAL PERFORMANCE AREAS FOR THE CHIMPANZEE.—Air Force Missile Development Center. Aeromedical Field Lab., Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 68930). AFMDC Technical Report no. 61-15, May 1961. vi+25 p.

Manual work space dimensions were determined for the chimpanzee. The findings can be used as guides in designing space capsules in which performance measures on chimpanzees are required. (Authors' abstract)

b. Operational Aspects

12549
Adams, C. 1960
ASTRONAUT SUPPORT PROBLEM. — Ground Support Equipment, 2 (4): 83-85. Aug.-Sept. 1960.

A discussion of the physiology of water metabolism and the water requirements of the human body is presented as a basis for an evaluation of the problems of water supply in space flight. The constituent sources of body water and the mechanisms of water loss are described, including urinary excretion, insensible water loss (pulmonary excretion and cutaneous evaporation), sweating, and fecal excretion. Brief consideration is given to the hazards of dehydration, the chemical constitution of the body fluids, and the unique problems of space flight, including the probable absence of the normal source of water in food and the necessity for special drinking devices. To insure a proper water intake, it is suggested that space ships will require electronic systems for the computation of water balance and for the rationing of the individual water supply.

12550
Alluisi, E. A. 1960
ON OPTIMIZING CUTANEOUS COMMUNICATION: A RESPECTFUL SUPPLEMENT TO SOME ADVENTURES IN TACTILE LITERACY.—In:

Symposium on cutaneous sensitivity, 11-13 February 1960, p. 114-130. Army Medical Research Lab., Fort Knox, Ky. Report no. 424, Dec. 22, 1960.

Studies are presented which deal with the transmission of linguistic information tactually, and on optimizing such cutaneous communication. The available data indicate that such communication is possible, feasible, and efficient. The basic symbol sets from which a practical stimulus-alphabet may be constructed (with mechanical vibratory skin stimulation) appear to be limited to two or three intensities, three or four durations, and numerous locations depending upon the skin employed, i.e., six or seven on the chest. Two generalizations founded on empirical evidence are presented to show how optimum codes might be constructed. They refer principally to construction of maximally compatible S-R ensembles through the use of "correspondence" and "stereotypy". The former demands that elements of the stimulus and response alphabets correspond to one another in a direct physical sense, or in a less direct conceptual or dimensional sense. The latter demands that the pairings of stimulus and response in the ensemble agree with strong individual and population stereotypes, where such stereotypes exist. Hypotheses are presented concerning specific response alphabets (i.e., linguistic versus literate forms) expected to interact with man's information-handling tasks (decoding versus assimilating linguistic information) in a cutaneous communication system. It is specifically hypothesized that use of a syllabic alphabet might combine literate forms with the linguistic forms to produce a nearly ideal response alphabet. (Author's summary, modified)

12551
Baker, C. H., 1959
and G. E. Boyes
INCREASING PROBABILITY OF TARGET DETECTION WITH A MIRROR-IMAGE DISPLAY.—Jour. Applied Psychol., 43 (3): 195-198. June 1959.

The present study is concerned with maximizing the probability of detection of targets appearing near locations representing the maximum range by designing a radar-like display on which the maximum range was represented by the center of the sweep line. A description of the special apparatus employing a "mirror-image" display is included. It was demonstrated experimentally that displays can be designed to capitalize on the fact that some portions of displays are given more visual coverage than others. By designing a display in such a manner that brief events of greatest importance occur in the center of the area being searched, the probability of such events being detected is greater than if they occur in relatively peripheral regions. This principle appears to hold particularly in situations where lateral eye movements are involved. Vertical eye movements, where the distance scanned involves head movements, did not contribute toward improving the probability of detection of centrally located events.

12552
Baker, R. C., 1958
A. I. Siegel, and F. W. Stirner
CAUTION AND WARNING LIGHT INDICATORS FOR NAVAL AIRCRAFT. VI. AN EXPERIMENTAL COMPARISON OF VISUAL AND AUDITORY "MASTER" SIGNALS UNDER TWO LEVELS OF TASK COMPLEXITY.—Applied Psychological Services, Villanova, Pa. (Contract no. N156s-33252); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM EL 52004, Part 18). Report no. NAMC-ACEL-366, Jan. 27, 1958. ii+24 p.
AD 152 775

Subjects perceived a simulated flight task (multiple compensatory tracking) and simultaneous attendance to verbal passages as their major tasks and reaction to the cautionary and warning signals as collateral tasks. Time to respond to peripheral light signal indicators and the number of signals missed constituted the basis for the comparisons. The results suggested that within each level of tracking task complexity: (a) the two-tone master auditory signal was the best; (b) the brighter of the two master visual signals employed possessed the greater potential for reducing response time and missed signals; (c) of the four master indicator variations investigated, the dim visual master was the poorest; and (d) there was no statistically significant difference between the one-tone master auditory signal investigated and the brighter of the two master visual signals. (From the authors' abstract)

12553
Bamford, H. E., 1958
and M. L. Ritchie
COMPLEX FEEDBACK DISPLAYS IN A MAN-MACHINE SYSTEM.—Jour. Applied Psychol., 42 (3): 141-147. June 1958.

Performance of nine Air Force pilots in a flight simulator was studied under three conditions: (1) reference condition in which the full instrument panel is available to the subject; (2) control condition where the attitude indicator is covered to simulate a failure of that instrument; (3) experimental condition where the turn indicator is covered and the integrated roll-and-turn indicator substituted. Performance under the experimental and control conditions was inferior to that under reference conditions; performance under experimental condition was superior to that under control condition. The experimental display (the integrated roll and turn indicator) is shown to be characterized by distinct indication of the control-induced components of system output, and by anticipatory indication of the derivative feedback signal. The data are viewed as supporting the two principles of display design expressed in the design of the integrated roll-and-turn indicator. (Authors' summary, modified)

12554
Beauchamp, G. T. 1961
DISTURBING FORCES PRESENT IN A ROTATING SPACE STATION. — Jour. Environmental Sci., 4 (5): 12-13, 21. Oct. 1961.

Coriolis forces, present wherever movement within a rotating vehicle takes place, adversely affect the movement of human beings in a rotating space vehicle and inanimate objects as well. By carefully considering vehicle size and the magnitude of simulated gravity, and by making allowance for slower movement, the awkward and perturbing effects of Coriolis forces may be reduced. The following design dictates are given: (1) the optimum vehicle radius at floor level should be from 45 to 50 feet, (2) smaller radii should be avoided because of increasingly intolerable Coriolis compo-

nents and gravity gradients, and (3) gravity levels of 0.10 g will require large spin radii to overcome perturbing Coriolis forces. Such radii have already been proposed for nuclear powered vehicles which have the nuclear power plant separated from the manned compartment by a mile of cable. The position of functional machinery, controls, and control consoles is considered, as their operation may be seriously disturbed by the effects of Coriolis forces.

12555
[Beresford, T., and B. Freeman] 1959
RECOVERY FROM SPACE.—Product Engineering, 30 (12): 17-19. March 23, 1959.

Brief discussions are given of some of the problems involved in the recovery of a manned satellite and its occupant from space, and of some of the tests and devices being designed to facilitate this recovery. The intense heat barrier encountered upon return to the earth's atmosphere must be surmounted; an optimum height at which to start using recovery apparatus must be decided; the attitude and position of the vehicle upon landing must be controlled for aeromedical rescue teams; and the final landing impact must be minimized. Extensive, high-altitude wind-tunnel tests are recommended for studying the heat of re-entry; a completely automatic, triple-control-unit recovery system such as that designed by the Radioplane Division of the Northrop Aircraft Corp. appears feasible; ground-actuated retro-rockets are suggested for positioning the vehicle; final impacts may be cushioned by honeycomb decelerators or by airbags, both designed by Northrop. A variation of Northrop's Skysail parachute is also being considered as a means of recovery of the first man-carrying missile.

12556
Berest, N., G. Perdriel, and J. Colin 1958
[A STATISTICAL STUDY ON VISUAL FATIGUE OCCURRING AMONG READERS OF RADARSCOPES] Etude statistique de la fatigue visuelle des lecteurs de scope radar.—Médecine aéronautique (Paris), 13 (2): 135-140. 1958. In French, with English summary (p. 139).

A statistical study was carried out on 331 radarscope operators between the ages of 20 and 45. The following ophthalmological examinations were performed: (1) measurement of visual acuity; (2) refractometric tests; (3) determination of disturbances of the oculomotor equilibrium; (4) color vision tests; and (5) dark adaptation measurements. Visual fatigue was classified into three clinical forms: (a) major disturbances (18% of the cases), which made it impossible to read the scope; (b) minor transitory disturbances appearing early and preventing efficient reading of the scope; and (c) minor transitory trouble appearing later and not interfering with radarscope work. Exact data are given regarding etiological factors responsible for ocular fatigue, including the following: ametropia, failing of oculomotor equilibrium, deficiency of the accommodating power of the eye, partial color blindness, and incomplete dark adaptation. It is thought that this study will help to formulate standards for radarscope readers and that suitable working periods for radarscope readers can be determined on the basis of the findings.

12557
Brandt, U. 1961
VESTIBULAR REACTIONS DURING PREORBITAL FLIGHT. —Acta oto-laryngologica (Stockholm), 53 (1): 80-87. Feb. 1961. In English.

Accelerative forces affecting the astronaut placed in the nose cone of a rocket are considered. The vestibular sensations were studied experimentally in a human centrifuge in a number of dynamic conditions aimed at changing the resultant between linear and radial acceleration and gravity force. By applying Graybiel's "law of the otoliths", it seems permissible to draw some conclusions as to the probable vestibular experiences of the astronaut, at least during the "gravitational" part of the flight. However there is still insufficient knowledge in regard to the period of weightlessness. The nature of the vestibular sensations coupled with lack of external visual references will aggravate the difficulties associated with active participation of the astronaut in correcting the flight path. (Author's summary, modified)

12558
Carapancea, M., M. Popescu, M. Ştefan, D. Bengulescu, and Ş. Muşetescu 1961
[VISUAL DISORDERS AND THEIR EFFECTS ON THE BODY UNDER CONDITIONS OF OPERATION OF RADAR APPARATUS] Tulburările vizuale şi consecinţele lor asupra organismului, în condiţiile percepţiei la dispozitivul radar. —Studii şi cercetări de fiziologie (Bucureşti), 6 (4): 695-708. 1961. In Rumanian, with French summary (p. 707-708).

Radar operation affects man by producing a group of cilio-visceral reflex disorders caused by hypermetropia, termed hypermetropic neurosis. Also manifest is a decrease in sexual ability, independent of the visual refraction state, and caused by the absence of normal light stimulation to the pituitary gonadotropic function found during prolonged exposure to radar equipment. These symptoms can be prevented by screening radar operators with hypermetropia which exceeds +1.5 spherical diopters, and those with simple or complicated hypermetropic astigmatism. To eliminate choroido-conjunctival deficiencies, vitamin B_2 administration is advocated. Accommodation fatigue may be controlled by vitamin B_1 and C administration, and vitamin A with the use of light filters before and after entering the radar room is recommended for improvement of ocular adaptation to darkness. To control the reduction of the sexual function, avoidance of prolonged stay at radar stations is stressed and the wearing of ocular light filters or possibly sunbathing is advised. (Authors' summary, modified)

12559
Carterette, E. C., and M. Cole 1959
REPETITION AND CONFIRMATION OF MESSAGES RECEIVED BY EAR AND BY EYE.—Univ. of Calif. Dept. of Psychology, Los Angeles (Contract Nonr 233 (58); Office of Naval Research Project no. NR 170-282). Technical Report no. 3, June 29, 1959. 18 p. AD 220 404

The rating method was used to obtain operating characteristics for 60 heterogeneous words, and to compare visual and auditory modes of reception. A single message was sent under difficult conditions of

reception and was repeated until it had been assigned to the highest accuracy category ("confirmed") or until it had been sent a maximum of six trials. Comparisons show that it matters little whether reception is by eye or ear. Accuracy of reception is a direct function of the confidence rating and is relatively independent of the intelligibility level. (Authors' discussion, modified)

12560
Clinton, A. C. 1958
THE HUMAN OPERATOR AND HIGH-SPEED FLIGHT.—Nature (London), 182 (4649): 1562-1564. Dec. 6, 1958.

The following topics related to human engineering in modern aircraft were discussed at the first International Congress of Aeronautical Sciences, held in Madrid from September 8 to 13, 1958: (1) ways of simplifying the tasks of the air crew, both physical and mental; (2) aspects of visual observation both inside and outside the cockpit, including the design and arrangement of instruments and the angle of view from the cockpit of a pressurized aircraft (with increase in performance, a television display, reliable under all weather conditions, would be desirable); (3) location, design, and shape of controls, levers, and knobs for instant recognition by sight or touch, day or night; (4) apparatus providing reliable information about the amount of fuel in the tank at any given time and indicating the nearest available landing field; (5) warning lights flashing up in case of vital emergency, and illuminated descriptive panels for secondary troubles; (6) air conditioning and temperature control; (7) escape methods, including a self-contained detachable cockpit ejected by parachute to a suitable altitude, from which the crew can escape with their individual parachutes; (8) disorientation in flight; (9) protection against cosmic radiation during space flight; and (10) the problem of weightlessness in space.

12561
Cole, J. N., 1961
and C. E. Thomas
FAR FIELD NOISE AND VIBRATION LEVELS PRODUCED DURING THE SATURN SA-1 LAUNCH (PRELIMINARY REPORT).—Aeronautical Systems Division. Aerospace Medical Research Labs., Deputy for Test and Support, Wright-Patterson Air Force Base, Ohio (Projects no. 7321, and 1309; Tasks no. 723104 and 130905). ASD Technical Report no. 61-607, Dec. 1961. vi+22 p.

Acoustic measurements were made of the sound pressure level-time functions which were produced at six locations on Cape Canaveral Missile Test Annex (CCMTA) and at four locations in the surrounding communities during the Saturn SA-1 launch on 27 October 1961. The frequency range of measured data was from the 4.7 to 9.4 c.p.s. octave band to the 4800 to 9600 c.p.s. octave band. Distances from the launch site to the noise measuring sites ranged from 3700 to 100,000 feet. Vibration data were taken at three locations at the Tel-2 telemetry site. The frequency range of measured data was from the 4.5 to 9 c.p.s. octave band to the 1125 to 2250 c.p.s. octave band. The distance from the launch site was 5200 feet. Only the basic sound pressure level-time environments and vibration level-time environments as a function of octave bands of frequency are presented in this report. (Authors' abstract)

12562
Conklin, J. E., 1958
and O. H. Lindquist
RECOVERY FROM UNUSUAL AIRCRAFT ATTITUDES UNDER THE INFLUENCE OF VERTIGO.—Jour. Applied Psychol., 42 (2): 136-138. April 1958.

Recovery performance under the influence of vertigo was measured on two experienced pilots using two types of aircraft attitude indicators: (1) one in which the artificial horizon was the moving element (similar to conditions in contact flying), and (2) one in which roll and pitch deviations were simulated by a moving drone against a stationary horizon. Preceding each recovery performance trial the pilot was rotated to induce vertigo (various positions of the head were used in successive rotations), and the pilot was instructed to return 16 display elements to straight and level flight as quickly as possible. Twenty two-minute trials were given in each of six test sessions. An analysis of the results indicated that the estimated rate of accidents caused by pilot disorientation due to vertigo could be minimized if pilot training included recovery experience under the conditions of the foregoing experiment. Whether training with a moving-drone display interfered with performance on the moving-horizon (i.e., the conventional) indicator was also tested prior to, and after the recovery performance trials during each test session. It was observed that reversal errors were absent after the second experimental session when the moving-drone display was used. Improvement in recovery was observed when the moving-horizon indicator simulated roll dimensions.

12563
Curtis, J. L. 1959
VISUAL PROBLEMS ABOVE 50,000 FEET.—U. S. Armed Forces Med Jour., 10 (11): 1304-1307. Nov. 1959.

Visual problems associated with flight at high altitudes are discussed. Practical aspects of phenomena such as empty field myopia, glare, contrast, and cockpit haze are briefly considered.

12564
Day, R. H., 1960
J. R. Baxter, and J. C. Lane
THE PSYCHOPHYSICAL TESTING OF AN AIRCRAFT VISUAL APPROACH AID. — Human Factors, 2 (4): 203-210. Nov. 1960.

Field and laboratory psychophysical tests which have been applied to the evaluation of a ground-based, aircraft visual approach aid (the Precision Visual Glidepath) are described. The device is designed to provide a direct indication of deviations from a predetermined glidepath and thus reduce pilot judgment errors and accidents during the approach and landing phase. Four tests of long-range sensitivity in perceiving the misalignment between bars of light on the ground were carried out: (1) determination of misalignment thresholds for detection and operational decision; (2) validation of the laboratory simulator; (3) the effect of an adjacent runway light pattern; and (4) the effects of an aircraft windscreen atmospheric attenuation of the display.

12565
Doelling, N. 1961
ACOUSTICAL EVALUATION OF TWO DURASTACK

GROUND RUN-UP NOISE SUPPRESSORS.—Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-3335); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71708). WADC Technical Note no. 57-392, Nov. 1961. vi+41 p.

Measurements of the noise characteristics of two "Durastack" noise suppressor systems are reported. The only difference in the two systems is the acoustical treatment of the secondary air intake. Type A suppressor has essentially no acoustical treatment in the secondary air intake while Type B is acoustically treated. Measurements in octave bands taken on a 250-foot circle and at close-in positions are presented. Average noise reduction of both types of suppressors is fairly flat above the first octave band. The average value of the noise reduction from 75 to 10,000 c.p.s. is about 14 db. for the Type A noise suppressor and about 21 db. for the Type B noise suppressor. No intake suppressor was used. The relative magnitude of the major noise sources of the aircraft suppressor is also presented. Some non-acoustical aspects of the noise suppressors are included in the appendix. (Author's abstract)

12566
Douglas, W. K. 1961
FLIGHT SURGEON'S REPORT FOR MERCURY-REDSTONE MISSIONS 3 AND 4. —In: Results of the second U. S. manned suborbital space flight July 21, 1961, p. 23-31. Washington, D. C.: National Aeronautics and Space Administration, [1961].

A description is given of some of the operational procedures in the first two suborbital flights. The flight operations can be divided into three phases: (1) the period of three days to 12 hours before launch, (2) the immediate preflight preparation, and (3) the debriefing period. The various aspects discussed include diet and feeding, housing, isolation, launch rehearsal, application of the biological sensors, and suiting-up. Debriefing procedures are described with respect to transporting the astronaut to the debriefing site, examining the pilot, and providing for rest and relaxation.

12567
Dyer, I., 1958
P. A. Franken, and P. J. Westervelt
JET NOISE REDUCTION BY INDUCED FLOW.—Jour. Acoust. Soc. Amer., 30 (8): 761-764. Aug. 1958.

The effect on the generation of jet noise by the secondary air induction of a modified jet nozzle is analyzed. It is shown that the combination of the secondary air with the primary jet air creates a new jet stream of larger area, lower velocity, and lower noise generation. The decrease in noise radiation is found in terms of the area of the combined jet stream. Detailed check of the theory is not possible at present because measurements of the areas of the combined jet streams have not been generally made along with measurements of the noise. However, it is possible to estimate the upper limit of the appropriate jet stream area in order to obtain the upper limit on noise reduction. The upper limit on noise reduction obtained from the theory is consistent with existing measurements. Qualitative conclusions from the theory with respect to the spectrum and directivity of the noise radiated by jets with modified nozzles are in accord with measurements. (Authors' abstract)

12568
Eldred, K., 1961
and J. Ortega
ACOUSTICAL EVALUATION OF THE CURTISS-WRIGHT CORPORATION JET GROUND RUNUP NOISE SUPPRESSOR TYPE 700658.—Western Electro-Acoustic Lab., Inc., Los Angeles, Calif. (Contract AF 33(616)-5744); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723104). ASD Technical Report no. 61-542, Oct. 1961. xii+93 p.

This report contains the results of a series of acoustical evaluations of a Curtiss-Wright Corp. Type 700658 ground runup noise suppressor. Data were obtained for suppressor operation with J71 and J57 engines and with the F8U-1P aircraft. Results give the acoustical performance of the suppressor in both near and far fields, clearly illustrating the effect of aircraft suppressor spacing. The results also demonstrate the dominance of high-frequency noise radiated by the secondary air intake to the far field. The average noise reduction in the far field for the best engine-suppressor configuration varies from approximately 12 db. in the 18.75-37.5 c.p.s. frequency range to the order of 23 db. in the 75-300 c.p.s. range, then decreases rapidly with increasing frequency to 5 db. in the 4800-9600 c.p.s. octave band. However, this reduction is limited to the aft quadrant of the measurement semicircle, and negative values of noise reduction were found in the forward quadrant. Furthermore, the noise level in the near field and at the maintenance positions was found to be generally higher with the suppressor than that with the unsuppressed engine. (Authors' abstract)

12569
Eldred, K., 1961
and J. Ortega
ACOUSTICAL EVALUATION OF THE EMHART MANUFACTURING COMPANY, MAXIM DIVISION, PORTABLE GROUND RUNUP SUPPRESSOR.—Western Electro-Acoustic Lab., Inc., Los Angeles, Calif. (Contract AF 33(616)-5744); issued by Aeronautical Systems Divison. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723104). ASD Technical Report no. 61-541, Oct. 1961. xii+92 p.

This report contains the results of a series of acoustical evaluations of an Emhart Manufacturing Company, Maxim Division, ground runup noise suppressor. Data were obtained for suppressor operation with J57 and J71 engines and with the F8U-1P aircraft. Results give the acoustical performance of the suppressor in both near and far fields, and also show the effects of configuration modifications on the suppressor's over-all acoustical performance. The average (0°-180°) far field noise reduction for the final suppressor configuration varies from about 16 db. in the 37.5-75 c.p.s. octave band to about 24 db. between 75 and 300 c.p.s., tapering off to approximately 5 db. in the higher frequencies. Negligible noise reduction is achieved in the near field for maintenance personnel and in some frequency ranges the near field noise actually increases when the engine is operated with the suppressor. (Authors' abstract)

12570
Erdmann, R. L. 1959
AN INVESTIGATION WITH NEUTRAL DENSITY FILTERS OF THE RELATIONSHIP BETWEEN CRT SIGNAL DETECTION AND BRIGHTNESS DISCRIMINATION.—Rome Air Development Center, Griffiss Air Force Base, N. Y. (Project no. 8501, Task no. 85001). Report no. RADC-TN-59-318, Nov. 1959. iv+8 p. AD 229 419

Signal detectability on cathode ray tubes (CRT) depends primarily upon the brightness discrimination ability of the observer. Typical data on brightness discrimination indicates that this function improves continuously up to intensity values well above the maximum light output of a CRT. Yet, observations relating to voltage required for signal detection on CRT's to grid bias, which regulates light output, show a minimum value well below the bias that produces maximum light output. This report presents two previous explanations of this phenomenon and investigates the implications of one. The discussion section presents some special difficulties encountered when trying to apply brightness discrimination data to intensity modulated scopes. (Author's abstract)

12571
Farr, L., and H. Schmitz 1961
AN ESTIMATE OF THE 1970-75 ENVIRONMENT FOR AIR-TRAFFIC CONTROL.—System Development Corp., Santa Monica, Calif. Technical Memorandum no. 599/000/01, Sept. 18, 1961. 54 p.

Air traffic estimates are presented to serve as a basis for the initial design of the terminal air traffic control system to be simulated in the Systems Simulation Research Laboratory (SSRL), one of the projects sponsored by the System Development Corporation as part of its over-all program of corporate-sponsored research.

12572
Franken, P. A. 1958
REVIEW OF INFORMATION ON JET NOISE.—Noise Control, 4 (3): 8-16. May 1958.

Diagrams are presented which show: (1) typical jet stream flow patterns, (2) sound-power levels of turbojets at military power (100% r.p.m.), (3) turbojet directivity patterns (i.e., relative sound pressure levels at various angles from the jet axis), and (4) turbojet spectra (relative sound pressure levels with respect to octave bands). These figures are interpolated for conditions when the aircraft is static or in motion. The corrections which must be applied to noises when after-burner craft are operating at less than 90% r.p.m. are indicated. The importance is stressed of considering acoustic efficiency when measuring sound frequencies produced by large jets and rockets. Noise control is discussed with respect to various types of nozzle adapters which have been designed to reduce noise levels on the ground or in flight. Four typical devices are shown which may be of value in reducing noise levels in flight. It is already known that mufflers of heat- and velocity-resistant materials may protect ground personnel from ear damage. The possibility is discussed of redesigning turbojet engines; by-pass engines and low-temperature engines produce less noise, and a change of placement of the engine with respect to the craft's axis may result in cabin noise reduction.

12573
Geldard, F. A. 1960
SOME NEGLECTED POSSIBILITIES OF COMMUNICATION.—Science (Washington), 131 (3413): 1583-1588. May 27, 1960.

A historical summary is given of efforts to train the human integument as a supplement to the message-transmitting capacities of the eye and the ear. Attempts to communicate have revolved mainly around some form of mechanical energy, such as vibration, but the chemical and thermal forms of stimuli should be investigated.

12574
Gilmer, B. v. H. 1960
POSSIBILITIES OF CUTANEOUS ELECTRO-PULSE COMMUNICATIONS.—In: Symposium on cutaneous sensitivity, 11-13 February 1960, p. 76-84. Army Medical Research Lab., Fort Knox, Ky. Report no. 424, Dec. 22, 1960.

Following a discussion of the problems of electro-pulse communication and some current research in the field, an outline is presented of the psychophysical phase of cutaneous electro-stimulation using the modified Hahn apparatus, oscilloscope, resistance meter, etc. Exploratory studies were made on 50 normal human subjects and two blind subjects. Painless pulses could be applied to the skin for coding. Pilot studies determining lower thresholds using square wave stimulation, with duration at 1 millisecond (msec.) and frequency at 1 p.p.s. showed that voltage and current were stable over as long a period as one hour of stimulation. Skin resistance leveled off after the first few stimulations and held an almost constant value for the remainder of the stimulation session on any given skin area. Repeated stimulation, slightly above minimal threshold, at 1 p.p.s. with a duration of 1 msec. on the dorsal forearm surface up to two hours did not produce pain, only redness of the skin area. Holding frequency constant at 1 p.p.s. and varying five different durations in a geometric progression chosen arbitrarily between limits of 0.05 and 50.0 msec. showed that as duration decreased, voltage necessary to attain threshold values increased. Values around 50.0 msec. duration usually yielded a painful sensation. Preliminary studies supported the data of other investigators that frequencies in excess of 8-10 p.p.s at most any duration induced pain.

12575
Gramberg-Danielsen, B. 1961
[OPTICAL PROBLEMS OF AVIATION] Optische Probleme der Luftfahrt. —Klinische Monatsblätter für Augenheilkunde (Stuttgart), 138 (4): 562-565. May 1961. In German, with English summary (p. 565).

The visual problems in modern aviation are above all attributable to oxygen deficiency, acceleration, and speed. The primary effect of hypoxia is on the brain as indicated by raised flicker fusion frequency threshold, impaired capacity for dark-adaptation, poor coordination of the extraocular muscles, and frequently a constricted visual field. Because of the existing hydrodynamic conditions acceleration forces affect the intraocular circulation first while the brain is protected to a great extent (blackout). Supersonic speeds create an optic barrier in that a light stimulus is transmitted at the speed of light only to the retina; thereafter the speed of neural conduction is slowed down to ap-

proximately 20 impulses per second useful for fine discrimination. Thus the perception time becomes a significant element in the total reaction time (distance scotoma). Improvements in the technical flight controls are desired to relieve the pilot's visual system.

12576
Gregg, L. W. 1960
SOME CODING PROBLEMS IN THE DESIGN OF A CUTANEOUS COMMUNICATIONS CHANNEL.—In: Symposium on cutaneous sensitivity, 11-13 February 1960, p. 85-102. Army Medical Research Lab., Fort Knox, Ky. Report no. 424, Dec. 22, 1960.

In elaborating the ideas on coding, first considered is some general evidence concerning the rate of reception of auditory and visual signals. From this analysis, certain requirements are derived for defining the processes by which human receivers interpret sensory data. These requirements are then use to construct a simple theory that purports to explain how people interpret a particular code. Included are representative tables and figures. In constructing a system of cutaneous sensation to correspond with the elemental sounds of speech, the present code interpreter will serve to indicate the direction to be taken. Consideration is given to the nature of cutaneous imagery; combinations of levels and dimensions of cutaneous stimuli providing unique sense "sample points" over variations in rate and intensity; the number and duration of distinct symbols based on cutaneous stimuli derived; and the possibilities for simultaneous stimulation over dual cutaneous channels.

12577
Hartman, B. O. 1961
TIME AND LOAD FACTORS IN ASTRONAUT PROFICIENCY.—In: Psychophysiological aspects of space flight, p. 278-308. Ed. by B. E. Flaherty. New York: Columbia Univ. Press, 1961.

The short- and long-term effects of time, load, and other factors on the proficiency of man in space are evaluated. Operator proficiency at any point in time is determined largely by the machine. If it overloads him by imposing requirements high in load stress or speed stress, man's performance deteriorates. The engineer appears to have a more direct influence on the aspect of operator reliability than the human factors specialist, since the designers of the several subsystems make the allocations in accordance with the functional requirements of the system, without regard for competing requirements from other subsystems. Two long-term factors which alter operator proficiency are fatigue and diurnal variation, which will probably be less critical than anticipated. (47 references)

12578
Hock, R. J. 1960
THE POTENTIAL APPLICATION OF HIBERNATION TO SPACE TRAVEL.—Aerospace Med., 31 (6): 485-489. June 1960.

The advent of the space age focuses attention on three problems to be encountered in journeys of several years' duration. Although, reportedly, aging in space will not occur at the same rate as on Earth due to the rapid velocity attained, it is concluded that speed has nothing to do with time in a biological sense, and aging will take place at the normal rate. The possibility of freezing the whole body of a man was suggested but, to date, no vertebrate animal has been recovered from being completely frozen. The third possibility is that of hibernation, for which it will be necessary to radically reduce body temperature, metabolic rate, and heart rate. Although men have recovered from rectal temperature of 17.8° C. (64° F.) and lower, there is general agreement that temperatures below 24° C. (75° F.) are usually lethal. Below 30° C. (86° F.), there is an onset of ventricular fibrillation, with resultant death.

12579
Howell, W. C. 1960
ON THE POTENTIAL OF TACTUAL DISPLAYS: AN INTERPRETATION OF RECENT FINDINGS.—In: Symposium on cutaneous sensitivity, 11-13 February 1960, p. 103-113. Army Medical Research Lab., Fort Knox, Ky. Report no. 424, Dec. 22, 1960.

In terms of the criteria of need, practicability of instrumentation, unique characteristics, and possible limitations, the feasibility of vibro-tactual display is considered in relation to several classes of input information: those characterized by frequent or infrequent signals; those containing a high or low degree of uncertainty; and those displayed via continuous or discrete signals. On the basis of available evidence it is concluded that the most fertile areas for the development of tactual displays are those concerned with presentation of frequent discrete (or even continuous) signals with a low degree of uncertainty, or those concerned with the display of extremely infrequent discrete signals. It is suggested that tactual display be used to increase the over-all level of stimulation in the organism and thus maintain the state of arousal necessary for detection of visual signals. They may also be used as a means of displaying relevant information per se, in that tactual signals would accompany visual signals (and thereby serve as redundant cues) or they would replace visual signals as the only source of relevant information.

12580
Howell, W. C., 1959
R. T. Christy, and R. G. Kinkade
SYSTEM PERFORMANCE FOLLOWING RADAR FAILURE IN A SIMULATED AIR TRAFFIC CONTROL SITUATION.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-3612); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71583). WADC Technical Report no. 59-573, Sept. 1959. iv+15 p.

The present experiment investigated the ability of controllers to take over and maintain control of aircraft after loss of PPI information in a simulation of an air traffic control system. The variables examined were the level of control flexibility and prebreakdown activity of controllers. Flexibility, or the number of alternatives available to the controller, was defined by the number of fixed flight paths used (3 vs. 17), and prebreakdown activity was defined by the task of monitoring versus that of active controlling. A condition requiring control after prebreakdown monitoring was intended to simulate manual takeover after failure of a semi-automatic control system. In general, the results indicated that whereas procedural flexibility is beneficial to performance during normal operations, it becomes less beneficial and even harmful subsequent to PPI breakdown. Whether the controller

is monitoring or controlling prior to breakdown appears to have little effect on performance after breakdown. (Authors' abstract)

12581
INSURING VIGILANCE FROM PRESCRIBED CREW STATIONS.—Soc. Exper. Test Pilots Quart. Review, 3 (2): 95-133. Winter 1959.

Five papers by various authors and a panel discussion are presented. The danger of mid-air collisions is greatest in high-density areas immediately surrounding busy airports. The requirements for crews to watch carefully for other aircraft in these areas is complicated by a multitude of requirements inside the cockpit after take-off and prior to landing. Some suggestions which would help crews to perform a better job of vigilance were brought out: A look-out time of 30 minutes should alternate with a 30-minute rest period. Hot food and drink aid in improving the duration of efficient look-out periods. Training in scanning and focusing techniques can greatly improve any individual's visual detection capabilities. An efficient proximity warning system would provide an assistance in crew vigilance if it were capable of directing attention to a particular sector. Reduction of in-flight paper work would relieve some crew members for surveillance. Increased use of automatic control devices, simplification and/or automation of mandatory reporting to traffic control stations, and full use of extra crew members might reduce collision hazards particularly in high-density traffic.

12582
AN INVESTIGATION INTO ENGINE NOISE. — Bristol Siddeley Jour. (London), 2 (2): 35-38. Winter 1960-61.

Intake and exhaust noise from an Olympus Mark 104 turbojet engine (13,500 lb. thrust) and a Viper Mark 102 (1750 lb. thrust) were tested for their noise characteristics in view of studying ways of reducing jet aircraft noise. In the Olympus Mark 104 the noise level contours are lobed, and the greatest noise level at any given radius occurs at an angle of 30°-45° to the exhaust axis. The angle of greatest intensity is generated as a cone to the rear of the engine. The smaller the cone angle, the greater is the distance at which the point of maximum intensity will reach the ground. Therefore, without decreasing the engine noise, the noise heard on the ground can be lessened by keeping the cone angle small. The intake noise contains a high-frequency spectrum having a number of high intensity frequencies which produce the predominant tones.

12583
Jayle, G. E., 1959
A. G. Ourgaud, L. F. Baisinger, and R. L. Boyer
[FLYING AND NIGHT VISION] Activités aériennes en vision de nuit.—Médecine aeronautique (Paris), 14 (2): 139-146. 1959. In French, with English summary (p. 146).

The following illumination techniques for night flying are discussed: (1) color and position of lights used during take-off; (2) techniques of illuminating the cockpit and maps; and (3) lighting during landings, including both crash and emergency landings. Methods for preadapting pilots to darkness, such as remaining in semi-darkness or wearing red lenses for 30 minutes prior to flight, are briefly mentioned. Some of the autokinetic illusions frequently experienced by night flyers are also described.

12584
Jones, Edward R. 1961
MAN'S INTEGRATION INTO THE MERCURY CAPSULE. — In: The training of astronauts, p. 15-21. National Academy of Sciences-National Research Council, Publ. no. 873. 1961.

Although the primary control of the Mercury capsule is automatic, the secondary control by the astronaut is important for the success of the vehicle. Man can also have a basic role by functioning as follows: (1) as a scientific observer, (2) by correcting malfunctioning components, (3) by correcting flight conditions not anticipated in designing the system, and (4) by acting as a redundant component who can manually carry out a desired number of functions. Determination of man's specific functions is discussed, and examples such as attitude control, positional location of the space vehicle, and the detection and diagnosis of malfunctioning components are given. Proper integration of man with the systems' operations will insure a greater probability of success for the mission.

12585
Keast, D. N. 1961
ACOUSTICAL EVALUATION OF F-102 PRODUCTION SILENCER, CONVAIR, SAN DIEGO.—Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-3938); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71708). WADC Technical Note no. 57-390, Nov. 1961. vii+47 p.

The F-102 production silencer enclosure at Convair-San Diego has been evaluated acoustically. This silencer is similar to a turbojet engine test cell, but is designed to enclose a complete aircraft. Measurements of sound pressure level in and around the silencer are reported, and the noise reductions of the various elements of the acoustical treatment, as well as the noise reduction of the silencer as a whole, are determined. The results indicate that the average insertion-loss noise reduction of the silencer at 250 feet increases from about 20 db. in the 20-75 c.p.s. band to somewhat greater than 50 db. for all frequencies above 300 c.p.s. (Author's abstract)

12586
Kinkade, R. G., 1959
and J. S. Kidd
THE EFFECT OF DIFFERENT PROPORTIONS OF MONITORED ELEMENTS ON OPERATOR PERFORMANCE IN A SIMULATED RADAR AIR TRAFFIC CONTROL SYSTEM.—Ohio State Univ. Lab. of Aviation Psychology and Research Foundation, Columbus (Contract AF 33(616)-3612); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71583). WADC Technical Report no. 59-169, June 1959. 12 p.

A simulated radar approach control system was utilized to evaluate the influence of different levels of monitoring on system performance. Monitoring level was varied by manipulating the proportion of aircraft in the system having airborne position information (API) equipment. The API-equipment aircraft did not require active control of their

approach path as did those aircraft without such equipment. Four conditions were compared: (a) 100%, (b) 63%, (c) 37%, and (d) 0% of aircraft with API equipment. Eight laboratory-trained controllers participated. Results indicated an approximately linear increase in system performance as proportion of API-equipped aircraft was increased. Recommendations for future utilization of API in terminal operations were considered. (Authors' abstract)

12587
Klass, P. J. 1960
MOVING GLOBE DISPLAYS PILOT POSITION.—Aviation Week and Space Technol., 73 (2): 69-73. July 11, 1960.

Cockpit devices have been developed by Melpar and by International Business Machines Corp. to display vehicle position in true spherical coordinates on a small screen by projection from a transparent cartographic globe continuously positioned by signals from an external navigation computer. Small glass globes with the extreme cartographic detail and precision required for the device have been successfully produced by Melpar and by the U.S.A.F.'s Aeronautical Chart and Information Center.

12588
Marchbanks, V. H., and R. L. Slack 1958
KC-135 NOISE STUDY.—Noise Control, 4 (3): 17-20, 52. May 1958.

An evaluation of interior noise levels in a Boeing KC-135 jet tanker showed that sound levels in certain areas of the plane were higher than those prescribed for personnel safety. Variations of sound levels within the aircraft during flight are shown. A nomograph is included which allows computation of "equivalent exposure time" (EET), i.e., the time of exposure to noise equivalent to 85-db. exposure minutes. The chart is easy to use and has proven to be of great value in determining the maximal allowable time individuals may be subjected to given noise levels. The following octave bands were considered: 300-600, 600-1200, 1200-2400, and 2400-4800 c.p.s. Two limit values of exposure time have been established: (1) if the daily EET in any one of the four octave bands equals or exceeds 480 minutes, the use of ear protection is recommended; (2) if the daily EET in any band equals or exceeds 4800 minutes, the use of ear protection is mandatory.

12589
Meister, F. J., and S. Ruff 1959
[NOISE OF MILITARY JET PLANES AROUND AIRPORTS OF THE AIR FORCE AND ITS EFFECT ON NEIGHBORING INHABITANTS] Uber den Lärm von militärischen Düsenflugzeugen im Bereich von Flugplätzen der Luftwaffe und seine Wirkung auf die Bewohner der Umgebung.—Deutsche Versuchsanstalt für Luftfahrt (Germany). Report no. 83, March 1959. 26 p. In German, with English abstract (on card insert).

A comprehensive analysis of the noise produced after takeoff by jet aircraft at varying speeds, altitudes, and directions from the hearer is presented. Spectral patterns, noise measurements, and ground noise patterns are given in graphic and chart form. Criteria for the evaluation of the significance of the data obtained are determined from estimations of the maximum values of noise commonly encountered and tolerated (80 phon).

12590
Metcalf, C. W., and R. G. Witwer 1958
NOISE PROBLEMS IN MILITARY HELICOPTERS: AN EVALUATION OF EAR PROTECTION IN HR2S-1 AIRCRAFT.—Jour. Aviation Med., 29 (1): 59-65. Jan. 1958.

Audiometric and spoken-voice microphone tests were conducted in 33 subjects before and after 1-2 flights in an HR2S-1 helicopter, with a noise level in the passenger compartment averaging 119 decibels. Hearing losses of 18-22 decibels were found when no ear protection or a standard combat helmet was worn with full recovery after an average of 26-32 hours. Almost all subjects reported tinnitus for several hours following flight, and nearly one-third experienced nausea, headache, or drowsiness. When cotton plugs or rubber ear defenders were worn, average hearing loss was 3-6 decibels, and normal hearing was recovered in 4.5 to 10 hours. Tinnitus was experienced by only one-third of subjects wearing ear protectors, and other symptoms by one-eighth. In three subjects tested after flights of 1/2 and 2 hours, only a slight progression of hearing loss was observed with the longer flight. It is concluded that the hearing losses and physical symptoms observed in the absence of ear protection would be expected to produce an impairment of combat efficiency.

12591
Morris, F. M. 1959
VISUAL PROBLEMS ASSOCIATED WITH SPACE FLIGHT AND SUPERSONIC SPEED.—Jour. Amer Optometric Assoc., 31 (3): 141-145. Sept. 1959.

The visual problems induced by supersonic speed and flight at high altitude are reviewed. Visual problems at high altitude include those induced by (1) difficulty in reading instruments, (2) subjective haze within the cockpit, (3) empty field (space) myopia, (4) weightlessness, and (5) wearing spectacles and flying equipment. Visual problems at supersonic speed include those induced by (a) slanting optical surfaces, (b) different types of air flow, (c) buffeting, (d) dynamic visual acuity, and (e) the lag in visual perception time. Possible means of overcoming these problems are discussed.

12592
Nakao, H., M. Hirahara, K. Omori, J. Okada, and Y. Kasahara 1961
[ON THE NOISE OF JET AIRCRAFT, AND ACOUSTIC ACUITY (Abstract)]. — In: [Abstracts from the 6th meeting of the Japanese Aviation Medicine and Psychology Society]. Nihon Kōkū Igaku Shinri Gakkai Kiroku [Proc. Japan. Soc. Aviation Med. and Psychol.] (Tokyo), no. 11: 1. May 27, 1961. In Japanese.

Measurements of noise levels and an analysis of noise were made in various jet aircraft such as the Viscount, Lockheed Electra, Comet, etc. Piston-engine planes including the DC-4, DC-6B and DC-7C were also studied for comparison. Each type of aircraft showed characteristic responses to octave analysis. The high noise levels of turbojets were in agreement with the complaints of the ground men. (Dr. H. Saiki)

12593
Naugle, J. E. 1958
THE TEMPERATURE EQUILIBRIUM OF A SPACE VEHICLE.—In: Vistas in astronautics, p. 157-158. Ed. by M. Alperin, M. Stern, and H. Wooster. N.Y.: Pergamon Press, 1958.

The temperature equilibrium of a space vehicle is considered. In space, away from the earth, the vehicle will come into radiative equilibrium with the Sun's radiation. The skin temperature of the vehicle will rise until the amount of energy radiated by the vehicle is equal to the sum of the energy absorbed from the Sun and that produced in the vehicle itself. The absorbed solar energy is in the visible portion of the spectrum, whereas the emitted energy is in the far infrared. Equilibrium temperatures attainable with existing materials are too high. The basic problem is one of keeping the vehicle cool. (Author's abstract, in part)

12594
Nuttall, J. B. 1958
THE PROBLEM OF SPATIAL DISORIENTATION.—Jour. Amer. Med. Assoc., 166 (5): 431-438. Feb. 1, 1958.

A discussion is presented of the hazards of spatial disorientation in flight. The physiological basis of the various types of disorientation is discussed, including the visual illusions of autokinesis, misinterpretation of visual cues, and the oculogravic and oculogyric illusions; and the labyrinthine (attitude and motion) illusions involving misinterpretation of gravitational forces, erroneous sensations of rotation, Coriolis acceleration, kinesthetic feedback, and vegetative effects of vestibular stimulation. Practical effects of the illusions are described, and case reports of pilot incidents involving disorientation are presented. It is suggested that spatial disorientation is a frequent occurrence in experienced pilots as well as trainees, although disorientation accidents are often associated with inexperience of a particular aircraft or flight condition. Further study is needed of the importance of individual sensitivity to spatial disorientation, the adequacy of present programs for pilot indoctrination, training, and practice, and the adequacy of existing flight instrument designs and cockpit layouts.

12595
Pietrasanta, A. C., and K. N. Stevens 1961
GUIDE FOR THE ANALYSIS AND SOLUTION OF AIR BASE NOISE PROBLEMS.—Bolt Beranek and Newman, Inc. (Contract AF 33(616)-3685); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71711). WADC Technical Report no. 57-702, Nov. 1961. x+163 p.

This guide presents detailed engineering procedures for analyzing and solving air base noise problems caused by jet operations. These problems are classified according to five "activity areas": (a) on- and off-base housing, (b) offices and work areas, (c) group meeting, study, and rest and relaxation areas, (d) hospitals, and important communication areas. For each of these areas, analysis procedures are described in detail, and several illustrative examples of the application of these procedures are discussed. The procedures are simplified so that personnel with little or no engineering training can readily apply them to solve air base noise problems. Also, these procedures have been developed so that all noise problems can be solved on paper. No direct measurements of air base noise are required. The guide is intended to be useful to anyone concerned with air base noise problems. It provides engineering guidance for the solution of a variety of problems, including planning new bases, modifying existing bases, and planning future modifications which may become necessary with newer aircraft. (Authors' abstract)

12596
Pigg, L. D. 1961
HUMAN ENGINEERING PRINCIPLES OF DESIGN FOR IN-SPACE MAINTENANCE. — Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718406). ASD Technical Report no. 61-629, Nov. 1961. iii+10 p.

Results of research on problems related to human performance of maintenance actions in space systems are reviewed. The interactions of sensory, psychomotor, and motor functions are discussed, along with problems of remote-handling applications in the space environment. (Author's abstract)

12597
Rising, B. 1959
HOW SOVIETS MAY LAND MAN ON MOON—Aviation Week, 70 (19): 54-61. May 11, 1959.

With reference to the Russian claim of having launched a cosmic rocket on January 2, 1959, and in view of their purported preparations for a lunar expedition, speculations are made on possible means of accomplishing such a feat. A theoretical mission is proposed, and a tentative equipment list (including weight breakdown) for a typical lunar landing vehicle is presented. In this list, consideration is given to such items as food, water and containers, oxygen supply and tankage, nitrogen supply and tankage, air conditioning and heating systems, and weight of the human occupant and his clothing. Further speculations are made on the reliability of getting a man safely to the Moon and back.

12598
Rose, H. W. 1960
PERCEPTION AND REACTION TIMES.—In: Physics and medicine of the atmosphere and space, p. 478-485. New York, etc.: John Wiley and Sons, 1960.

The luminance of space is discussed in terms of physical formulas. In high-altitude aircraft, as long as reference objects are visible, the lack of a gravitationally fixed vertical does not influence proper orientation, but in space flight, depth perception is impossible in many instances. The timely decision that an object is on collision course is difficult in space. Spacecraft and small natural objects in space may have the combination of small size and high relative velocity that make them visible only as point sources of light up to the time when they are too close for evasive action. However, rapid increase in the luminosity of a point source is a signal for collision danger. Light and shadow expected on the planets are presented.

12599
Seminara, J. L. 1960
ACCURACY AND SPEED OF TACTICAL READING: AN EXPLORATORY STUDY.—Ergonomics (London), 3 (1): 62-67. Jan. 1960.

A study is reported of an attempt to determine the ability of individuals to read words presented tactually. This information has practical implications for military or other situations where the weapon or machine operator may be required to operate his equipment in the absence of visual cues. Six subjects made a total of 540 identifications of words ranging from 2 to 7 letters in length. The average time of performance ranged approximately linearly from 5.5 sec. for two letters to 24.5 sec. for seven-letter words. Practice with 90 words during a one-hour session resulted in an over-all improvement of 29% in time of response. It was also indicated that repeated practice with the same words would reduce the time of performance even further. It is concluded that the time required to impart this type of information to an operator via the touch sense makes this technique practical for most situations where visual cues are precluded. (From the author's abstract)

12600
Simon, J. R., 1959
and B. P. Simon
DURATION OF MOVEMENTS IN A DIAL SETTING TASK AS A FUNCTION OF THE PRECISION OF MANIPULATION.—Jour. Applied Psychol., 43 (6): 389-394. Dec. 1959.

Subjects were required to adjust alternately each of two dials on a control panel. The precision required to adjust each dial was systematically varied and the effects of this variation on the durations of four parts of the control movement were determined. An electronic motion analyzer recorded separately and automatically the durations of each part of the task: i.e., the two dial adjustments and the two travel movements. Results clearly demonstrated that the time taken by operators to move between adjustments depended on the precision requirements of those adjustments. Travel movements following a fine adjustment were slower than movements following a gross adjustment, and, in general, travel movements toward a fine adjustment were slower than movements toward a gross adjustment. These findings indicate that the speed of control movements is determined not only by the content of individual movement components but by the over-all characteristics of the task. Results provide additional evidence to refute the concept that a work cycle consists of an additive combination of independent elements. (From authors' summary)

12601
Stacy, E. F. 1961
THE NOISE PROBLEM OF BUILDINGS NEAR AIRPORTS. — Annals Occupational Hygiene (London), 3 (2): 94-106. Feb. 1961.

Noise from aircraft (piston engine with propeller, jet, turbo-prop, helicopter) varies with changes in engine power. No hope is seen for reducing the noise at airports or within large areas around them unless vertical take-off aircraft operating at reasonably high altitude are developed, which would limit the area subjected to the loudest noise but increase the noise exposure of the area. Since the noise source cannot be abated in any way, an alternative is to insulate buildings within noisy areas. This is feasible, though moderately expensive, for some buildings but not for houses. The possibility of restricting large areas of land around airports as far as new housing is concerned is suggested.

12602
Taylor, C. W., 1958
William R. Smith, B. Ghiselin, B. V. Sheets, and J. R. Cochran
IDENTIFICATION OF COMMUNICATION ABILITIES IN MILITARY SITUATIONS.—Univ. of Utah, Salt Lake City (Contract AF 18(600)-1211); issued by Wright Air Development Center. Personnel Lab., Lackland Air Force Base Tex. (Project no. 7719, Task no. 17053). WADC Technical Report no. 58-92, June 1958. vi + 57 p. AD 151 043 PB 140 829

This research was designed to define the dimensions of communication abilities, to provide techniques for measuring performance in communication in military situations, and to determine test predictors of the communication abilities thus defined and measured. A list of communication requirements was abstracted from descriptions of airman jobs. Tests were assembled which were assumed to be predictive of these abilities. From their administration in two large test batteries to samples of airmen, the data were analyzed for selection of predictors, to include with criterion variables, in a validation battery. Eighteen situation tests were constructed from which were derived 27 criteria of communication effectiveness in military situations. Significant relationships between predictors and criteria demonstrated the practicability of assembling either a general set of predictors or groups of specific predictors. There is evidence that communication abilities are more complex than the categorization by communication channel (speaking, writing, reading, listening) implies; integrating abilities are predictive of effectiveness in all channels. The report supplies extensive data useful for further development of selection and classification procedures for Air Force personnel primarily concerned with communication tasks. (Authors' abstract)

12603
Wallis, D., 1961
and J. A. Samuel
SOME EXPERIMENTAL STUDIES OF RADAR OPERATING. — Ergonomics (London), 4 (2): 155-168. April 1961.

An account is given of experiments in which several critical features of the radar operator's task were examined. Experienced operators were used in each case, and special simulators were constructed to give realistic but controllable presentations. Throughout the first study, subjects were required to undertake an auditory detection task at the same time as maintaining a visual search on the radar display. Each experimental watch lasted for 3 hours and was preceded and followed by a measurement of "optimal" performance under psycho-physical test conditions. Results were analysed to compare the effects of "continuous" and "interrupted" radar operating, and to show how performance on watch is related to "optimal" standards. Trends throughout a single session, and throughout five successive daily or weekly ones, were examined. The second experiment was designed to assess the influence of target density (the number of contacts displayed simultaneously) and of blip-scan ratio (probability of "paint") upon the detection of a new contact. Experimental sessions lasted for 30 minutes. An interaction between the two variables was established. A third investigation is reported in which the eye-movement patterns employed in radar research were recorded by the electro-oculographic method. This

was an exploratory study only, but it revealed consistent evidence of unsystematic visual scanning, with wide differences between patterns used by the operators. The overall results and their implications for radar operating are discussed. (Authors' abstract)

12604
Weltman, G. 1961
ESTIMATION OF THE CENTER OF SIMULATED PLANETARY BODIES. — Human Factors, 2 (4): 211-220. Jan. 1961.

The task of centering the simulated image of a planetary body on a display representing the viewscreen of a satellite was investigated in a study employing both male and female subjects. It was found that task performance, as measured by relative radial error, is significantly poorer for crescent and gibbous bodies than for full-phase bodies, and that a circular screen is significantly better than a rectangular one. No significant difference appears for the three diameters of planetary image which were tested. There occur large differences among individuals within the subject group, and the male group exhibits lower error scores than the female. The best subject performed at a level of approximately 1 per cent estimation for all conditions. This amount of operator error is theoretically compatible with the requirements for attitude control during the re-entry of a satellite vehicle. (Author's abstract)

12605
Whisenhunt, G. B. 1961
LIVING IN SPACE. — Indus. Research, 3 (3): 19-23. June-July 1961.

A description of the life support functions (techniques of cabin atmosphere storage and carbon dioxide removal, humidity, temperature, odor and obnoxious gas control, sanitation, food, and water) which must be provided for in space vehicle design considerations is followed by a discussion of the three types of systems (open, semi-closed, and closed) under development. The selection of life support components for systems suitable in specific vehicles must be weighed against the following design criteria: weight reliability, development status, suitability for varied mission requirements, power requirements, and cost. Final system selection requires evaluation of auxiliary power, propulsion, attitude control, and equipment cooling systems in addition to the life support system in order to achieve optimum over-all vehicle design.

12606
White, S. C. 1961
BIOMEDICAL SUPPORT OF PRESENT MAN-IN-SPACE PROGRAMS. — Arch. Environmental Health, 3 (6): 689-694. Dec. 1961.

A review of the life support program for Project Mercury is given. The program is divided into the areas of astronaut support, spacecraft development, medical support, and research programs. Selection methods and training programs are discussed under the astronaut support phase. Medical support is oriented toward flight operations, and concerns itself with monitoring the flight and medical care in case of accident during launching or landing. Spacecraft development has dealt with size and space allocation for the astronaut, the physiological limits of exposure of the astronaut, and design of the astronaut panel display. The biological research program is studying the need for real time surveillance of the astronaut, the availability of reliable data gathering systems, and biosensors.

12607
Whiteside, T. C. D. 1959
PROBLEMS OF VISION IN AVIATION.—Amer. Jour. Optometry, 36 (6): 327-333. June 1959.

Searching tasks performed at high altitudes, and at low altitudes in conditions of clear blue sky, mist, or fog are complicated by the absence of clouds or other visible details upon which ordinary visual accommodation can act. This paper reviews the visual accommodation behavior of the emmetropic, the hypermetropic, the cycloplegic, and the myopic eye in such an empty visual field. Judgments of target size and speed as they are influenced by the perception of distance in environments devoid of background detail, and by the perception of movements of small angularities in the absence of a fixed background pattern, are also briefly considered.

12608
Witmer, R. G., and C. C. Cole 1961
HEARING CONSERVATION PROGRAM AS CONDUCTED WITHIN THE SECOND U.S. MARINE CORPS AIRCRAFT WING.—Aerospace Med., 32 (9): 853-858. Sept. 1961.

Sound and frequency levels were taken whenever possible within the immediate working area of the 14 different types of aircraft from the fuselage outward to 30 feet in order to determine the hazards to flight and ground crew members. With the exception of the R5D fixed-wing airplane, decibel levels far exceeded Bureau of Medicine and Surgery requirements for the use of protective devices. Previous studies in the HR2S helicopter revealed the over-all noise to be at a potentially harmful level of 119 db. in the troop compartment. An additional factor of fatigue was noted due to excessive vibration in two types of transport aircraft. Noise levels in which men must work showed that all aircraft tested generated from a minimum of 88 db. to a maximum of over 150 db. A five-stage hearing conservation program is near completion which is based on detection and correction of those problems already materialized by prolonged exposure to hazardous areas, education of all exposed personnel to sources and effects of sound, and provision of adequate facilities and protective devices.

12609
Zeitlin, L. R. 1960
THE INFLUENCE OF HEART ACTION AND THE CIRCULATION OF THE BLOOD ON MANNED SATELLITE ATTITUDE CONTROL. — Jour. Astronautical Sci., 7 (3): 70-72. Fall 1960.

A discussion is presented of the effects of the internal forces of the body on requirements for the design of an attitude control system for a manned satellite. It is calculated that a significant displacement of a space vehicle would result from (1) the ballistic or recoil forces caused by heartbeat and other impulsive motions of the astronaut, and (2) the mass displacement produced by movement of the arms and feet, change of body position, changes in the distribution of contents within the digestive tract, and blood pooling during various physiological processes, and that angular displace-

ment would result from (3) the torques or couples caused by the natural dissymmetry of blood flow.

c. Instruments and Controls (Including Visual Displays)

12610
Abbey, D. S., 1961
D. Pearce, and C. Gold
DEGREES OF CONTROL-DISPLAY ALIGNMENT AND PERFORMANCE ON A COMPLEX PERCEPTUAL-MOTOR TASK. —— Perceptual and Motor Skills, 13 (3): 343-348. Dec. 1961.

The control unit of the Toronto Complex Coordinator was changed from a joy-stick to a matrix of push-buttons, each button being identified with one of 81 display lights (discs). The subject attempted to light the disc within an illuminated target ring thus scoring a "match". Each of six groups of subjects had the control matrix placed at a different degree of alignment to the display. Amounts of misalignment were 0°, 22 1/2°, 45°, 67 1/2°, 90°, and 180°. Performance, in terms of the ratio of matches to total responses, varied inversely with degree of displacement between 0° and 90°. Performance for 180° displacement was nearer the level of 90° than was expected on the basis of previous studies employing the joy-stick control. The results suggest that type of control (whether discrete or continuous) may interact with degree of misalignment in determining the level of this complex perceptual-motor performance. (Authors' summary)

12611
Ashkenas, I. L., 1959
and D. T. McRuer
THE DETERMINATION OF LATERAL HANDLING QUALITY REQUIREMENTS FROM AIRFRAME-HUMAN PILOT SYSTEM STUDIES.——Systems Technology, Inc., Inglewood, Calif. (Contract AF 33(616)-5661); issued by Wright Air Development Center. Flight Control Lab., Wright-Patterson Air Force Base, Ohio. WADC Technical Report no. 59-135, June 1959. xi + 80 p. PB 161 538 AD 212 152

Present-day lateral handling quality requirements are based upon experiments with craft having certain dynamic characteristics which differ markedly from those occurring in more modern configurations. This departure from past norms has led, in some instances, to unsatisfactory flying qualities in airplanes which met current specifications. In some cases this type of problem can be predicted or explained by the application of existing pilot dynamic response data to serve analysis studies of airframe-pilot systems. These studies result in specifications upon the magnitudes and/or the relative location of airframe transfer function poles and zeros. In the present paper this approach is used to derive tentative criteria for certain roll/aileron transfer function quantities. These criteria are examined in the light of existing pilot opinion data and limited regions of validation are established. For those regions where no data exist the tentative criteria can provide an interim basis for design and a guide to future testing. (Authors' abstract)

12612
Austin, F. H. 1959
PHYSIOLOGICAL INSTRUMENTATION OF PILOTS FOR TEST AND OPERATIONAL FLIGHTS IN NAVY HIGH PERFORMANCE JET AIRCRAFT. I. PRELIMINARY INVESTIGATIONS.——North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development, Report no. 240, May 1959. iv+3 p.

The over-all U. S. Navy In-flight Physiological Instrumentation Program has a dual goal, first to develop a useful research tool for gathering data to feed back into laboratory simulators such as the centrifuge, low-pressure chamber and disorientation simulator, and secondly to discover the measuring of which physiological parameters can best be adapted to operational flight to aid pilot safety and effectiveness.

This Report presents information on the electrocardiogram and respiratory rate during spin tests of a supersonic carrier fighter airplane. Also presented are the accelerations encountered by a pilot, measured concurrently on the airplane seat frame and on his helmet during catapult launch, rapid accelerations and decelerations and rolls and under actual instrument flight conditions. Analysis of accelerations during actual instrument approaches may lead to better understanding and solution of the vertigo accident problem.

An oximeter pick-up based on a new concept of operation and packaged with a miniaturized tape recorder for in-flight data link, now under development for flight test, is described. (From the author's summary)

12613
Bailey, A. W. 1958
SIMPLIFYING THE OPERATOR'S TASK AS A CONTROLLER.——Ergonomics (London), 1 (2): 177-181. Feb. 1958.

As a method of task simplification, application of a display "quickening" technique to helicopter cockpit instrumentation is discussed, using a number of continuous control problems. This technique resulted in substantially increased pilot-helicopter stability while concomitantly reducing the pilot's required physical output. These advantages will contribute towards alleviating the fatigue problem in helicopter instrument flight.

12614
Baker, D. F., 1959
and B. M. Crawford
RANGE LIMITATIONS OF THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR WITH THE SEATED OPERATOR.——Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). WADC Technical Note 59-359, Oct. 1959. iii+12 p.

The master-slave manipulator is now widely used as a general-purpose tool for remote handling. Heretofore, common practice has been for the worker engaged in remote handling to stand while working. However, it is probable that under certain circumstances in the foreseeable future (e.g., in a space vehicle situation) the operator may be required to work while in a sitting position. A study was conducted to determine the extent of limitations upon the inherent work range of the master-slave manipulator (CRL Model 8) when the operator is seated. Contours of effective performance areas in five horizontal planes were determined. (Authors' abstract)

12615
Baker, D. F. 1961
REMOTE-HANDLING TASK PERFORMANCE AS A FUNCTION OF INDEXING VARIABLES.—Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718407). ASD Technical Report no. 61-626, Dec. 1961. iii+23 p.

Three variables in remote-handling operations were studied: mode of indexing actuation, rate of angular indexing, and task distance. A Central Research Laboratory Model 8 Master Slave Manipulator was used by subjects performing a positioning task which required angular indexing (mechanical motion was locked in the Y axis). Actuation of indexing was either by a finger trigger or a foot pedal, and at one of three different indexing speeds. The task involved positioning objects at one of two distances from the operator. In terms of speed of performance, the foot-pedal and finger-trigger controls were equal. However, rate of learning and accuracy of performance were greater with foot-pedal actuation. Task efficiency, measured in speed of performance, increased directly with indexing speed at the far-task distance. This effect was not noted at the near distance. (Author's abstract)

12616
Baker, D. F., 1959
and B. M. Crawford
TASK PERFORMANCE WITH THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR AS A FUNCTION OF COLOR-CODING, DISTANCE, AND PRACTICE.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). WADC Technical Report no. 59-728, Nov. 1959.

An experiment was undertaken to investigate the ability of Master-Slave Manipulator (CRL Model 8) operators to identify the slave hands and their movements with corresponding components and functions of the human body (specifically forearm, wrist and finger movement). A handling task involving rearrangement of blocks was devised to be performed under two different conditions: (1) with standard slave jaws (red jaws) and (2) with slave jaws modified so that the jaw corresponding to the thumb of the operator was green. The task was performed at distances of 9 inches, 36 inches, and 63 inches from the radiation shield. Work time as a function of task distances was investigated and work ratios, based on mean time scores for direct handling vs. remote handling, were determined. (Authors' abstract)

12617
Baker, D. F. 1960
TASK PERFORMANCE WITH THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR AS A FUNCTION OF OBJECT SIZE, ANGLE, AND HEIGHT OF DISPLAY.—Wright Air Development Division. Aerospace Medical Division, Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). WADD Technical Report no. 60-167, May 1960. iii+16 p.

This experiment was undertaken to investigate criteria for design of equipment to be handled and tasks to be performed with remote-handling equipment. Three variables in remote-handling task performance were studied: size of object handled, height, and angle of display. A CRL Model 8 Master-Slave Manipulator was used for a performance task in which subjects removed three sizes of hexagonal nuts from a display panel presented at three different heights and five different angles. Task performance times were analyzed in relation to joint range limitations of shoulder, elbow, forearm and wrist movements. Within the limits of this study, the size of the object to be handled remotely has little effect on performance. Change in angle of display brings about significant differences in performance time. Performance time tends to improve as angle moves from horizontal to vertical at the upper height; and from vertical to horizontal at the lower height. (Author's abstract)

12618
Barr, N. L. 1958
IFR FLIGHT WITHOUT ATTITUDE INSTRUMENTS.—Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 15 01 00.01.01 (Vol. 16, p. 389-394), April 25, 1958. AD 202 950

An attempt is made to determine how effectively trained instrument pilots can fly without the primary attitude instruments. The performance of 14 pilots using only the gyrocompass, the altimeter, the air-speed indicator and the clock was compared with their performance with a normal instrument panel. With the partial set of instruments performance was impaired but except for turn rate was within acceptable tolerance limits. It is concluded that trained pilots can fly safely without attitude instruments providing they recognize that these instruments are not functioning and use the other instruments correctly. (Author's abstract)

12619
Barr, N. L., 1959
and R. B. Voas
TELEMETERING PHYSIOLOGICAL RESPONSES DURING EXPERIMENTAL FLIGHTS.—In: The first international symposium on cardiology in aviation, p. 51-62. Brooks Air Force Base, Texas: School of Aviation Medicine, [1959].
Also published in: Amer. Jour. Cardiology, 6 (1): 54-61. July 1960.

This paper discusses the basic equipment used and the underlying principles which are applied in monitoring the pilot's responses to the physiologic and psychologic stresses of space flight. Physiologic stressors include gravitational stress, oxygen tension, carbon dioxide tension, pressure changes, temperature, radiation problems, and zero gravity. They generally produce their effects by direct action on the body and its functioning. Psychologic stressors are typified by the threat of physical injury, confinement, lack of stimulation, or the time pressures and complexity of the task required of the pilot and generally produce their effects by provoking an emotional reaction within the person. Such emotional reactions are accompanied by conscious feelings such as fear, anger, excitement or boredom, and by a physiologic mobilization of energy which generally results in increased heart rate and blood pressure, reduced gastric motility, etc. The reactions to these stresses are mediated primarily by the autonomic system or by variations in the amount of hormones secreted by the adrenal glands and usually involve electrical, mechanical, or thermal changes which are measurable. Emphasis is placed upon the importance of collecting preflight control data under non-stress conditions and

under simulated stress of various types in order that the normal and the stress response levels for each subject will be known in advance.

12620
Bartlett, R. G., 1960
and A. J. Moss
OBSERVATIONS ON THE PNEUMOTACHOCARDIOGRAM.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-7004, Subtask 7). Report no. 1, Dec. 16, 1960. 20 p.

The contracting heart causes changes of pressure within the thorax with resultant air flow through the respiratory passages. The purpose of this study is to record the cardiac air flow at the mouth and correlate the pattern detail with electromechanical cardiovascular events. A method for recording the pneumotachocardiogram (PTCG) is developed. The electrocardiogram, ballistocardiogram, and carotid pulse are recorded simultaneously with the pneumotachocardiogram, and representative tracings are presented. The PTCG is shown to record the velocity of air flow at the mouth and to reflect the net balance between the rates of thoracic venous inflow and arterial outflow. The various pneumotachocardiographic deflections are related to specific cardiovascular mechanical events. (Authors' summary)

12621
Basan, L., 1958
and I. Lovdzhiev
[RADIO-TRANSMITTING SET FOR INVESTIGATING RESPIRATION DURING WORK AND SPORT PERFORMANCE] Metodika dlia issledovaniia po radio dkyhaniia vo vremia truda i sportivnykh uprazhnenii. —Fiziologicheskii zhurnal SSSR (Moskva), 44 (8): 773-775. Aug. 1958. In Russian.
English translation: RADIO-TRANSMITTING METHOD FOR THE INVESTIGATION OF RESPIRATION DURING WORK AND ATHLETIC EXERCISES. —Sechenov Physiol. Jour. U.S.S.R. (New York), 44 (7-8): 733-736. Dec. 1958

A telemetric transmitter is described, which functions by transforming the energy of respiratory air into frequency-modulated radio waves. The frequency changes correspond to changes in respiration. The transmitter may be attached to a person and is suitable for measuring respiration during actual work.

12622
Bauerschmidt, D. K., 1960
and S. N. Roscoe
A COMPARATIVE EVALUATION OF A PURSUIT MOVING-AIRPLANE STEERING DISPLAY. —IRE Trans. on Human Factors in Electronics, HFE-1 (2): 62-66. Sept. 1960.

An experiment was conducted using a flight simulator to determine the relative ease with which pilots can learn to use four types of airborne fire-control system steering displays. The four displays compared were (1) a moving-horizon display with a space-stabilized error dot, (2) a moving-horizon display with an aircraft-stabilized error dot, (3) a compensatory type moving-airplane display, and (4) a pursuit type moving-airplane display. Of the four displays, the moving-airplane types were found to yield significantly smaller firing errors and require less learning as compared to either moving-horizon type display. Furthermore, the pursuit type of moving-airplane display yielded learning performance and terminal performance error levels superior to any of the other displays. (Authors' summary)

12623
Beenken, H. G., 1958
and F. L. Dunn
SHORT DISTANCE RADIO TELEMETERING OF PHYSIOLOGICAL INFORMATION. —IRE Trans. Med. Electronics, PGME-12: 53-57. Dec. 1958.

A completely transistorized radio transmitter and a receiving system are described operating at 104 megacycles. The weight of the transmitter is under two pounds without the use of miniature parts. Design is for transmission of up to ten channels with bandwidths of 250 and 1000 c.p.s. The channel reported has a carrier frequency of 2100 c.p.s. and has been tested for electrocardiogram recording. Satisfactory calibrated records were obtained while walking and while on treadmill. (Authors' summary)

12624
Bengulescu, D. 1961
[ELECTRONIC APPARATUS FOR THE SIMULTANEOUS TELE-REGISTRATION OF FOUR BIOLOGICAL CURRENTS] Dispozitiv electronic pentru teleînregistrarea simultană a patru curenţi biologici. —Studii şi cercetări de fiziologie (Bucureşti), 6 (4): 721-726. 1961. In Rumanian, with French summary (p. 726).

An electronic telemetric apparatus which registers four biological electrical potentials (2 electroencephalograms and 2 electrocardiograms) simultaneously is described and diagramed. The apparatus is proposed for installation in aircraft in order to study the behavior of pilots during flight. The maximum distance at which telemetry is possible is 50-60 kilometers. (Author's summary, modified)

12625
Bernberg, R. E. 1960
A COMPARISON OF THREE FLIGHT ATTITUDE DISPLAYS. —Human Factors, 2 (1): 14-17. Feb. 1960.

Requirements for presenting to the human operator the information needed to pilot air vehicles change as the performance characteristics of aircraft change. In this study, an evaluation was made of the efficiency of three flight attitude displays (an attitude ball indicator, a horizontal cross-hair bar, and a vernier scale side-read in vertical) in aiding a pilot to fly a constant pitch climb of twenty-five degrees pitch attitude with three levels of stick damping. The results indicate that the differences between instruments are highly significant, and that the vernier scale is a more effective flight display under all conditions of the experiment than the other displays. The author recommends the use of a vernier scale in the attitude ball, appropriately scaled for small pitch reading, to provide the base for optimum human performance. (From the author's abstract and conclusions)

12626
BIONICS SYMPOSIUM: LIVING PROTOTYPES—THE KEY TO NEW TECHNOLOGY, 13-14-15 SEPTEMBER 1960.—Ed. by J. C. Robinette. Wright Air Development Division. Directorate of Advanced Systems Technology, Wright-Patterson Air Force Base, Ohio. WADD Technical Report no. 60-600, Dec. 1960. viii+499 p.

This report compiles the papers presented at the Bionics symposium sponsored by Wright Air Development Division in September 1960. The introductory session discusses the background from which bionics arose, the military and general need, attitudes toward intelligent machines (a major product of bionics) and a survey of current research on living prototypes. The four technical sessions deal with current work in stages successively closer to practical devices. This begins with logic derived from the contemplation of neurones but applicable to the design of electronic networks of increased capacity and reliability. It continues with discussion of theories, devices and techniques based on or simulating visual and auditory perceptual processes. The final technical session contains five papers on the mechanization of higher functions, such as learning, self-programming, pattern recognition, decision making, and heuristic programs. The report concludes with discussions of the potential value of bionics, its present status, procedural methods and difficulties, and possible social consequences. (Editor's abstract)

12627
Bradley, J. V., 1958
and R. A. Wallis
SPACING OF ON-OFF CONTROLS. I. PUSH BUTTONS.—Antioch Coll., Yellow Springs, Ohio (Contract AF 33 (616)-3404); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7182, Task no. 71514). WADC Technical Report no. 58-2, April 1958. iv+16 p. AD 142 272
Also published as: SPACING OF PUSH BUTTON ON-OFF CONTROLS.—Eng. and Indus. Psychol., 1 (4): 107-119. Winter 1959.

An experiment was conducted to determine performance efficiency in the operation of single on-off push-button controls as a function of spacing between adjacent controls. Level of performance was defined by measurement of operation time and number of errors in touching or operating adjacent controls. A horizontal configuration of controls was observed to be more efficient in all parameters than a vertical array. Operation time was decreased independently of changes in control diameter with increasing distances between push-button centers. Operation time was improved with increasing push-button diameter with control edges spaced at a constant distance. Touching errors decreased with increasing push-button diameter with constant edge spacing, and decreased with decreasing diameter with constant center spacing. It is concluded that with a permissible control spacing of 1 1/2 inches between centers, a 1/2 inch diameter push button is superior to larger diameter controls. With an intercenter spacing of two or more inches, push buttons as large as one inch are desirable.

12628
Bradley, J. V., 1960
and R. A. Wallis
SPACING OF TOGGLE SWITCH ON-OFF CONTROLS. — Eng. and Indus. Psychol., 2 (1): 8-19. Spring 1960.

Thirty-six subjects participated in an experiment investigating the operating efficiency, two orientations, the direction of throw, and the spacing of three toggle-switch types. When a given amount of panel space is available in which to place a linear array of on-off controls, the speed of operation of controls will be maximized by using push buttons (1/2 inch in diameter or larger) rather than toggle switches and controls of large dimensions and small resistance to operation. On the other hand, if, under similar circumstances, space is so limited that controls must be spaced less than an inch between centers, the frequency of inadvertent operation of adjacent controls will be minimized by using toggle switches rather than push buttons and controls of small dimensions and large resistance to operation. (Authors' conclusions, modified)

12629
Brebner, J., 1959
and A. A. Burrows
THE EVALUATION OF AIRCREW INFORMATION SYSTEMS.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC 108, Feb. 1959. 9 p.

The methods and criteria for evaluations of aircrew information systems are examined. Seven types of systems are listed, and three useful approaches are discussed. (1) The "checklist" approach should be carried out when the equipment is designed; it should be comprehensive; and it should conform to agreed principles. (2) The operations to be performed by the operator after receiving the information should be analyzed; it should be determined whether a different display would make such operations easier or even unnecessary. (3) Measures of performance of the operator are related to the conditions in which the experimenter is interested and to the total output, both in-flight and during simulated flight.

12630
Breckler, A., 1959
L. Kaeburn, B. L. Ettleson, and D. W. Douglas
"SPACE CANARIES": IMPLICIT BIOLOGICAL MONITORING.—American Rocket Society, Publication 925-59. [8] p. New York, 1959.

A method of radio transmission of cardiovascular data by a surgically implanted semiconductor circuit is described, as is the surgical procedure for implantation. Photographs of the transmitter package, implantation surgery, transmitted electrocardiogram, and X-ray of the implanted package in a dog are included. (Authors' summary, in part)

12631
Caldwell, L. S. 1959
THE EFFECT OF THE SPATIAL POSITION OF A CONTROL ON THE STRENGTH OF SIX LINEAR HAND MOVEMENTS.—Army Medical Research Lab., Fort Knox, Ky. (Project no. 6X95-25-001, Task no. 03). Report no. 411, Dec. 30, 1959. ii+9 p.

The effects of distance, angular elevation, and lateral position of an isometric control on the strength of six linear hand movements were determined. The control distance exerted a stronger influence on the output of the operator than did either of the other spatial variables. The up, down, left, and right movements were strongest at the near control positions. Pull increased in strength as the control distance increased to maximum, but push increased with distance to the 20-inch position and then decreased as the distance was

increased. Neither angular elevation nor lateral position of the control had any significant effect on the up movement, but the effects on other movements varied. There was some overlap in the data for the strengths of the various movements so that the order of preference for the movements depends on the position of the control. (Author's abstract, modified)

12632
Camp, R. T., 1958
and S. N. Morrill
THE INTELLIGIBILITY CHARACTERISTICS OF H-79 EARPHONES AND TELEX MINIATURE LOUDSPEAKERS IN THE FULL PRESSURE SUIT HELMET.—U. S. Naval School of Aviation Medicine, Pensacola, Florida (TED PEN Project AE-1403.16). Special Report no. 58-29, Oct. 8, 1958. ii+14 p.

Intelligibility tests were performed on the H-79 earphones and the Telex miniature loudspeakers mounted in full pressure helmets. The tests were performed under various altitudes (from sea level to 60,000 ft.), pressure, and ventilation conditions, on a trained observer who was wearing a full pressure suit and helmet. The earphones used less electrical power for a given amount of intelligibility, but both types of transducers are efficient enough to yield adequate speech and radio signal intelligibility under noise conditions expected in jet aircraft cockpits. (Authors' summary)

12633
Carbery, W. J., 1961
C. A. Steinberg, W. E. Tolles, and A. H. Freiman
AUTOMATIC METHODS FOR THE ANALYSIS OF PHYSIOLOGIC DATA.—Aerospace Med., 32 (1): 52-59. Jan. 1961.

A computer facility for the rapid analysis of data from the manned space satellite is described. The main features of this facility, which make possible the rapid and quantitative assessment of the astronaut and his environment, are (1) automatic signal recognition and measurement; (2) automatic analysis of several channels of simultaneously recorded data for the early detection of significant changes; and (3) automatic analysis to determine the underlying cause of these changes. Since the facility does not as yet exist, the results of operating it cannot be presented. However, results obtained from the analyses of similar types of data demonstrate the feasibility of developing such a computer, e.g., the physiological signals from the electrocardiograph, the ballistocardiograph, the phonocardiograph, and the arterial pulse from 45 subjects are analyzed. (Authors' summary, modified)

12634
Carlson, L. D. 1961
REQUIREMENTS FOR MONITORING PHYSIOLOGICAL FUNCTION IN SPACE FLIGHT. — In: Space medical symposium. Astronautik (Stockholm), 2 (4): 310-320. 1961.

The physiological functions to be monitored in space flight and in very high altitude flights are those related to vital function (such as eye movement, galvanic skin reflex, respiration, and electrocardiogram) and routine performance (psychomotor functions such as vigilance and logical decision making). The combination of these critical parameters and assessment of their significance, in reference to past events and present cabin conditions, by a computer increases the speed with which these relationships can be established and permits some warning time only when events are beyond set limits. This approach necessitates the accumulation of information necessary for programming the computer but spares the observer constant visual analysis of records. By relating changes to the existing event the critical judgement of the monitor is enhanced. The establishment of a multiple-factor computer-type animator predictor incorporating the above factors is discussed and shown schematically.

12635
Clark, J. 1958
PRESSURE TRANSDUCERS—TRANSFORMER TYPE. —In: Aviation medicine—selected reviews, p. 245-252. Edited by C. S. White and others. London, etc.: Pergamon Press, 1958.

The author points out the need for pressure transducers of high output and sensitivity and proceeds to describe the general design and characteristics of three units which he has developed and used, employing the electromagnetic characteristics of transformers. One unit utilizes two transformers placed symmetrically on each side of a circular, pressure-sensitive diaphragm and is recommended for use as a differential pressure-sensing instrument. The other two instruments employ a single transformer and both are flush diaphragm units. One is of conventional size, but the other is a subminiature unit, 0.100 in. in diameter and 0.250 in. long. The latter is suitable for bonding to a No. 8 catheter and thus is appropriate for use inside the bodies of even small animals. Recommended electrical components of the equipment required to use the transducers are described and examples of employment in biological work are given, such as respiratory pattern tracings. (Summary by C. S. White)

12636
Conover, D. W. 1959
THE AMOUNT OF INFORMATION IN THE ABSOLUTE JUDGMENT OF MUNSELL HUES.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-3612); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184). WADC Technical Note 58-262, June 1959. vii+48 p.

Using surface colors provided by the Munsell 50-hue series of colored papers, the author developed a preliminary equal-discriminability scale for the absolute recognition of colors. Based on these data 16 colors were selected that represented an equally spaced series. This scale was validated with a second group of subjects. The results indicated that no adjacent pair of colors was confused with much greater frequency than any other pair. Both the initial and validating data indicate that the average color-normal individual can identify, on an absolute basis, nine surface colors. For practical coding purposes these results indicate that a maximum of somewhere between five and eight colors can be used, the exact number depending on how unfavorable the viewing conditions are expected to be and how large a proportion of the population must read the code without error. Theoretical and practical aspects of the results are reviewed. (Author's abstract) (49 references)

12637
Crawford, B. M., and D. F. Baker 1960
HUMAN FACTORS IN REMOTE HANDLING SURVEY AND BIBLIOGRAPHY.—Wright Air Development Division. Behavioral Sciences Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71586). WADD Technical Report no. 60-476, July 1960. 30 p.

The state of the art in remote handling is assessed and related to present and future advanced system requirements. Principal features and purposes of the main types of remote-handling systems, including sensory feedback provisions, are described. Human engineering considerations related to equipment design, motor and sensory requirements of tasks and perceptual difficulties, together with possible solutions, listed to stimulate and coordinate further research and development efforts. Possible implications of current remote-handling concepts for planing nuclear-powered systems and space support units are given special consideration. A bibliography representing a thorough screening of information sources in the United States, Canada, Great Britain, and France is included. (Authors' abstract) (173 references)

12638
Crosbie, R. J., J. D. Hardy, and E. Fessenden 1961
ELECTRICAL ANALOG SIMULATION OF TEMPERATURE REGULATION IN MAN. —Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task MR005.15-2002.1, Report no. 25). Report no. NADC-MA-6130, June 12, 1961. vi+21 p.
Also published in: IRE Trans. Bio-Med. Electronics, BME-8 (4): 245-252. Oct. 1961.

Physiologic temperature regulation involves three of the basic types of control modes, namely, proportional control, rate control and some of the characteristics of on-off control. The rate and proportionality constants have been determined experimentally on the assumption that the regulated temperature is the average body temperature. Time constants for the various thermal changes can be determined from the thermal constants of tissue and the response times of the physiological variables of sweating, vasomotor activity and change in metabolic rate. The simulator predicts steady-state situations of rectal temperature, skin temperature, metabolic rate, vasomotor state and evaporative heat loss under both resting conditions and exercise. Dynamic responses to sudden shifts in environmental temperature, air velocity, relative humidity and metabolic rate can be simulated to a considerable extent using equations based on the controls outlined above. (From the authors' summary)

12639
Cushman, R. H. 1959
BIOPHYSICAL FEEDBACK FOR SPACE SYSTEMS. —Automatic Control, 10 (6): 14-24. June 1959.

An ideal biophysical instrumentation and control system for future space systems is described which consists of a lightweight harness integrated with the pilot's clothing. The harness contains sensors attached painlessly to various body parts with lead wires woven into the clothing, and contains its own feedback loops to serve as personal homeostasis and psychological stability augmentors for the human. Tiny warning devices tell the pilot in advance when he is becoming nauseous, sleepy, or emotionally hyperaroused. The receivers on the space ship in turn relay the status of the human to both the ground telemetering transmitter and the space ship's own central computer. Included in the system is a miniature electrocardiograph, breathing sensors, heart recorders, bead thermistors for skin temperatures, blood pressure pickup, and instrumentation systems for galvanic skin resistance and electroencephalography.

12640
Davis, J. F. 1959
MANUAL OF SURFACE ELECTROMYOGRAPHY.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71580). WADC Technical Report no. 59-184, Dec. 1959. viii+122 p.

The methodology and instrumentation of surface electromyography are presented in detail. Principles (and applications of principles) of electrode placement are given along with certain standard placements. Various types of ink-writing electromyographs and accessories are evaluated and specifications are outlined for a satisfactory research instrument. These specifications include type of power supply, type of recorder, and desirable characteristics for the pre-amplifiers, the main amplifiers, and the control panel. Basic principles are given for layout and construction of laboratory rooms so as to minimize artifacts in the EMG record. Finally, the manual discusses the operation of EMG instruments, including methods of eliminating various artifacts, and the measurement of both primary and integrated records. Illustrations of electrode placements and construction and schematics of ink-writing electromyographs are provided. (Author's abstract)

12641
Ellis, D., L. Steinman, and F. Ludwig 1961
THE TUNNEL DISPLAY CONCEPT. —Advances Astronaut. Sci., 6: 357-368. 1961.

One of the problems of space travel is to provide the astronaut with a suitable frame of reference and other visual displays or auditory signals to enable him to keep his craft on course and to inform him of significant events. One means of doing so is the use of the tunnel display concept, which relates to an advanced integrated format for the display of pilot/navigator (or space-craft controller/occupant) information. In this display, the status of system constraints in their entirety is presented in a visual form perceptually natural to the controller; namely, in terms of dynamic alterations of spatio-temporal relationships. Mission profiles in consonance with system limitations are preprogrammed and become effective upon selection by the controller. In addition, various three-dimensional displays and the use of words and sounds as directive or altering signals are described and various critical situations are illustrated. Means of mechanizing the control equations and implementing the system are given. (Authors' abstract, modified)

12642
England, S. J. M., 1961
and B. Pasamanick
RADIOTELEMETRY OF PHYSIOLOGICAL RESPONSES IN THE LABORATORY ANIMAL. — Science (Washington), 133 (3446): 106-107. Jan. 13, 1961.

A radiotelemetric system has been developed for use as an adjunct to studies in the classical conditioning of animals. The system will permit the monitoring and recording of selected physiological reactions in intact, unanesthetized laboratory animals during their normal daily routines in a simulated normal environment uncontaminated by the intervention of the experimenter and experimental procedures, except for planned changes in the controlled environmental chambers. Permanently-implanted, transistorized, miniaturized, battery-powered packages permit short-distance propagation of selected physiological activities, with the possibility also of providing remote control of selected stimuli. Continuous measurement of physical conditions within the environmental chambers (ambient temperature, humidity, air ionization, barometric pressure, air velocity, light intensity, chemical composition of the air within the chambers, and other such physical parameters as may be shown to be significant) may be recorded along with the physiological activity specific to the animals. The behavior of the animal may be observed by a remote visual system. The construction and operating principles of the system are discussed. (Quoted in part)

12643
Ettelson, B. L., 1960
W. N. Cooper, M. A. Beaupre, T. Freedman, L. G. Throssell, and B. Pinc
INTERNAL ANIMAL TELEMETRY—A FEASIBILITY TEST PROGRAM. — American Rocket Society, Publication 1426-60. 9 p. New York, 1960.

An improved method of animal telemetry instrumentation is described using dogs and simians. The internally implanted sensor and telemeter allow the transmission of physiological data to a receiver-signal conditioner for subsequent air-to-ground telemetry. The surgical procedure carried out on the simian is described. The testing of the instrumentation included acceleration, acoustic noise, radio interference, and vibrations. These measurements were checked against external recordings. It was found that the animals tolerated the implants very well with no serious effects. Improvements that were found to be necessary are better attachment of the transmitter, reduction of self-generated noise, simplification of the recharging system, and prevention of the decoder from responding to noise spikes.

12644
Farrar, J. T., 1960
C. Berkley, and V. K. Zworykin
TELEMETERING OF INTRAENTERIC PRESSURE IN MAN BY AN EXTERNALLY ENERGIZED WIRELESS CAPSULE.—Science (Washington), 131 (3416): 1814. June 17, 1960.

A pressure-sensitive telemetering capsule, energized by an external wireless source, has been employed to detect and record the intraluminal pressures of the gastrointestinal tract in eight subjects. After the capsule is swallowed, an external coil is placed around the subject and a high-frequency signal is delivered intermittently to the capsule through this coil. Intraluminal pressure on the capsule diaphragm modulates the frequency at which the capsule circuit responds to the signal. The modulated signal is detected and rectified by the external coil and a pressure curve is recorded. Pressure records similar to those yielded by other sensing devices were obtained from the stomach, small intestine, and colon. It is suggested that the system has significant potential value in the detection and transmission of other physiologic information from different organ systems in man and animals.

12645
Fogel, L. J. 1959
NEW INSTRUMENTATION CONCEPTS FOR MANNED FLIGHT.—Proc. IRE, 47 (11): 1978-1992. Nov. 1959.

The advent of modern aircraft has forced the recognition of three fundamental principles required to optimize human flight control: The first, kinalog attitude display, is an adaptive kinesthetic analog tracing the human orientation as g force is sensed, intended to inhibit the onset of vertigo through the maintenance of continued agreement between the instruments and the human operator's internal "up" vector. The second, anticipatory display, describes information relative to some aspect of a future status of the vehicle, thus overcoming both the pilot's and the vehicle's response time lag. The speed of modern aircraft already leaves too little time for decision making. Anticipatory display may overcome this problem and significantly improve performance. The third, modified pictorial display, presents an integrated pictorial view from which have been removed many of the irrelevant data which would be seen in the real world. These concepts are embodied in proposed aircraft instrument designs which fall within the present state of the art. They are also extended to possible future spacecraft applications. Compatible quantitative instrumentation is also described to complete the cockpit panel. Cursory evaluation has been accomplished by ground simulation and some relevant data are presented. These initial experiments appear to offer a significant promise to increase the performance capability of future manned vehicles. (Author's summary)

12646
Freeman, W. J., 1959
and A. Hemingway
NERVOUS CONTROL OF SHIVERING: A MANUAL FOR THE CONSTRUCTION, USE AND INTERPRETATION OF RECORDS FROM STAINLESS STEEL MICROELECTRODES.—Arctic Aeromedical Lab., Ladd Air Force Base, Alaska. Technical Report no. 58-1, May 1959. iii+34 p.

Detailed instructions are given for the construction and use of stainless steel microelectrodes. Information is also given on the recognition of noise and artifacts, on the analysis of action potentials recorded by this means, and on the problems likely to be encountered in localizing cell discharges in the brain and correlating them with physiological changes in other parts of the body. (Authors' abstract) (35 references)

12647
Frost, G. G. 1961
AN APPLICATION OF A DYNAMIC PILOT-MODEL TO SYSTEM DESIGN.—Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71584). ASD Technical Report no. 61-57, April 1961. iii+9 p.

Design, evaluation, and integration of controls and displays for advanced flight vehicles present recurrent problems for the human engineer. This report presents a method for solving these on a fast-time analog computer and describes one application. The basic concept of this approach centers about the use of a dynamic model of the pilot which can be instrumented on the computer along with the airframe and flight control dynamics, thus permitting design and evaluation of the total closed loop system during the early design phase. (Author's abstract)

12648
Frucht, A. H., and K. Otto 1959
[WIRELESS TRANSMISSION OF THE ECG OF MAN OR ANIMAL BY MEANS OF A MINIATURE TRANSISTOR TRANSMITTER] Drahtlose Übertragung des EKG mit Transistor-Kleinstsender vom Menschen oder Tier [Abstract].—Pflügers Archiv für die gesamte Physiologie (Berlin), 270 (1): 82. 1959. In German.

A miniature transistorized transmitter, capable of transmitting the electrocardiogram for pulse count and observations during rest and work, is described. Built-in nickel-cadmium storage batteries permit 6 hours of uninterrupted operation. The transmitter with storage battery and antenna weighs approximately 550 grams, and the receiver can be connected to an electrocardiograph or electrocardioscope. The range of the system is at least 50 m., under good conditions of visibility and using a 3-m. antenna.

12649
Gazenko, O. G., and R. M. Baevskii 1961
[PHYSIOLOGICAL METHODS IN SPACE MEDICINE] Fiziologicheskie metody v kosmicheskoi meditsine. — Iskusstvennye sputniki zemli (Moskva), 11: 68-77. 1961. In Russian.

Biotelemetrical methods in space medicine may be grouped along the following lines of application: (1) continuous monitoring of physiological functions in man or animals during space flight, (2) research on the effects of cosmic flight factors on the living organism, and (3) indicators of hazards to human life or health. Along with their use there arise new problems related to the design of transducers and amplifiers, conversion or coding of medical information in a form suitable for input into the telemetry channels, programming of measurements, and the volume of information to be transmitted. A brief review is presented of experience with methods employed on the second and third Soviet space flights, i.e., electrocardiography, seismocardiography (modified ballistocardiography), phonocardiography, arterial oscillography, sphygmography, pneumography, electromyography, actography, thermometry, and investigation of conditioned reflexes.

12650
Geddes, L. A., H. E. Hoff, and W. A. Spencer 1961
SHORT DISTANCE BROADCASTING OF PHYSIOLOGICAL DATA. — IRE Trans. Bio-Med. Electronics, BME-8 (3): 168-172. July 1961.

For the transmission of physiological data not requiring complete freedom for the subject, a direct wire system offers many practical advantages including low cost and high reliability. For general purpose physiological telemetry, it is necessary to transmit a bandwidth extending to zero cycles per second. Experience has demonstrated that such transmission is possible over a direct wire circuit for a distance of at least half a mile. An over-all response time of 100 microseconds provides an adequate bandwidth for the most rapidly changing physiological events. (Authors' summary, modified)

12651
Gerathewohl, S. J. 1960
S. W. Downs, G. A. Champlin, and E. S. Wilbarger
BIO-TELEMETRY IN THE NOSE CONES OF U. S. ARMY JUPITER MISSILES.—IRE Transactions on Military Electronics, MIL-4 (2-3): 288-302. April-July 1960.

Essentially the same: S. J. Gerathewohl, [SPACE-MEDICAL EXPERIMENTS WITH JUPITER ROCKETS] Raumfahrtmedizinische Versuche mit Jupiter-Raketen.—Raketentechnik und Raumfahrtforschung (Stuttgart), 4 (3): 86-92. July 1960. In German, with English summary (p. 86).

The biomedical preparations, packaging, and instrumentation which accompanied the launching of primates in ballistic flight are described. Information is given on animal selection criteria; techniques of conditioning to restraint, confinement, and g-forces; life support equipment within the nose cone; and methods of supporting and protecting the animal in the individual capsule. In-flight telemetered data included information on the electrocardiogram, heart sound, respiration rate, electromyogram, pulse velocity, the percent of CO_2 in the capsule, ambient pressure of the capsule, and the behavioral responses of the animals. A tabulated evaluation of the film obtained in flight of the rhesus monkey, Able, shows the movements of the animal during acceleration, free-flight, spin, and re-entry.

12652
Gold, D. C., and W. J. Perkins 1959
A MINIATURE ELECTROENCEPHALOGRAPH TELEMETER SYSTEM.—Electronic Eng. (London), 31 (376): 337-339. June 1959.

A telemeter system is described which enables the electrical activity of the brain of a normal free and unrestrained cat to be recorded. The voltage picked up by an electrode fixed into the skull is amplified sufficiently to modulate a transmitter carried on the cat's back. The transmissions are received and applied to a cathode-ray display unit or a tape recorder. A telemetered electroencephalogram illustrates the changes of electrical activity produced by a change in behavior. The limitations of the instrument are discussed.

12653
Goldberg, M. N., 1960
R. A. Mills, and W. V. Blockley
INSTRUMENTATION PACKAGE FOR INFLIGHT PHYSIOLOGICAL STUDIES.—North American Aviation, Inc., Los Angeles, Calif. (Contract AF 33(616)-5866); issued by Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71831). WADD Technical Report no. 60-83, Feb. 1960. vii+63 p.

An instrumentation package has been developed for the monitoring of pilot physiological status during flights in the X-15. Data recorded include electrocardiograph signals, respiratory flow rates, skin and deep body temperatures, and helmet-suit and suit-cockpit pressure differentials. Environmental and flight tests were performed to determine the characteristics of the package and to survey subject response during stress. The package is capable of driving a pulse duration modulation (PDM) system for telemetering pressure data. Descriptions of the components and method of use are included. (Authors' abstract)

12654
Gorman, H. A. 1960
INSTRUMENTATION OF ANIMALS FOR BIOSATELLITE RESEARCH: SURGICAL IMPLANTATION OF RADIO TRANSMITTERS FOR DETERMINING VIABILITY IN THE MOUSE. — Jour. Amer. Veterinary Med. Assoc., 137 (12): 693-697. Dec. 15, 1960.

A surgical procedure is described for the implantation of a miniature saddle-type transmitter and electrodes to sense and transmit signals describing the electrocardiogram, respiration, and muscular responses of mice during space flight. Transmission of each of the electrophysiological parameters is made on a preselected frequency to detectors outside the animal cage, where signals are amplified and retransmitted from the space vehicle. Signals have been received from mice with implanted radio transmitters for as long as 27 days.

12655
Green, C. [D.] 1959
BIOLOGICAL MONITORING OF SPACE FLIGHT.—American Rocket Society, Publication 931-59. 9 p. New York, 1959.

During space flight, the state of consciousness of an animal or a man may be telemetered by means of a camera, by recording of vocal sounds, or by measuring ability to perform a psychomotor test. The record of blood pressure and respiration can be recorded simultaneously or can be telemetered to a ground station. Circulatory adequacy may be measured by electrocardiogram, vectorcardiogram, and impedance plethysmogram. If the man or animal wears a mask or helmet at all times, it is possible through a choice of very low resistance flow meters to determine the minute volume of respiration. Environmental conditions within the space ship may also be telemetered, such as partial pressure of oxygen, relative humidity, temperature, and carbon dioxide tension.

12656
Green, M. R., 1959
and F. A. Muckler
SPEED OF REACHING TO CRITICAL CONTROL AREAS IN A FIGHTER-TYPE COCKPIT.—The Martin Co., Baltimore, Md. (Contract AF 33(616)-5472); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184). WADC Technical Report no. 58-687, June 1959. v + 16 p.
AD 216 298, PB 161038

Ten subjects (5 pilots and 5 nonpilots) were used to investigate basic speed of movement under optimum conditions to stimuli (stimulus light and a toggle switch used to extinguish the stimulus light) placed in nine critical cockpit movement areas which were chosen after an examination of a number of cockpits in current high-performance aircraft. Both normal and emergency pilot control functions were considered. The cockpit dimensions and movement areas selected for study were believed to be pertinent to current and proposed cockpit configurations both for conventional and space vehicles. The subject was alerted by the illumination of a 10-sec. cue light which indicated that the stimulus would originate from either the left, center, or right cockpit area. After the 10-sec. cue, the stimulus light was illuminated, and the cue light automatically and simultaneously extinguished. From the basic hand position on the side sticks, the subject shut off the stimulus light as rapidly as possible by actuating the spring loaded toggle switch. The subject then returned his hand to the basic position and refocused on the cue lights to await the next trial cycle. Controls on the right side of the cockpit were reached more rapidly than controls on the left side. The optimum area was on the right side console forward of the arm rest. Poorest areas were at the extreme right, extreme left, and lower middle of the center instrument panel. The performances of pilot and nonpilot subject groups did not differ.

12657
Groth, H., 1958
and J. Lyman
EFFECTS OF SURFACE FRICTION ON SKILLED PERFORMANCE WITH BARE AND GLOVED HANDS.—Jour. Applied Psychol., 42 (4): 273-277. Aug. 1958.

The effects of surface friction were explored upon three criterion measures of manipulatory performance: (a) prehension force (effort), (b) time per transport (speed), and (c) total number of transports (output). Changes in friction were produced by application of either a coat of wax-benzene paste or of silicone grease to the bare finger tips and to the tips of a leather glove. Twelve subjects performed a simple manipulation task which required discrete movements of an instrumented aluminum cylinder on a formboard. The results indicated a close relationship between decrease of surface friction and increase of prehension force. The effects of friction on time per transport remained obscure and the total number of transports decreased only at extremely low values of the coefficient of friction. (Authors' summary, modified)

12658
Grunzke, M. E. 1961
A RESTRAINT DEVICE FOR BEHAVIORAL

RESEARCH WITH THE CHIMPANZEE.—Air Force Missile Development Center. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689301). Technical Documentary Report no. MDC-TDR-61-37, Dec. 1961. vi+21 p.

This report describes a restraint chair that can be employed in operant conditioning research with the chimpanzee. The chair is designed for easy adjustment to various sizes and when used with a suit or vest will also facilitate attachment of sensors for collection of physiological data. (Author's abstract)

12659
Gurevich, B. Kh. 1958
ELECTROPHYSIOLOGICAL INVESTIGATIONS ON ROTATING SUBJECTS.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 43 (4); 341-343. 1958.

English translation of item no. 8210, vol. VI.

12660
Hartz, N. W. 1960
INSTRUMENTATION TO MONITOR AND CONTROL ATMOSPHERE COMPOSITION IN SPACE CAPSULES.—In: Closed Circuit Respiratory Systems Symposium, p. 7-11. Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 6373, Task no. 63120.) WADD Technical Report no. 60-574, Aug. 1960.

The working principles of four potential space-capsule atmosphere-analyzers are discussed. Devices utilizing infrared techniques could be selectively sensitized to measure carbon dioxide, water vapor, carbon monoxide, hydrocarbons, ammonia, and most of the fuels and oxidizers used for rocket power plants. Devices which use an alpha-excited ionization chamber (a Geiger tube used in reverse) may be sensitized for classes of compounds such as acid or alkaline contaminants, halogenated hydrocarbons, or organo-metal compounds. Detectors containing sensing elements which respond to both thermal conductivity and thermal convection, combined with proper annulling resistors to produce selectivity, may be used in space vehicles to monitor CO_2 and hydrogen, as well as other components of the atmosphere. Devices based on the principle of catalytic oxidation may be used to detect relatively low concentrations of CO, hydrogen, hydrocarbons, ammonia, and HCN. These analyzers are commercially available, and, with proper modifications and size-scaling, offer a selection of instruments from which designers and operators may choose to fit a particular vehicle and its associated equipment.

12661
Helvey, T. C. 1959
TELEMETERED PARAMETERS OF PRIMATES AND HUMANS FOR SPACE CAPSULES.—IRE Trans. Space Electronics and Telemetry, 5 (3): 99-102. Sept. 1959.

The biophysical requirements for telemetered information from extraterrestrial ecosystems are presented. These are grouped as follows: (1) monitoring environmental factors in the crew compartment, including measurement of barometric pressure and of oxygen and carbon dioxide partial pressures in the cabin atmosphere; (2) studying mammalian behavior under space-equivalent conditions, including the cardiogram, respiratory rate and volume, blood pressure, electroencephalogram, muscle activity, reflex activity, galvanic skin response, body temperature, activity of the gastrointestinal tract, food and water intake, urine and feces elimination, and voice transceiver; (3) research and development of the optimal human ecosystem for astronautics in the cis-lunar and translunar regions, and (4) counseling space crew during flight and in the Moon base (direct transmission of information from the sensors, without any transfer through possibly excited human operators, will enable the specialized terrestrial personnel to provide invaluable advice).

12662
Henry, J. P., and C. D. Wheelwright 1961
BIOINSTRUMENTATION IN MR-3 FLIGHT.—In: Conference on Medical Results of the First U. S. Manned Suborbital Space Flight, p. 59-70. [1961?].

The development of a suitable biosensor assembly for use in the MR-3 flight is discussed. Described and photographed are the body temperature sensor, respiration rate and depth sensor, electrocardiographic sensor, and blood pressure recordings.

12663
Henry, J. P., and C. D. Wheelwright 1961
BIOINSTRUMENTATION IN THE MR-3 FLIGHT.—In: Proceedings of a conference on results of the first U. S. manned suborbital space flight, p. 37-43. Washington, D. C.: National Aeronautics and Space Administration, 1961.

The physiological measuring and telemetry devices used on Alan B. Shepard's suborbital space flight (May 5, 1961) are described in some detail. Electrodes and sensing devices were designed for wearing comfort and operating efficiency. The devices used were: (a) a small thermistor type rectal probe for the measurement of body temperature; (b) a saturated $CuSO_4$ solution and low-frequency A.C. amplifier for respiratory rate and depth sensing; and (c) four electrocardiograph electrodes consisting of small nonconducting cups containing a nonirritating electrode paste. Blood pressure was not monitored in the MR-3 flight.

12664
Hertzman, A. B. 1961
REFINEMENTS IN PHOTOELECTRIC PLETHYSMOGRAPHY. II.—Arctic Aeromedical Lab., Fort Wainwright, Alaska. Technical Note no. AAL-TN-60-32, Sept. 1961. 12 p.

A mechanical design for a miniaturized photoelectric plethysmograph for recording skin pulses is described and diagrammed. Although phototubes are suitable for climate-chamber studies when information on changes in the blood content of the tissue is desired, recordings should be limited to volume pulses if they are subject to rapid changes in temperature. The differing spectral sensitivity of various photoconductive elements does not seriously affect the accuracy with which the cutaneous volume pulses are recorded but may grossly distort a plethysmogram. For the sake of accuracy, a regulated direct-current supply to the light bulb would be preferable to the oscillator supply described.

12665
Hetherington, A. W. 1959
OBJECTIVES OF BIO-INSTRUMENTATION.—American Rocket Society, Publication 930-59. 7 p. New York, 1959.

The objectives of bio-instrumentation can be considered at the philosophical, practical, or technical level. On the philosophical level, if the early space travelers are not monitored and checked in space, there will be no way of knowing whether or not their reports are factual and objective. On the practical level, bio-instrumentation will collect reliable biological information, monitor the exact status of the individual at each moment in space, and make the astronaut's non-conscious and non-voluntary bodily status indicators a part of various control loops in the vehicle. The technical level attempts to present the "state-of-the-art" in bio-instrumentation, and answers the question: How is it done? A fourth level is proposed, to which a list of instrument performance specifications is referred: (1) unmonitored reliability over long periods; (2) automatic, compact, light, economical receivers and amplifiers capable of periodic, selective, high-speed read-out and telemetering; (3) small, light sensors and transducers; (4) telemetering of internal capsule environment; (5) instruments for automatic analysis; (6) desirability of obtaining information on emotional states, activity, and alertness of astronaut; and (7) consideration of long-term effects on astronaut.

12666
Holcomb, G. A. 1960
APPLICATION OF BASIC HUMAN ENGINEERING PRINCIPLES TO A COCKPIT DESIGN.—Aerospace Med., 31 (8): 674-677. Aug. 1960.

The cockpit must be treated as a total entity, and task and link analysis techniques must be used to best locate controls in the cockpit relative to each other and their operator. In the cockpit in question, simplicity, regularity, and symmetry of the visual environment are achieved by orienting all controls along vertical and horizontal rows. The use of the alignment principle seems to expose more of the panel to the viewer. Improved resolution is gained by high contrast between white knobs and matte black panels. Groupings by function and usage are established, as are shape coding of buttons and switches.

12667
Hoover, G. W. 1959
U. S. NAVAL AIRCRAFT INSTRUMENTATION PROGRAMME.—In: Medical aspects of flight safety, p. 222-229, 3 unpaged leaves. North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development. AGARDograph no. 30, 1959.

The design of instrument displays for aircraft should be carried out by a team consisting of pilots, human engineers, engineering physicists, and engineers. Two major requirements must be considered: position in the vertical plane and in the horizontal plane. The first is primarily orientation, the second situation, display. Each of the two areas must be further divided into three types of display: (1) orientation, which tells the man what he is doing; (2) director, which tells him what he should be doing; and (3) quantitative, which tells him how he is doing. An instrument display was developed, although not yet completed, which includes on the vertical unit attitude information, altitude and velocity indications, obstacles and weather information, and director type information. The horizontal display will represent a type of map showing the aircraft's position geographically, along with fuel, heading, and track information. The new display for instrument flight requires an absolute minimum of training and provides information which produces little or no disorientation. A new concept was also developed of a design for a standard ejectable cockpit capable of being plugged into different wing-engine configurations for wide mission capability.

12668
Hopkins, C. O., 1960
D. K. Bauerschmidt, and M. J. Anderson
DISPLAY AND CONTROL REQUIREMENTS FOR MANNED SPACE FLIGHT.—Hughes Aircraft Company, Culver City, Calif. (Contract AF 33(616)-6033); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio. (Project no. 7184, Task no. 71585). WADD Technical Report 60-197, April 1960. xii+204 p.

A study was made of the display and control requirements for a manned orbital vehicle of the "space-ferry" type. The mission included ground launch, rendezvous with a satellite station already in orbit, re-entry into the Earth's atmosphere, and landing at a selected base on Earth. Display and control requirements were determined for vehicle attitude control while in orbit, orbital plane change, minimum energy transfer between circular orbits at different altitudes, and de-orbit for re-entry into the Earth's atmosphere. Displays, controls, and control panels were designed to meet these requirements. Representations of these displays and controls were constructed and incorporated into full-scale mockups of cockpits for two alternate display and control systems. (Authors' abstract) (175 references)

12669
Humphries, M. 1958
PERFORMANCE AS A FUNCTION OF CONTROL-DISPLAY RELATIONS, POSITIONS OF THE OPERATOR, AND LOCATIONS OF THE CONTROL.—Jour. Applied Psychol., 42 (5): 311-316. Oct. 1958.

Previous research has shown that control-display relations, position of the control and position of the operator are important factors determining the level of performance. Since these variables have usually been studied in isolation, an experiment was designed to investigate the interaction between them. Twenty-four groups of male subjects practiced for five minutes on the Toronto Complex Coordinator. Each group worked on only one of the 24 combinations of experimental conditions. The results indicate that, for the same apparatus, knowledge of the control-display relations alone is not sufficient to predict the relative levels of performance. (Author's summary)

12670
Jacobson, B., 1961
and L. Nordberg
ENDORADIOSONDES FOR PRESSURE TELEMETERING.—IRE Trans. Bio-Med. Electronics, BME-8 (3): 192-196. July 1961.

Two miniature radio transmitters have been developed for telemetering pressure values from internal body cavities. The large sonde has a volume of 4.1 cc. and has a life-time of up to three months when a mercury battery is used. It is employed for physiological studies on animals, and is attached to the wall of the gastrointestinal canal or other body cavities by sutures at operation. The small sonde has a volume of 1.0 cc. and a life-time of three weeks. It is used for gastrointestinal investigations on humans. The transducer in both sondes responds to a pressure variation of 300 cm. H_2O which gives a 30-kc. deviation of the 300 to 400 kc. carrier frequency. (Authors' summary)

12671
Jacobson, S. L. 1960
ENGINEERING OF THE SEALED CABIN ATMOSPHERE CONTROL SYSTEM.—Aerospace Med., 31 (5): 388-398. May 1960.

Problem areas common to all environmental control systems for sealed cabins are control of temperature, gas composition, and total pressure. The criteria applied to possible control scheme choices are those of safety, reliability, weight, volume, and power requirement. This report includes the results of a general analysis of atmosphere control problems and solutions. Control of carbon dioxide and temperature, as well as supply of oxygen, is analyzed, and weight-time curves are plotted. (Author's summary, modified)

12672
Jensen, R. E., 1961
W. Sipple, V. G. Benson, and R. D. Squires
BIOINSTRUMENTATION AND BIOTELEMETRY ON STRATOLAB HIGH-5 BALLOON FLIGHT. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005. 13-0002.2, Report no. 10). Report no. NADC-MA-6137, Nov. 1, 1961. iv+21 p.

A bioinstrumentation and biotelemetry system developed at the Aviation Medical Acceleration Laboratory (AMAL) was used to monitor the pilot during the record-breaking Stratolab High-5 Balloon flight of May 4, 1961. Satisfactory electrocardiographic and respiratory information was obtained with the AMAL system during 80% of the flight. Temperatures essential to providing an index of body comfort and efficacy of suit thermal protection were recorded continuously through 90% of the flight. No unexpected or unusual physiological changes were recorded. However, the data showed that any reduction in the thermal protection or possible longer stay in portions of the low temperature profile might have produced a marginal situation which could have affected the satisfactory completion of the flight. Valuable information was gained concerning the operation of a biotelemetry package exposed to the extreme ambient environment of a stratosphere flight. In addition, the use of the complete bioinstrumentation system in an operational situation of this type provided valuable experience for future operations. (Authors' summary)

12673
Kaehler, R. C., 1961
and S. Romano
NAVIGATION AND ENERGY DISPLAY REQUIREMENTS FOR PILOT-CONTROLLED SATELLOID FLIGHT. — Advances Astronaut. Sci., 6: 380-389. 1961.

A discussion is presented of information requirements for a piloted satelloid system while on an orbital bombing mission. Recent experimental data are presented regarding pilot capabilities for vehicle re-entry control and problem-solving activities while exposed to high-magnitude accelerations. Special emphasis is given to combining present and future navigation and energy information for the re-entry and approach-for-landing phases of flight. A "split-display" is described which provides the satelloid pilot with information at his command, such as vehicle position, deviation from the programmed orbit, command headings, predictions of energy-range capabilities, selection of feasible landing sites, altitude above ground, local aeronautical charts, radio facilities, and various checklists. A sample mission and the various possible operating modes of a conceptualized "split" navigation-energy display are illustrated. (Authors' abstract)

12674
Lewis, C. 1958
SPACE BIOLOGICAL RESEARCH TESTS NEED INSTRUMENT IMPROVEMENT.—Aviation Week, 69 (19): 55-61. Nov. 10, 1958.

A small, light, oxygen sensor which operates on polarographic principles has been developed at the U. S. Air Force School of Aviation Medicine at Randolph Field, Texas. It provides a transducer that can measure oxygen partial pressure under extreme environmental conditions and is small enough to fit into a mask system, and measure directly the oxygen content in the air entering the lungs. It generates its own power and can transmit signals directly to a ground observer. Furthermore, a small tubular respiratory volume sensor has been developed, which uses a modification of the hot-wire thermocouple and can measure rapidly fluctuating flow rates while offering almost no resistance to gas flow. It fits easily into a face mask and can measure volume as well as rate of respiration.

12675
Licklider, J. C. R. 1961
AUDIO WARNING SIGNALS FOR AIR FORCE WEAPON SYSTEMS.—Bolt Beranek and Newman, Inc., Cambridge, Mass. (Contract AF 33(616)-5611); issued by Wright Air Development Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6190, Task no. 71556). WADD Technical Report no. 60-814, March 1961.[57] p.

This report presents technical information on the design, selection, and use of audio warning signals. It describes a procedure for specifying the acoustical characteristics of warning signals required to meet the exigencies and conditions expected for a given Air Force system, whether it be ground-based, airborne, or spaceborne. The procedure brings together the several applicable design criteria, the constraints imposed by the system, and the conditions under which the system must operate. The procedure then sets those considerations into interaction with characteristics of human sensation, perception, and reaction and from that interaction determines the acoustical specifications of the warning signals. A magnetic-tape recording illustrates the procedure and provides an auditory display of the dimensional sys-

tem in terms of which the warning signals are specified. (Author's abstract)

12676
Loveless, N. E. 1959
THE EFFECT OF THE RELATIVE POSITION OF CONTROL AND DISPLAY UPON THEIR DIRECTION-OF-MOTION RELATIONSHIP.—Ergonomics (London), 2 (4): 381-385. Aug. 1959.

The effect upon performance of the direction-of-motion relationship between a control and a display is shown to depend upon certain other features of the layout. When a rotary control knob is used in conjunction with a linear indicator, a clockwise movement of the control is expected to move the pointer upwards or to the right. This expectation is, however, weaker when the center of rotation of the control is situated on the line of movement of the display than when the control is situated to the side of the line, so that the pointer moves in the same direction as the nearest part of the knob. The orientation of the display and the position of the control have no effect apart from this relationship between them. (Author's abstract)

12677
Mackay, R. S., 1960
E. Marg, and R. Oechsli
AUTOMATIC TONOMETER WITH EXACT THEORY: VARIOUS BIOLOGICAL APPLICATIONS.—Science (Washington), 131 (3414): 1668-1669. June 3, 1960.

Intraocular pressure measurements are facilitated by a newly-devised tonometer which provides accurate readings independent of tissue tension, corneal stiffness, astigmatic curvatures, and surface tension. Separate indications of corneal rigidity and relaxation, and tonographic fluid expression are also allowed. The ability of the instrument to measure intracavity pressure through an intact tissue wall makes it suitable for other biological experimentation such as monitoring of blood pressure, measuring uterine contractions, and measuring infant intracranical pressure. It is also applicable as a complementary device to the small, swallowable radio transmitters which have been developed in recent years.

12678
Mackay, R. S. 1959
RADIO TELEMETERING FROM WITHIN THE HUMAN BODY.—IRE Trans. Med. Electronics, ME-6 (2): 100-105. June 1959.

This paper summarizes recent developments in techniques for the wireless transmission of physiological information from within the human body. Using transistorized radio transmitters small enough to be introduced into the bladder or swallowed without unpleasant sensation, readings of pressure, temperature, and acidity can be made. Other uses for these devices, such as the localization of internal bleeding, are suggested. Certain mechanical problems, such as those which might influence the performance of the devices in high-g situations, are mentioned.

12679
McLennan, M. A. 1959
PHYSIOLOGICAL TELEMETRY.—Advances in Astronautical Sciences, 4: 420-428. 1959.

The major responsibility for securing the vital experimental record in Earth satellite experiments is vested in the telemetering and associated communicating systems. The conditions encountered, as these experiments grow more complex with animal or manned satellites, impose serious limitations on customary data accumulation practices. In view of insuring the integrity of final record, internally monitored data selecting and reporting methods are suggested for use in place of the usual multiple channel transmission of raw source data from the satellite. Consideration is given broadly to data selection and concentration techniques for both physical and physiological types of data. A viability indicator, which provides a seven-stage indication of the subject's state of animation, is described in detail. (Author's summary)

12680
Marko, A. R. 1960
MONITORING UNIT FOR HEART- AND RESPIRATION-RATE. — Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7220, Task no. 71751). WADD Technical Report no. 60-619, Aug. 1960. iii+6 p.

A small unit has been developed to monitor heart and respiration rate of a man during experiments. This unit has been used at altitudes up to 100,000 feet, in temperature chamber tests, in actual high altitude balloon flights (with telemetering), and for monitoring endurance tests of the B-58 aircraft's emergency escape capsule (floating in water). The advantages of this monitor compared with other methods are mainly the simplicity of parts, reliability, low cost, low weight (4 oz. approximately), small size, and low power consumption (22 volts, 2 ma.). Also, only one communication channel is needed to convey information on two important physiological sources. (Author's abstract)

12681
Marko, A. R., 1961
M. A. McLennan, and E. G. Correll
A MULTICHANNEL PERSONAL TELEMETRY SYSTEM USING PULSE POSITION MODULATION.—Aeronautics Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71751). ASD Technical Report no. 61-290, July 1961. iii+10 p.
Also published in: Aerospace Med., 32 (11): 1019-1022. Nov. 1961.

A personal telemetry system using pulse position modulation technique has been developed. The laboratory model transmits heart rate, respiration rate, and body temperature within a range of 100 feet. Compared with FM-FM systems this system has the advantage of very low power consumption (20 milliwatts), light weight (6 ounces with batteries for 80 hours continuous operation), small size (4-3/4 by 3-1/2 by 1 inches), and sufficient accuracy and stability (2 percent baseline stability) for physiological measurements. An expensive, small, single-track tape recorder may be used for recording; and an extremely simple and inexpensive playback system can be used for scope display. The limitations of this personal telemetry system are: (a) the frequency capability for each channel is 0 to 40 c.p.s.; (b) it is limited to 6 channels; and (c) special playback equipment is required. (Authors' abstract)

12682
Marko, A. R. 1961
A TRANSISTORIZED HIGH QUALITY CARRIER AM-

PLIFIER FOR ELECTROCARDIOGRAM.—Wright Air Development Div. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71751). WADD Technical Note 61-55, March 1961. iii+7 p.

A miniaturized electrocardiogram transistor amplifier employing a high efficiency, low level modulator circuit has been developed. This amplifier combines the advantages of a carrier system with the low noise level and high input impedance of a resistor-capacitance coupled straight amplifier. Circuit diagrams and operating characteristics are included. (Author's abstract)

12683
Matsuo, T. 1959
EXPERIMENTAL ELECTRONIC EQUIPMENT FOR MEDICAL TELEMETRY. — National Aeronautics and Space Administration, Washington, D. C. Technical Translation no. F-51, Nov. 1960. i+20 p.

Translation of Material no. TM-51001. Mitsubishi Electric and Manufacturing Co., Tokyo. Nov. 20, 1959. In Japanese.

An experimental system was constructed to test the feasibility of the radio telemetry of a small bio-electric signal across a 5-kilometer radio link. Close correspondence was obtained between the curves of both electrocardiograms and electroencephalograms at the monitor and receiver locations. The design of a more suitable electrode attachment is required to allow the use of the system in aviation or space medicine.

12684
Miller, B. 1961
SYSTEM MONITORS BIOASTRONAUTIC DATA. — Aviation Week and Space Technol., 75 (17): 57, 61, 63. Oct. 23, 1961.

The Viability Data Acquisition System (VIDAT) is designed to gather data remotely from simians or men in aerospace environments. The information will be stored or easily displayed for inspection by physicians. Sensors will be placed on the subjects' body, and transducers will monitor the chamber's environment. Collected physiological data will include factors such as respiration, heart rate, blood pressure and skin and deep body temperature. Blood pressure data will be gathered by the new pulse wave velocity method, and body temperatures will be within 1% accuracy. Once the data are collected, they will be coded, "digitized", displayed, or stored for as long as two weeks.

12685
Morrell, R. M. 1959
AMPLITUDE-MODULATION RADIO-TELEMETRY OF NERVE ACTION POTENTIALS.—Nature (London), 184(4693): 1129-1131. Oct. 10, 1959.

Experiments are described in which the response of a single type of excitable tissue was relayed to and recorded at a distant point by telemetry. With distal end crushed, whole sciatic nerves of bullfrogs and radial or ulnar nerves of dogs were placed on two pairs of electrodes in a humid chamber at 20° C. Two radio links (one for each direction in which information was to flow) transmitted a pulse to the preparation at a distant point, and received the response to this stimulus at the point of transmission, where a strip-chart recorder was activated. In some experiments, reproducible records were obtained for 15-20 hours, during part of which the whole system could be left unattended except for changing the paper or filling the ink-reservoir of the recorder. The electrical process of the nerve impulse is similar to those in data-handling telemetry systems used for aircraft and missile testing, and for satellite experiments. The author further states that it is now possible to determine the effect on the whole nerve or single fiber of magnetic, gravitational, or radiation fields at very high altitude, in vehicles undergoing changes in acceleration. The method allows measurement of changes in acceleration, both positive and negative. Basic physiological data which can be collected in such circumstances include threshold, rheobase, chronaxia, strength-duration and strength-latency curves, refractory periods and critical stimulus interval for two stimuli. Controlled variation in potentials led from electrodes implanted in animal brains can also be studied by this means, either on the ground or in guided or orbital flight. By using a frequency-modulated multichannel system of the type commonly employed in satellite research, the wave-form of the action potentials can be recovered with fidelity through high-frequency interrogation during the passage of impulses. Its relationship to environmental variables can then be determined. With interval-measuring equipment at present available, nerves might be used in orbital vehicles as biological clocks to determine directly whether or not there is a relativisitic shift for excitable tissue. This cannot be done at present with intact animals or astronauts.

12686
Morrell, R. M. 1961
MONITORING OF ASTRONAUT BRAIN FUNCTION BY MEANS OF TELEMETERED ELECTROENCEPHALOGRAM WITH AUTOMATIC ANALYSIS. — Astronautical Sci. Rev., 3 (4): 13-19. Oct.-Dec. 1961.

It is suggested that the electroencephalogram can be used as a means of flight command control based on adequate analysis of changes in brain function. The present proposal depends on recognition of alteration in the cortical responses to standard stimuli and in the dominant (alpha) brain rhythm. Both correlation- and toposcope-instrumentation would be fed simultaneously from the same EEG signals. Necessary refinements will depend on subsequent experience. A set of norms would have to be established for the per cent deviation from "true" alpha scanning which could be expected under simulated orbital flight conditions. Certain extrapolations could be made from the norms, and additional values would have to be determined experimentally. The instrumentation and telemetering are fairly straight-forward problems which have already been dealt with in their separate fields. The type of command or control resulting from significant changes in brain function might be in form of warning devices to the pilot, or automatic control of his vehicle's mechanical operation. The whole monitoring system, including command mechanisms, can be set up for investigation in existing experimental facilities for simulated orbital vehicular motion. (From the author's conclusion) (51 references)

12687
Morrill, C. S., and L. T. Sprague 1960
OPERATOR PREFERENCES FOR MOVEMENT COMPATIBILITY BETWEEN RADAR HAND CONTROL

AND DISPLAY SYMBOLOGY.—Jour. Applied Psychol., 44 (3): 137-140. June 1960.

This study investigated whether (a) the radar display is viewed as a functional representation of antenna movement involving an incompatibility in the direction of the azimuth range symbol and the elevation symbol on the display, or as a direct representation of the hand control movements; and (b) what direction of movement is preferred for the azimuth-range symbol to make it compatible with the movement of the elevation symbol. Three groups of subjects with varying degrees of prior experience as radar operators or pilots were surveyed. The results indicate that all groups in this study preferred a compatible display-control relationship. The display which represents directly the hand control movements was preferred over that representing the functional operation of the antenna. Preferences expressed for a backward motion of the controls to effect an upward movement of the display symbol were related to prior experience with radar.

12688
Murrell, K. F. H., 1958
W. D. Laurie, and C. McCarthy
THE RELATIONSHIP BETWEEN DIAL SIZE, READING DISTANCE AND READING ACCURACY.—Ergonomics (London), 1 (2): 182-190. Feb. 1958.

The accuracy of reading a graduated scale was found to be related to the angle subtended at the eye by the called space. There was a critical point representing about 98% accuracy (for all intervals interpolated into five or less parts) below which there was a rapid fall off in accuracy and above which little improvement could be expected. Each combination of scale interval and called interval had a different critical point; from these it was possible to calculate the optimum reading distance for any dial size and vice versa. Experienced subjects (who had made more than 2000 readings on a particular graduation system) were able to read a dial at double the distance of an "unpractised" subject, both having 6/6 binocular eyesight. For "practised" subjects with 6/12 binocular eyesight the reading distances were reduced by one fifth. (Authors' abstract, modified)

12689
Neville, J. R. 1961
AN ELECTROCHEMICAL DEVICE FOR MEASURING OXYGEN. —— School of Aerospace Medicine, Brooks Air Force Base, Tex. Report no. 61-79, June 1961. 11 p.

An electrochemical device is described which utilizes a gold indicator electrode and a cadmium reference. This cell, when filled with electrolyte and encapsulated with a thin polyethylene membrane, gives a current proportional to the oxygen partial pressure in the ambient gas. Protected with a special plastic cover, the unit is relatively rugged, specific, and fast responding. It requires no power or polarizing unit and can operate unattended for relatively long periods of time. Laboratory, clinical, and field applications are illustrated and discussed. (Author's summary)

12690
Nordlie, P. G. 1959
METHODOLOGY FOR ANALYSIS OF MAN'S ROLE IN AN ADVANCED SPACE FLIGHT SYSTEM: A CASE STUDY IN SYSTEM RESEARCH METHODOLOGY.—Human Sciences Research, Inc., Arlington, Va. (Contract Nonr-2525(00)). HSR Report Memorandum no. 59/25-sm, Nov. 1959. iii+13 p.
AD 229 925

The tasks described represent the logical sequence of steps taken to develop design requirements for the displays and controls of the space vehicle cockpit. The phase/function analysis resulted in a set of required functional activities, which were tentatively assigned to human and equipment components. These functional activities were translated into a set of required input and output parameters, which were in turn described on a time base in the SSOA (Second-by-Second Operational Analysis). Results of the SSOA were summarized to provide indices of work load, link frequency, and use/frequency. These indices in turn helped to specify design requirements for the cockpit and for the displays and controls it contained. (Author's summary)

12691
Obonai, T., 1961
T. Kaneko, and M. Okawa
[LUMINESCENCE DISTRIBUTION AS FACTOR OF GLARE TO PILOTS (Abstract)]. —— In: [Abstracts from the 6th meeting of the Japanese Aviation Medicine and Psychology Society]. Nihon Kōkū Igaku Shinri Gakkai kiroku (Tokyo), no. 11: 3. May 27, 1961. In Japanese.

A study was made of the reading time of instruments on gray and black instrument panels under luminescence ratios of -10 to 50 db. Measurements were made on the commercial types DC-7, DC-6, DC-4, and DC-3 at the front and side of the pilot's seat, and at the instrument panel. The effect of the luminescence ratio became apparent from 30 db. upwards. It was demonstrated that the color gray, which reduces the difference between the two visual fields, is most suited for instrument panels.

12692
Olling, E. H., 1961
and J. R. Barton
HERE'S HOW THE FIRST U. S. ASTRONAUT WILL SURVIVE IN SPACE. —— SAE Jour., 69 (2): 68-73. Feb. 1961.

Two circuits comprise the environmental control system of the Mercury space vehicle, a circuit for the cabin and a closed loop for the pressure suit. Oxygen pressure is controlled by two single-stage, high-pressure reducing valves operating in parallel. Stages in the maintenance and recirculation of the atmosphere contained in the suit circuit (filtering, intake of fresh oxygen, compression, absorption of carbon dioxide and odors, cooling, and water separation) are delineated, and prelaunch operations are described.

12693
Ormerod, F. C., 1960
and K. McLay
ELECTRO-NYSTAGMOGRAPHY IN THE INVESTIGATION OF VESTIBULAR FUNCTION.—In: Medical electronics: proceedings of the international conference on medical electronics, II (Paris, June 24-27, 1959), p. 63-68. London: Iliffe & Sons, 1960.

The difference in electrical potential between the cornea and the retina can be recorded from the skin at the outer angles of the orbits. Movements of the eyeball in the horizontal plane cause an alteration in

the potentials which can be amplified, and it is possible to record with considerable accuracy the angular extent of the eye movements, their speed and their duration. Graphic records can be made of the results of positional, optokinetic, rotatory, and caloric tests of the vestibule. Descriptions of the tests are included. (Authors' abstract, modified)

12694
Paludan, C. T. 1960
THERMISTORS: THE KEY TO BIO-MEDICAL MEASURING IN SPACE.—Electronic Industries, 19 (4): 83-85. April 1960.

A brief description is given of the thermistor unit and circuitry of the gauge used to measure the breathing rate of primates (Gordo, Able, and Baker) during ballistic flight. The method of mounting the thermistor in the small diameter of the primate's exhaled air stream is explained, and a segment of the telemetered record from the first flight in December, 1958, is shown.

12695
Papaloïzos, A. 1961
SOME CHARACTERISTICS OF INSTRUMENT MEASURING DIALS. — Ergonomics (London), 4 (2): 169-182. April 1961.

Two experiments were undertaken to evaluate the legibility of dials. The results of both experiments showed that for correct and quick dial reading the relationship between the major graduations (the 10's and 5's) on the one hand and the minor graduations on the other should be one of figure and ground (i.e., major graduations must clearly stand out of and be distinct from the rest of the field of perception). The special case of omitting minor graduations from the scale is also discussed. (Author's abstract, modified)

12696
Parton, L. R., 1960
J. M. Lauer, and Douglas L. Smith
A NEW CHRONIC POLAROGRAPHIC IMPLANT UNIT FOR MEASUREMENT OF CEREBRAL OXYGEN AVAILABILITY.—Wright Air Development Division. Biomedical Lab., Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 71836). WADD Technical Report no. 60-388. May 1960. iv+7 p.

This report describes the design and development of a chronic brain polarographic implant unit capable of detecting small changes in cerebral oxygen availability (aO_2). The design and fabrication of this unit (a) provide for integral construction of both an anode and a cathode in a single assembly (the brain probe, cathode, may be changed or replaced without removal of the basic polarographic unit), and (b) improve surgical implant methods resulting in a simple, rapid, and relatively bloodless operation. Reproducible data can be obtained within 5 days (often as soon as 2 days) following postsurgical recovery. (Authors' abstract)

12697
Reed, W. S. 1960
SYSTEM CONTROLS CAPSULE ENVIRONMENT.—Aviation Week and Space Technol., 73 (1): 57-60. July 4, 1960.

The system controlling the internal environment (atmospheric pressure, oxygen and water supply, humidity, odor removal, and heat exchange) in the Project Mercury space capsule is briefly described. Pressure within the capsule and pressure suit of the pilot will be maintained at 5 p.s.i. in an all-oxygen atmosphere; therefore, the faceplate on the pressure suit may be opened at any time without risk to the pilot. Continuous recordings will be made in flight of the space pilot's condition—electrocardiogram, measurements of body temperature, and rate and depth of respiration. These data will be telemetered. At a predetermined time prior to re-entry, the pilot will cold-soak the cabin and pressure suit by manually opening the heat exchanger water control valve to allow maximum water flow into the heat exchanger.

12698
Regan, J. J. 1960
TRACKING PERFORMANCE RELATED TO DISPLAY-CONTROL CONFIGURATIONS. — Jour. Applied Psychol., 44 (5): 310-314. Oct. 1960.

The relative merit of six different display-control configurations was determined in a continuous tracking task using both pursuit and compensatory tracking, and position and rate control. Ninety-six subjects were tested, four on each of the 24 conditions of the experiment. The combined-joystick configurations proved to be significantly superior to the other five configurations for all conditions of the experiment. With both forms of tracking and both modes of control, there were no significant differences among the remaining five configurations. With both forms of tracking but with position control alone, the circular-circular configuration was significantly superior to the other four. Pursuit tracking was not different from compensatory across both modes of control. Under position control, pursuit was significantly superior; under rate control, compensatory was superior just short of significance. Position control was significantly superior to rate control for all conditions of the experiment. Practice did not significantly affect the relative merit of any of the variables tested. (Author's summary, modified)

12699
Renaud, G. E. 1959
INTELLIGIBILITY TESTING OF VOICE COMMUNICATION SYSTEMS.—Rome Air Development Center, Griffis Air Force Base, New York. RADC Technical Note no. 59-156, May. 1959. iii+6 p.
AD 215 023

Testing of voice communication systems can be accomplished simply and with considerable validity and reliability by using humans as the test devices. The results obtained are comparative and are dependent upon the amount of experimental control exercised.

12700
Ritchie, M. L., 1961
L. F. Hanes, and T. E. Hainsworth
SOME CONTROL-DISPLAY ASPECTS OF MANUAL ATTITUDE CONTROL IN SPACE. — Advances Astronaut. Sci., 6: 170-191. 1961.

An investigation was conducted to determine the ability of a human operator to control the attitude of a simulated exo-atmospheric vehicle using several different combinations of displays, controllers, and control systems. The displays were a three-axis moving sphere type attitude indicator with and without body-axis rate indicators. Three controller arrangements were studied—individual hand controls for each of the three axes, a three-axis integrated controller, and a combination of the integrated controller and foot pedals. Proportional and on-off

controls were used with the integrated controller. The operators were instructed either (1) to stop the attitude spin or (2) to stop the spin at a particular attitude. They were able to stop the spin with an efficiency of about 90 per cent and in less than 10 sec. with the best control-display combinations. Detailed suggestions are made for further precise experimentation. (Authors' abstract)

12701
Ritchie, M. L., and H. E. Bamford 1958
QUICKENING AND DAMPING AN AIRCRAFT INSTRUMENT DISPLAY.—In: Symposium on Air Force Human Engineering, Personnel, and Training Research, p. 162-173. National Academy of Sciences—National Research Council, Publication no. 516. 1958.

Same as item no. 8228 in vol. VI (1957).

12702
Rockway, M. R., and P. E. Franks 1959
EFFECTS OF VARIATIONS IN CONTROL BACKLASH AND GAIN ON TRACKING PERFORMANCE.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7197, Task no. 71635). WADC Technical Report no. 58-553, Jan. 1959. iii+16 p. AD 209 384, PB 151745

Six subjects performed a simulated aircraft tracking task using each of twelve control conditions resulting from combining four levels of control backlash and three levels of gain. The experimental findings demonstrated a significant interaction between the effects of backlash and gain on system performance. That is, there was a monotonic increase in system error with increasing backlash at all levels of gain. However, the higher the gain the greater the rate of increase. The implications of these results for the design of manual control systems are discussed briefly. (Authors' abstract)

12703
Rohles, F. H., and M. E. Grunzke 1961
A SPATIALLY CONTIGUOUS STIMULUS RESPONSE APPARATUS FOR PRIMATES.—Air Force Missile Development Center. Aeromedical Field Lab., Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 68931). AFMDC Technical Report no. 61-32, Oct. 1961. iii+5 p.

This report describes a stimulus-response device for primates in which the response manipulandum and stimulus cue are combined into a single unit. Considerable success has been obtained with this device in cognitive learning problems. (Authors' abstract)

12704
Rowen, B. 1960
PHYSIOLOGICAL TELEMETRY IN RESEARCH AIRCRAFT. — Jour. Applied Nutrition, 13 (4): 189-192. 1960.

Instrumentation for monitoring the environmental conditions and physiological changes of man during space flight are discussed. The physiological data package for the X-15 program will include devices for telemetering the pilot's helmet positive pressure, suit inflation pressure, respiration, body temperature, and electrocardiogram. It is anticipated that biomedical monitoring during the X-15 program will demonstrate techniques applicable to the Mercury and Dyna-Soar programs, which will emphasize aeromedical monitoring of crewmen to a greater extent. The objectives of the in-flight monitoring program are also included in the discussion.

12705
Rozenblat, V. V., and A. T. Vorob'ev 1961
[A METHOD OF PICKING UP CARDIAC POTENTIALS FROM MOVING HUMAN SUBJECTS FOR RADIOTELEMETRY] K metodike otvedeniia biotokov serdtsa u cheloveka pri dinamicheskoi radiotelemetrii. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 52 (10): 119-122. Oct. 1961. In Russian, with English summary (p. 122).

A comparison was made of various methods of transmitting cardiac potentials by radiotelemetry; the frequency of the heartbeat was recorded by means of the radiopulsophone, utilizing the R wave of the electrocardiogram. From the data obtained, "suction" electrodes were developed, and the paste normally employed was replaced with a 10% sodium chloride solution. The area of electrode in contact with the skin was 2.85 cm.^{2}. The procedure was as follows: complete treatment of the skin was applied using Vodolazskii's method: the upper epidermis was removed carefully by means of a cream containing finely ground pumice and the skin was then degreased with ether and alcohol. The electrodes were fixed with the adhesive cleol, and suction. In this way, stable contact and a low value of contact resistance were obtained. (From the authors' summary, translation)

12706
Rozenblat, V. V., and L. S. Dombrovskii 1959
[RADIO RECORDING OF THE HEART RATE IN FREELY MOVING SUBJECTS] Registratsiia po radio chastoty serdechnykh sokrashchenii u svobodno peredvigaiushchegosia cheloveka.—Fiziologicheskii zhurnal SSSR (Leningrad), 45 (6): 718-724. June 1959. In Russian.

English translation in: Sechenov Physiological Journal of the USSR (Pergamon Press, London), 45 (6): 100-108. Dec. 1959.

An apparatus (called a radiopulsophone) for the remote recording of the pulse rate (from the cardiac potential) of a freely moving subject is described. The radiopulsophone is carried in a helmet on the subject's head and consists of (1) special fluid-suction electrodes, (2) an amplifier, (3) an analyzing and shaping system including a neon tube monostable trigger and a flip-flop circuit, and an amplifier of three transistors and a relay, (4) a radio transmitter, and (5) a power supply. The radio signals emitted can be received by any sensitive ultra-short wave receiver in the 38-42 mc./sec. range. Continuous observations of skaters employing the radiopulsophone brought out certain characteristics of pulse rate during exertion and fatique. The apparatus permits relatively interference-free and steady recording of the heart rate during movement.

12707
Sadoff, M. 1960
THE EFFECTS OF LONGITUDINAL CONTROL-SYSTEM DYNAMICS ON PILOT OPINION AND RESPONSE CHARACTERISTICS AS DETERMINED

FROM FLIGHT TESTS AND FROM GROUND SIMULATOR STUDIES.—National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. NASA Memo no. 10-1-58A, Oct. 1958 [Declassified Feb. 8, 1960]. 63 p.

The effects on pilot opinion and response characteristics of variations in stick force per g, control-system time constant, and deadband, or stabilizer breakout force, are presented. With the possible exception of sensitive control-system problem areas, generally good agreement was shown between flight and simulator results, demonstrating the adequacy of simulator studies which do not duplicate motion feedback effects on the pilot. (Author's abstract)

12708
Schwan, H. P. 1961
BIO-MEDICAL ELECTRONICS—PAST AND PRESENT. — IRE Trans. Bio-Med. Electronics, BME-8 (4): 234-238. Oct. 1961.

The Professional Group on Bio-Medical Electronics concerns itself with the application of engineering theory and techniques to biology and medicine. This involves: (1) application of engineering concepts and methods to the structure and function of biological systems, and (2) development of electronic instrumentation useful in biological and medical research and in clinical practice. Discussion and representative tables are included on the development of the field of bio-medical electronics, its present status, relation to university laboratories, educational programs, and future outlook.

12709
Seminara, J. L. 1959
SPEED AND ACCURACY OF MATCHING TACTUALLY CODED RELATED PAIRS OF ITEMS.—Eng. and Indus. Psychol., 1 (4): 128-133. Winter 1959.

The speed and accuracy of matching related pairs of simulated plugs and receptacles was determined under tactual coding conditions (raised letters on each element) with visual cues present or excluded. Performance under visual conditions was four times faster than under tactual conditions. Performance accuracy was 97% under tactual conditions, and 100% under visual conditions. It is concluded that tactual cuing provides a useful method of communication in certain matching operations.

12710
Siegel, A. I., 1960
and K. Crain
EXPERIMENTAL INVESTIGATIONS OF CAUTIONARY SIGNAL PRESENTATIONS. — Ergonomics (London), 3 (4): 339-356. Oct. 1960.

Four experiments were performed to investigate optimum methods for presenting cautionary-warning information. In each experiment multiple compensatory tracking constituted a primary task, while response to various cautionary-warning signals constituted a collateral task. Experiment I investigated the effects of a centrally located master signal on response to peripherally located cautionary indicators. Experiments II and III compared the effectiveness of various types of visual, auditory and combined visual-auditory master cautionary-warning signals under various levels of task complexity. In Experiment IV, the design of lensed, legend cautionary-warning indicators was investigated. The major results of the four experiments indicated that when multiple cautionary-warning signals are presented peripherally: (1) the use of a master signal reduces response time and the number of signals missed, (2) auditory master signals are superior to visual, (3) the use af a combined visual-auditory master produces the fewest missed signals, (4) a two-tone auditory master is superior to a one-tone, (5) for illuminated legend signals, a dark legend on an illuminated background is superior to an illuminated legend on a dark background, and (6) for the former type a letter height of 1/4 in. is superior to one of 1/8 in. (height to width ratio 5:3) but is not significantly better than one of 3/8 in. (Authors' abstract)

12711
Siegel, A. I., 1958
and Fred R. Brown
AN EXPERIMENTAL STUDY OF CONTROL CONSOLE DESIGN.—Ergonomics (London), 1 (3): 251-257. May 1958.

This study was concerned with a systematic evaluation, through a series of experimental trials, of the angular orientation of the side panels of an operator's console. Since both a single operator and paired operators had to be accommodated, the trials embraced both of these conditions. Seven different measures were used. The single-operator data showed a consistent pattern pointing to the choice of the greatest angle (closest to the operator) tried. The paired-operator data gave inconsistent indications. A balanced resolution of all the data indicated a choice of 50° or 55° as the best angle taking all the conditions of use into consideration. (Authors' abstract)

12712
Sjoberg, S. A., 1959
W. R. Russell, and W. L. Alford
FLIGHT INVESTIGATION OF A SMALL SIDE-LOCATED CONTROL STICK USED WITH ELECTRONIC CONTROL SYSTEMS IN A FIGHTER AIRPLANE.—National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Va. NACA Research Memorandum no. L56L28a, March 11, 1957. [Declassified Feb. 10, 1959]. 43 p. AD125 371

A flight investigation was made to obtain pilots' opinions on the suitability of using a small stick mounted at the end of an arm rest at the pilot's side as the maneuvering flight controller for a fighter airplane. The stick used was about 4 inches long and was pivoted at the bottom. Simple springs were used to provide centering and feel to the stick. None of the 14 pilots who used the side-located control stick reported any difficulty in flying or controlling the airplane. Furthermore, the pilots were able to do precision flying such as tracking a nonmaneuvering or mildly maneuvering target with good accuracy. In the pilots' opinion the controller was comfortably located and comfortable to use. The stick motions required were natural and the pilots became accustomed to the controller quickly. The pilots preferred to move the stick with finger and wrist motions rather than arm motions. A significant reduction of physical effort from that required for a conventional control stick resulted from use of the side-located controller. From a comfort and precision control standpoint the arm rest was considered to be essential. (Authors' summary)

12713
Sosnow, M., 1961
and E. Ross
ELECTRODES FOR RECORDING PRIMARY BIOELECTRICAL SIGNALS. — Litton Industries, Woodland Hills, Calif. (Contract AF 33(616)-7304); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71751). ASD Technical Report no. 61-437, Sept. 1961. 188 p.

This report summarizes electroding practices in the biological sciences. The literature concerning major problems associated with physiological electroding techniques in common use is reviewed. Primary areas of interest and discussion are: (1) general electrode problems, (2) methods of minimizing these problems, and (3) specific applications to bioelectric measurements (electroencephalogram, electrocardiogram, electromyogram, electro-oculogram, galvanic skin response). (Authors' abstract) (88 references)

12714
Steinberg, I. I. 1959
MEDICAL ELECTRONICS: BLACK BAG IN SPACE. —Astronautics, 4 (6): 26-27, 42. June 1959.

Brief descriptions are given of specially designed medical-electronic instruments for monitoring the physiological and psychological responses of man in space. Included are a respiration rate and depth transducer over mouth and nose; ceramic chest microphone for taking heart sounds; electrodes protected by ankle spats to take galvanic skin response (an index to psychological reactions); painted-on electrodes for taking electrocardiogram and heart rate; and an electronic (bead thermistor) contact thermometer for making direct, instantaneous reading of skin, rectal, and oral temperatures.

12715
Tipton, C. L., 1959
and H. P. Birmingham
THE INFLUENCE OF CONTROL IN A FIRST-ORDER MAN-MACHINE CONTROL SYSTEM.—Human Factors, 1 (3): 69-71. Aug. 1959.

An experiment was conducted to observe the effect of varying control sensitivity in a velocity control system. A single sine wave of 0.05 c.p.s. was used as the course input, and the subjects tracked in the compensatory mode using a pressure control. The operator was required to apply a maximum force of one ounce to stay on target when tracking with a maximum control gain, whereas eight pounds of force were required with a minimum control gain. Eight naval enlisted men received eight test runs on eight control sensitivities covering a range of 128 to 1. Test runs were one minute in length. A region of minimum error occurred at the lower control sensitivities. The overall error variation was 2.5 times for the entire 128 to 1 range of control sensitivities. The maximum average tracking error did not exceed one percent of the input amplitude. (Authors' abstract)

12716
Tolles, W. E., 1960
and W. J. Carbery
THE MEASUREMENT OF TISSUE RESISTANCE IN PSYCHO-PHYSIOLOGICAL PROBLEMS.—In: Medical electronics: proceedings of the international conference of medical electronics, II (Paris, June 24-27, 1959), p. 43-49. London: Iliffe & Sons, 1960.

A method of low-frequency measurement of skin resistance is presented, and the design considerations in the choice of method, frequency, voltage, and current are discussed. The design, judged from the results of many experiments, has proved satisfactory and provides unambiguous measurements. The long-term stability of the measurement of skin resistance, coupled with the sensitivity to short-term responses, recommends the application of this method to a broad spectrum of studies of stress, fatigue, alertness, and anxiety, and to psychophysiological monitoring. (Authors' abstract)

12717
Traite, M., 1959
W. Welkowitz, J. Kilduff, and C. Purpuro
ENVIRONMENTAL TESTING OF FUTURE SPACEMEN.—Electronics, 32 (42): 65-69. Oct. 1959.

Some of the approaches to instrumenting a human being under conditions of space flight are discussed. The transducers of a physiological instrumentation system must be external to man, permit free movement, and be relatively comfortable. The transducer-associated circuits must be small, lightweight, and low on power consumption. The author discusses specific technological problems in measuring such physiological variables as respiration, electrocardiogram, temperature, heart sounds, skin temperature skin resistance, and electroencephalogram. The standard bulky electrode can now be replaced by an electrode-type suitable for extended wear (a fine metallic mesh disk attached to the skin by means of a conductive paint). Thermistors are excellent for skin or body temperature measurements; their small size, low power consumption, and high sensitivity offset the disadvantage of their logarithmic resistance variation with temperature. External blood pressure measurements are possible by measuring the peaks of waves electronically. Heart sounds can be detected by a small microphone mounted over the heart. At present a solution to electroencephalographic measurements is dependent upon further electronic advances. Circuit packaging for physiological electronic circuitry may be approached as for a multichannel system, i.e., broken down in functional blocks. Pickup and cross-channel coupling into the initial low level stages must be avoided due to low signal levels of some transducers.

12718
Tunstall, J. 1960
PILOT AID DESIGNED FOR AUTOMATIC LANDING. —Aviation Week and Space Technol., 73 (2): 83-84. July 11, 1960.

A cockpit indicator positioned to present flight attitude information to the pilot's extrafoveal visual field during forward vision has been designed by Smiths Aircraft Instruments, Ltd. The display is composed of rotating cylinders painted in a black and white helical pattern which appears to move in the same direction as the required movement of the control column.

12719
Van Laer, J., 1960
E. H. Galanter, and S. J. Klein
FACTORS RELEVANT TO THE DEVELOPMENT OF AIRCRAFT WARNING AND CAUTION SIGNAL SYSTEMS.—Aerospace Med., 31 (1): 31-39. Jan. 1960.

In the operation of an aircraft, the pilot is a biomechanical link between the aircraft and its environment. In this capacity, the problems of priority of information presentation and the variety of input channels exist. At the present time, only the sense modalities of vision, audition, and cutaneous pressure sensitivity show promise as input channels for warning and caution signals. Visual stimuli are poorly suited to serve as alerting signals, but are ideally suited to serve as directing signals. Auditory and vibratory tactile stimuli are well adapted to serve as alerting signals, but not as directing signals.

12720
Vrînceanu, R. 1961
[RADIO-RECORDING OF BIOLOGICAL PARAMETERS] Radioînregistrarea parametrilor biologici. — Studii şi cercetări de fiziologie (Bucureşti), 6 (4): 709-720. 1961. In Rumanian, with French summary (p. 720).

A system for the radio-recording of biological parameters of a subject during work is described. The apparatus consists of an emittor with transistors, and records the electrocardiogram, electroencephalogram, electromyogram, and pneumogram. These data can be transmitted at a distance. Included are illustrative photographs and figures of the apparatus at work, along with a discussion of installation possibilities.

12721
Weisz, A. Z., 1960
J. I. Elkind, B. C. Pierstorff, and L. T. Sprague
EVALUATION OF AIRCRAFT STEERING DISPLAYS. — IRE Trans. on Human Factors in Electronics, HFE-1 (2): 55-61. Sept. 1960.

A number of radar steering display designs utilizing the moving-airplane principle were compared with the standard Air Force moving-horizon display in a series of simulator experiments. Significant improvement in tracking performance for military pilots with and without prior fire-control experience was found for a display which incorporated rate feedback and pursuit tracking features in addition to the moving-aircraft principle. Results of smaller-scale tests with naive and relatively inexperienced subjects are also reported.

12722
Yamazaki, T. 1960
[STUDY ON THE RESPONSE OF THE OPHTHALMIC ARTERY WAVE TO DYNAMIC ACTION. II. ON RECORDING THE OPHTHALMIC ARTERY WAVE TRANSMITTED OVER A LONG DISTANCE] Rikigakuteki sayō ni taisuru gandōmyaku myakuha no kenkyū. 2. Gandōmyaku myakuha no entatsu kiroku ni tsuite. — Japanese Defense Forces Med. Jour. (Tokyo), 7 (5): 6-9. May 1960. In Japanese, with English abstract (p. 9).

A device is described for recording the telemetered response of the ophthalmic artery wave to in-flight maneuvers. Graphic records are shown of responses during pre-flight (stand by), while climbing, and while turning during climb.

d. Simulators and Analogs

12723
Achilich, J. H. 1959
THE HUMAN DISORIENTATION DEVICE: A SIMULATOR OF ANGULARLY-ACCELERATED MOTION. — IRE Trans. Military Electronics, MIL-3 (3): 99-104. July 1959.

The Human Disorientation Device has been developed as a research tool in the field of aviation medicine for the generation of angularly accelerated motion to enable the accomplishment of medical research in the field of animal or human responses to angular acceleration. The device will produce accurately known and controlled values of angular acceleration about two axes of rotation when the subject is seated so that his head is located at the point specified by the intersection of the axes. The Human Disorientation Device will allow medical research in the field of sensory responses to angular acceleration, vertigo, and similar phenomena required for an analysis of human behavior and human performance limitations in the rapid maneuvering (spin and tumbling, etc.) of high-speed aircraft and spacecraft. (Author's summary)

12724
Ackerman, M. 1959
AN INTEGRATED SPACE-FLIGHT SIMULATOR. — IRE Trans. Military Electronics, MIL-3 (3): 92-98. July 1959.

The application of a flight simulator in the engineering and development of a space cabin or capsule is discussed. Those elements of the space environment which might physiologically or psychologically affect the pilot or crew are reviewed in terms of the following systems: propulsion, flight, internal environment, communication, and navigation. A proposed flight simulator is described which will integrate the physiological and psychological effects of these systems and thereby provide a complete environment for experimentation. Early phasing of the integrated simulator with the space vehicle is suggested as a better foundation for design of the space cabin or capsule than sole dependence on feedback from early flights.

12725
Armstrong, R. C. 1961
MARS-SPACE TRAVEL SIMULATOR. — Interavia (Geneva), 16 (12): 1683. Dec. 1961. In English.

The Manned Astronautical Research Station (MARS) mockup vehicle is capable of taking three astronauts 200 miles into space for three weeks of scientific study. MARS, which is 24 ft. in diameter and contains three rooms, can simulate all of the biological environments of orbit except those of hard radiation, zero g, the internal stress of apprehension, the hyper-gravity encountered during launch and re-entry, or the vehicle's dynamic sound pressure levels. It does simulate the normal background noise of orbital flight. As an experimental platform for life science research it will be useful in: determining the physical reactions and operational capabilities of man during flight; conducting physiological and sociological experiments in a confined environment; conducting biological experiments varying the atmospheric pressure, temperature, and humidity; providing for the design and test of apparatus and equipment for advanced space vehicles; and determining the types of testing and training program necessary for space crews.

12726
Blatteis, C. M., 1960
and E. F. Tucker
CONSTRUCTION OF A LOW-COST TEMPERATURE-CONTROLLED ALTITUDE CHAMBER.—Army Medical Research Lab., Fort Knox, Ky. (AMRL Project no. 6X64-12-001). Report no. 420, March 30, 1960. i + [19] p.

Details are presented for the construction of an inexpensive, temperature-controlled altitude chamber designed for chronically exposing rats and other small animals to low barometric pressures at any desired ambient temperature.

12727
Buddenhagen, T. F., 1961
and M. P. Wolpin
A STUDY OF VISUAL SIMULATION TECHNIQUES FOR ASTRONAUTICAL FLIGHT TRAINING.—Bell Aerospace Corp. Bell Aerosystems Co., Avionics Div., Buffalo, N. Y. (Contract AF 33(616)-7028); issued by Wright Air Development Division. Behavioral Sciences Lab., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio (Project no. 6114, Task no. 60863). WADD Technical Report no. 60-756, March 1961. xi+210 p.

A study was made of the engineering requirements for visual simulation in astronautical flight training and of the basic techniques available to accomplish such simulation. An evaluation of the potentialities of the various techniques led to the choice of closed circuit television as an image transfer technique. A preliminary design concept using this technique was formulated to determine the areas in which development work will be required prior to the design of a complete simulator. This report includes a compilation of applicable techniques, a determination of the probable visual environment of space, and an investigation of a method to predict the perceptual fidelity achieved by various simulation techniques as an aid in optimizing the training value of a simulator. (Authors' abstract)

12728
Buning, H. 1961
FLIGHT SIMULATION OF ORBITAL AND REENTRY VEHICLES. III. AERODYNAMICS INFORMATION REQUIRED FOR SIX DEGREES OF FREEDOM SIMULATION.—Univ. of Michigan, Ann Arbor (Contract AF 33(616)-5664); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 6114, Task no. 611407). ASD Technical Report no. 61-171 (III), Dec. 1961. v+26 p.

A survey of the aerodynamic information required for a simulator for a glide reentry vehicle is presented. Various phases of the flight are considered: hypersonic reentry, hypersonic-supersonic glide, and supersonic-transonic-subsonic approach and landing. Accuracy requirements and origin of aerodynamic information are briefly discussed. Aerodynamic parameters are defined, and the dependence of aerodynamic coefficients on these parameters is outlined. Special emphasis is placed on a technique for generating functions of two or three independent variables and some sample calculations are presented. (Author's abstract)

12729
Crosbie, R. J. 1959
THE REQUIREMENTS FOR MODIFICATION OF THE HUMAN CENTRIFUGE FOR HIGH PERFORMANCE AIRCRAFT AND SPACE VEHICLE SIMULATION RESEARCH.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. NM 11 02 12.6, Report no. 3). Report no. NADC-MA-5907, July 6, 1959. iii+30 p. AD 225-000

A proposed modification for the human centrifuge is presented. Specifications are given concerning centrifuge improvements as a dynamic simulator for space vehicle studies such as the X-15 and Mercury Project, and for g-tolerance and performance investigations. A proposed 100-g capability for the centrifuge is discussed and an interchangeable capsule concept is explained. Also presented are the detailed requirements for the complete program along with criteria for a feasibility study of the proposed modifications. (Author's abstract, modified)

12730
Curtiss-Wright Corp. 1961
STUDY PROGRAM FOR SIMULATOR COMPONENT INTERCONNECTIONS.—Curtiss-Wright Corp., Electronics Div., East Paterson, N. J. (Contract AF 33(616)-6896); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6114, Task no. 60167). ASD Technical Report no. 61-71, April 1961. vi+28 p.

The primary purpose of this project is to develop component interconnecting techniques, patching logic and component distribution which can be incorporated into the designs of flight training simulators. The techniques developed are to attain flexibility and versatility of general purpose computers for simulators; thus, lessening the arduous operations presently incurred whenever alterations to an existing system are required. Emphasis has been placed on providing a means to accomplish this desired result without increasing the size or space required for any given cabinet. In fact, using the techniques derived herein, the cabinet size and space needed has been cut down. Various solutions as to how to effect this fast, easy and reliable way of wiring were considered, primarily from the standpoint of expediting field modifications. As a consequence of this, contemplation was also given to this method as applied to initial manufacture and test. In the final analysis a "Hermaphrodite Body" type of connector was selected utilizing crimp type pins and sockets, affixed to standard lengths of wire which in turn are inserted into the prescribed holes in the connector body as dictated by the electrical circuit design. (Author's abstract)

12731
Drone, K. C. 1961
DESIGN STUDY FOR AN ACCELERATION RESEARCH DEVICE. —Rucker Co., Oakland, Calif. (Contract AF 33(616)-7536); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71746). ASD Technical Report no. 61-425, Aug. 1961. viii+256 p.

A design study was made of an acceleration research device (required to be constructed by proven methods and economically feasible) capable of simulating presently recognized requirements of accelerations, levels of various exposure conditions,

and combinations of stresses in aerospace systems. Basically the device is a centrifuge with a payload cab located at the end of a 50-ft. arm. The centrifuge is to be used for two modes of operation (testing of hardware with accelerations up to 100 g and testing subjects—including man—under controlled environmental conditions) each having its own payload cab and using the same arm and drive. Twenty-two different sections are presented allowing major items contributing to the end configuration to be examined as entities within themselves. No problems were encountered which did not appear to have a feasible solution.

12732
Gerathewohl, S. J. 1961
ZERO-G DEVICES AND WEIGHTLESSNESS SIMULATORS. —— National Academy of Sciences—National Research Council (Washington, D. C.). Publication no. 781, 1961. 143 p.

A comprehensive report is given on zero-g devices and weightlessness simulators. The zero-g devices covered are vertical motion devices (e.g., the drop tower), various aircraft, and ballistic missiles. The weightlessness simulators discussed are the null-gravity simulator, the NASA weightlessness simulator, the WADC frictionless device, the orbital air bearing simulator, the multi-axis test facility, and the Martin reaction control simulator. Suggested areas are given for research in subgravity and zero-gravity effects. (114 references)

12733
Grandpierre, R., 1959
F. Violette, F. Flandrois, and J. B. Tosan
[SIGNIFICANCE AND LIMITATIONS OF RESEARCH ON ANIMALS AND MAN BY MEANS OF CENTRIFUGES] Intérêt et limites des recherches effectuées sur l'animal et sur l'homme au moyen des centrifugeuses.——Médecine aéronautique (Paris), 14 (4): 325-337. 1959. In French, with English summary (p. 336).

A history of the centrifuge from the time of Darwin, and an evaluation of the centrifuge as an instrument of basic and applied research, particularly in the field of aviation medicine, is presented. Because of basic limitations on the use of the centrifuge for precise research, such as the mechanical limitation on rate of acceleration and the complications of data analysis stemming from the use of experimental animals with a different physical configuration (and susceptibility to acceleration) from that of man, the usefulness of the centrifuge in the future is seen to be in the field of applied rather than basic research.

12734
Grandpierre, R., 1961
F. Violette, R. Flandrois, and J. B. Tosan
[ADVANTAGE AND LIMITS OF STUDIES DONE ON THE ANIMAL AND ON MAN BY MEANS OF CENTRIFUGES] Intérêt et limites des recherches effectuées sur l'animal et sur l'homme au moyen des centrifugeuses.——In: Bio-assay techniques for human centrifuges and physiological effects of acceleration, p. 140-146. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961. In French, with English summary (p. 140).

Following a brief history of the centrifuge since Darwin (1794), the authors discuss the use of centrifuges for studying long-duration acceleration stress and the technical limitations of extremely rapid accelerations. They emphasize the limitations of the evaluation of data obtained, since the difference between the 2-foot vertical attitude of man and the 4-foot horizontal attitude of the animal is not only of an anatomic nature, and orthostatism results in important vascular regulations. In summary, fundamental physiological research is likely soon to be completed, and the use of centrifuges will be restricted to applied research, namely the testing of new techniques and materials. (Authors' summary, modified)

12735
Guedry, F. E., 1961
and A. Graybiel
ROTATION DEVICES OTHER THAN CENTRIFUGES AND MOTION SIMULATORS: THE RATIONALE FOR THEIR SPECIAL CHARACTERISTICS AND USE. —— National Academy of Sciences-National Research Council, Washington, D. C. Publication no. 902, 1961. v+40 p.

Rotation devices used in studying the role of the semicircular canals and otolith organs in aerospace flight are considered. A listing is presented of some particular problems of aerospace medicine to which vestibular studies are applicable. Locations and general characteristics are given for a number of devices especially adapted for research pertinent to problems of vestibular function and spatial orientation at some domestic and foreign facilities. The vestibular system is used to point out the need for a melding of disciplines in the human factors problems of aerospace endeavors. Investigations to be included in future research are outlined. (93 references)

12736
Hardy, J. D., 1958
and C. C. Clark
THE DEVELOPMENT OF DYNAMIC FLIGHT SIMULATION.——Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. NM 11 02 12.6, Report no. 1). Report no. NADC-MA-5817, Dec. 4, 1958. iv+19 p. AD 216 508

The development of the Dynamic Flight Simulation Program at the Aviation Medical Acceleration Laboratory is traced. The adaptation of the 50-foot human centrifuge to the demands of closed loop simulation and the computer control involved are explained. Also discussed is the role played by dynamic flight simulation in the training of pilots to fly the X-15 research plane. (Authors' abstract)

12737
Hart, E. M. 1961
EFFECTS OF OUTER-SPACE ENVIRONMENT IMPORTANT TO SIMULATION OF SPACE VEHICLES. —— Cornell Aeronautical Lab., Inc. Buffalo, N. Y. (Contract AF 33(616)-6858); issued by Aeronautical Systems Division. Behavioral Sciences Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6114, Task no. 60806). ASD Technical Report no. 61-201, Aug. 1961. viii+106 p.

The results of a literature survey undertaken to define the effects of the outer-space environment important to the simulation of space vehicles are presented. Only the natural environment of space is considered and the survey is limited to the solar system with particular emphasis on the region in the near vicinity of the earth-moon system and

at heights greater than 80 kilometers above the earth's surface. To specify those effects that need to be incorporated into a space-training simulator, the exterior environment (corpuscular and electromagnetic radiation, condensed matter, gaseous medium, spatial force fields, upper atmosphere), its effects on the vehicle and crew, and the malfunctions that may result must be determined. Included are 41 figures, 8 tables, and recommendations for further study. (Author's abstract, modified) (127 references)

12738
Hartman, B. O. 1961
EXPERIMENTAL APPROACHES TO THE PSYCHO-PHYSIOLOGICAL PROBLEMS OF MANNED SPACE FLIGHT. — In: Lectures in aerospace medicine, 16-20 Jan. 1961, [section] 14. 42 p. Brooks Air Force Base, Texas: School of Aviation Medicine, 1961.

Problems arising in putting man into space must be approached from the multi-discipline point of view. The manned space program is concerned first with survival, then survival without damage, and finally survival without cost when the astronaut now makes a contribution to the over-all performance of the system. It is here that the psychophysiologist plays a paramount part. A description of the work being done in the School of Aviation Medicine in three major areas of research is given: the weightlessness problem, the Space Cabin Simulator program and the analysis of behavior in the cabin environment. A review of the problem of weightlessness is given along with a description of the work using water immersion to study the effects of the weightless state on sleep, cardiovascular reflexes, and work capacity. Discussed are aspects of the Space Cabin Simulator program such as astronaut proficiency, effects of fatigue, and effects of the diurnal cycle. The Two-Man Cabin program is described including operations of a simulator for the performance of tasks and a simulated mission of 30 days. The mission studies the effects of prolonged commitment, duration of the work period, the effects of differing signal rates and Circadian variation. Aspects of the behavior in the Space Cabin program are discussed in view of aberrant behavior as a result of isolation, confinement, and deprivation. Crew interaction is studied in the Two-Man Cabin program with emphasis on personality changes as a result of the stress of flight. (35 references)

12739
Hawkins, W. R., 1958
and G. T. Hauty
SPACE CABIN REQUIREMENTS AS SEEN BY SUBJECTS IN THE SPACE CABIN SIMULATOR.—American Rocket Society, Preprint, p. 1-18. Nov. 1958.
Reprinted in: Reports on space medicine—1958. School of Aviation Medicine (U. S. Air Force), Randolph Air Force Base, Texas. [24] p. [Unnumbered Report], Feb. 1959.

The subjective responses and recommendations of subjects who have undergone simulated space flight are reported. Small things which the subjects normally would consider incidental or trivial assumed greater significance, such as haphazard storage of gear, tools, food, etc., and position of monitoring instruments. The recommendations include: enlarging the space cabin, recycling the work-rest cycle so that it is closer to normal and fatigue is lessened, regulating carbon dioxide and heat levels within the cabin more closely, and providing an acceptable diet and adequate fluid.

12740
Helvey, T. C. 1959
PROBLEMS OF GROUND SIMULATION OF LONG RANGE SPACE FLIGHT ENVIRONMENTAL CONDITIONS.—In: International Astronautical Congress, IXth (Amsterdam, 1958), Proceedings, vol. 1, p. 405-413. Wien: Springer, 1959.
Also published in: IRE Trans. Space Electronics and Telemetry, SET-5 (2): 57-60. June 1959.

A description is given of the need for refined engineering testing for space vehicles with special emphasis on multiple stresses. An environmental chamber is described for the testing of complete single-stage missiles. The feasibility of the simulation of meteoric impact is discussed, and a suit for protection against radiation hazards is described. (Author's abstract, modified)

12741
Hendler, E., 1958
and D. A. Mancinelli
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS. I. INTRODUCTION TO A CONFINEMENT EXPERIMENT AND DESCRIPTION OF THE TEST CHAMBER.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-1403). Report no. NAMC-ACEL-383, Aug. 27, 1958. v+10 p.

The six-man, seven-day habitability and confinement study was conducted at a simulated altitude of 10,000 feet and in an artificial atmosphere of 55% oxygen and 45% nitrogen, sea level equivalent. It was found that the conditions were well tolerated by the men, properly motivated and having good discipline and training. In addition, considerations of increased comfort derived from food selection and quality, amusement, factors relating to personal hygiene, and maintenance of a constant temperature and odor-free atmosphere are indicated for future runs. (Authors' conclusions, modified)

12742
HIGH, WIDE ... AND SPATIAL. — Environmental Quarterly, 7 (3): 20-22, 27-30. July 1961.

A review of new space environment simulators is given. Lockheed's high-vacuum orbital simulator (HIVOS) simulates altitudes up to 350 miles and accommodates objects of 10x32 feet in size. Republic Aviation's new 30-feet space chamber will test men and equipment under ionospheric conditions. The new Chance Vought simulator will produce altitudes of 200 miles and can spin objects of 1000 pounds. A heat sink will be cooled to -320° F. The planetary horizon and star fields will be simulated for visual training of pilots. General Electric's new simulator features a collimated sun source, and test vehicles up to 5 tons can be accommodated.

12743
Holzman, B. G. 1960
BIRDS, BEES, AND BALLISTIC BEASTS. — Science (Washington, D. C.), 132 (3430): 793-794. Sept. 23, 1960.

Biological research may contribute to the formulation of laws of organization and information processing. Studies of animal sensing devices that may have practical application in the design of computers and missile detecting devices include investigations of the vision of beetles, sonar system of porpoises and whales, electroreceptors of fish, smell receptors of insects, and the infrared detection organ of rattlesnakes.

12744
Kelly, C. F., 1960
A. H. Smith, and C. M. Winget
AN ANIMAL CENTRIFUGE FOR PROLONGED OPERATION. — Jour. Applied Physiol., 15 (4): 753-757. July 1960.

The construction details and functional characteristics of an animal centrifuge capable of producing accelerative forces up to 6 g for long periods are described. The centrifuge consists of a series of four double radial arms with animal cages suspended on pivots, revolving in a horizontal plane about a vertical drive shaft. Consideration is given to standardization of the environment for control and experimental animals, the effects of angular speed, cage weight, and cage cross-sectional area on power requirements and cage angle, and the engineering and biological factors involved in the choice of arm radius, including the limitations of space and cost of materials, the increase in torque and in velocity required to produce equivalent accelerative forces with increasing radius, and the effects of rotation rate on the labyrinthine apparatus, transfer of fluids and electric signals, and variability of the force field.

12745
Kopecký, M. 1960
LOW-PRESSURE CHAMBER WITH CONTROLLED TEMPERATURE AND HUMIDITY.—Jour. Applied Physiol., 15 (3): 540. May 1960.

A small low-pressure chamber with controlled temperature and humidity has been devised for studying adaptation to chronic hypoxia in rats. As many as 40 adult rats in four separate cages can be housed in the chamber. Animals have been exposed at various times for 24-48 hours with 24-hr. intervals to a simulated altitude of 5,000 or 7,000 meters. The exposed animals enjoyed the same good health as the controls as judged from similar mortality rate, growth curves, and appearance.

12746
Kubiak, E. J., 1961
J. Rest, and R. A. Bambenek
A CLOSED RESPIRATORY SYSTEM EVALUATOR. — American Machine and Foundry Co., Mechanics Research Division, Niles, Ill. (Contract AF 33(616)-7392); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). ASD Technical Report no. 61-512, Sept. 1961. v+48 p.

A program to develop a device capable of simulating human respiration and recording the operating characteristics of closed respiratory systems is summarized. The closed respiratory system evaluator as described is capable of performing all tests necessary to evaluate the performance of any type closed respiratory system. The desired values of the parameters of human respiration may be set independently of each other so that either realistic or unrealistic relationships can be chosen within certain limits. The capabilities of the evaluator are: (1) oxygen removal rate of 0.02 to 0.85 lb./hr. at standard temperature and pressure, (2) carbon dioxide addition rate of 0.02 to 2.8 lb./hr., (3) sensible heat addition rate of 0 to 300 BTU/hr., and (4) water vapor addition rate of 0.02 to 0.9 lb./hr. (From the authors' abstract)

12747
Kuehnegger, W. 1960
THE REACTION CONTROL SIMULATOR—A FLIGHT TRAINER FOR MANNED ORBITAL AND SPACE VEHICLES. — Advances in the Astronautical Sciences, 5: 33-38. 1960.

This paper explains the need for, and presents a more complete reaction control device to qualify and prepare personnel for orbital and space flight. The paper covers design of the basic unit, control system, communications, safety provisions, and suggests various uses and applications. (Author's abstract)

12748
Kydd, G. H., 1960
and P. Craig
BIOSATELLITE, DEVELOPMENT AND STUDY WITH: LETTER REPORT CONCERNING LIFE SUPPORT SYSTEM.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Project no. TED ADC AE 1412.2). Report no. NADC MA L6001, Jan. 6, 1960. [12] p.

A closed-system environmental chamber has been designed and successfully constructed to provide a means for the study of animals under simulated capsule conditions for extended periods of time. Preliminary observations have been made of several of the sub-systems integral in the final simulation, including a carbon dioxide scrubber (LiOH), circulating pump, temperature regulating system, relative humidity control, and oxygen supply system.

12749
Larsen, F. J. 1960
AIR CONDITIONING IN SPACE AND ON EARTH. — New Scientist (London), 8 (201) : 770-772. Sept. 22, 1960.

The problems of air conditioning encountered in the construction of a space cabin simulator are briefly discussed. Among the requirements of an atmospheric control system for a closed space vehicle are the control of air temperature, humidity, oxygen and carbon dioxide concentration, removal of odors by passage of air through activated charcoal, removal of particulate matter from the air by electrostatic cleaning, and conversion of solid and liquid wastes.

12750
Levine, R. B. 1961
NEW APPROACH TO ZERO GRAVITY TESTS. — Aircraft and Missiles, 4 (6): 26-29. June 1961.

Lockheed's Null-Gravity Simulator simulates the effects of a space environment by immersing a man in water. Water immersion gives the following desired effects: (1) the subject loses the ability to detect gravitational support, (2) muscular effort for maintaining posture is reduced, (3) previously stretched, soft tissues no longer perceive the di-

rection and magnitude of the gravitational field, (4) the force of friction between the vessel walls and the subject decreases to zero, and (5) hydrostatic pressures in the circulatory system are nearly equaled by the water pressure. By eliminating the action of the otoliths by rotating the entire water chamber, null-gravity simulation is further enhanced. A physical description of the simulator is given. Tests carried out with fish indicate that spinning of humans will produce the desired results, but further tests should be done.

12751
Lowrey, R. O. 1960
SPACE FLIGHT SIMULATORS: DESIGN REQUIREMENTS AND CONCEPTS. — Aerospace Eng., 19 (10): 50-56. Oct. 1960.

The design requirements for the environmental simulation of each of the phases of space flight are discussed. Space flight phases are categorized and described by reference to the elements which convey environmental situations to man (acceleration, atmosphere, visual field, and aural field). Devices and techniques are suggested for the provision of reasonable simulation of: (1) departure and landing, by a centrifuge capable of providing six degrees of freedom of motion (radial, translational, and rotational); (2) the mid-course phase, by a crew endurance simulator and by a null-gravity simulator which eliminates sensory cues received through the otolith organs, muscular tension, and pressure points by rotation of a subject about the long axis in a horizontal plane within a supporting fluid; and (3) the terminal mission phase (space station), by simultaneous suspension of three vehicles within a chamber, with six degrees of freedom of movement controlled by subject operators.

12752
Lowry, R. D., 1961
and W. M. Wolff
DESCRIPTION AND PERFORMANCE EVALUATION OF THE AEROSPACE MEDICAL RESEARCH LABORATORIES' VERTICAL ACCELERATOR. — Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 7210, Task no. 71703). ASD Technical Report no. 61-743, Dec. 1961. iii+23 p.

The Aerospace Medical Research Laboratories' Vertical Accelerator was developed for bioastronautics research to simulate vibration and buffeting encountered in aerospace operations. The design, motion capabilities, control, and safety features are described. This Vertical Accelerator can be programmed with periodic or random acceleration patterns obtained from actual environmental measurements. It is a complex electromechanical device employing a unique type of friction drive to move a test platform with a 200-lb. load capacity. The accelerator, for continuous operation, can produce peak to peak amplitudes of ±5 ft. over the frequency range from 0.5 c.p.s. to 10 c.p.s. The maximum acceleration output is from 2.5 to 3 g depending on load and permissible distortion. (Authors' abstract)

12753
McKiernan-Terry Corp. 1960
FEASIBILITY AND DESIGN STUDY FOR AN ADVANCED HUMAN ENVIRONMENTAL RESEARCH ACCELERATOR.—McKiernan-Terry Corp., Dover, N. J. (Contract AF 33(616)-6538); issued by Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71746). WADD Technical Report no. 60-225, March 1960. vi+494 p.

This study presents an analysis of the engineering problems inherent in the design of a high-performance accelerator research device capable of producing controlled high levels of centripetal acceleration and, simultaneously, linear and rotary motion of a payload about various axes. Engineering feasibility is studied and related to various combinations of acceleration parameters, including acceleration level, rate of change of acceleration, radius of rotation, payload mass, and displacement and rotary degrees of freedom. The conclusions resulting from a study of these factors are integrated to yield specifications for accelerators of optimum performance. All significant facets of accelerator concepts are treated, including prime mover considerations, arm strength, aerodynamic loss problems, gimbal mechanisms, capsule layout, and basic dynamic and kinematic properties. Automatic control and analogue simulation of the acceleration problem is also discussed. (Author's abstract)

12754
Malette, W. G., 1960
J. B. Fitzgerald, and B. Eiseman
A RAPID DECOMPRESSION CHAMBER FOR SMALL ANIMALS. — School of Aviation Med., Brooks Air Force Base, Tex. Report no. 60-73, Aug. 1960. 3 p.

A simple, mobile chamber designed for the study of the effects of rapid decompression on small animals is described. The apparatus consists of an accumulator chamber, a standard laboratory vacuum pump, a pressure manometer, a decompression port and diaphragm, and an animal chamber.

12755
Mayo, A. M. 1961
REQUIREMENTS FOR ARTIFICIAL GRAVITY DURING PROLONGED SPACE FLIGHT: IMPACT ON VEHICULAR DESIGN AND OPERATION. — American Astronautical Society, 7th Annual Meeting (Dallas, Texas, January 16-18, 1961), Preprint 61-13. [8] p.

The provision of an environment suitable for effective human performance during space flight is discussed. The artificial gravity problem would be solved if propulsion technology were sufficiently advanced to provide continuous thrust effecting a 1 g equivalent acceleration. Since such an advance is lacking, alternate solutions are proposed including: (1) providing a stable environment capable of values up to 1 g; (2) minimizing learning and adaptation problems; (3) making implementation compatible with integration in the over-all space flight system; and (4) conceiving that the size and weight increment should be the criterion for selection within the limitations of the first three requirements. A theoretical system is described in detail which provides an equivalent to gravity and satisfies the conditions listed above. Possible early investigations (such as studying graded levels of subgravity and the effects of variation in rotation velocity) using such an artificial gravity system are discussed.

12756
Naish, J. M. 1959
SIMULATION OF VISUAL FLIGHT, WITH PARTICULAR REFERENCE TO THE STUDY OF FLIGHT INSTRUMENTS.—Royal Aircraft Establishment (Gt. Brit.), Farnborough. Technical Note no. I.A.P. 1099, Aug. 1959. 16 p., 12 illus.

A visual flight simulator is described, which uses a television camera-screen combination technique. Its essential features are freedom of maneuver of the camera over a flat, varied terrain, binocular presentation, variable visibility and illumination, compactness, relative simplicity of construction, and flexibility of application to flight simulators. The simulator operates by having an edge-viewed ground pattern projected from the television screen. Problems regarding successful simulation, including considerations of picture quality, field of view, scale, and viewing distance are discussed.

12757
Newman, A. I., and R. J. Dennis 1959
SIMULATING SPACE.—Indus. Res., 1 (4): 63-69. Nov.-Dec. 1959.

The testing of equipment designed for conditions of space travel is discussed. The prohibitive cost of actual rocket launchings makes simulated space-environment tests a necessity. The simulation of space vehicle conditions, including sound, temperature, humidity, vibration, and acceleration, are considered. The question of single versus combined environment tests is also discussed.

12758
Panchenko, L. F. 1958
A MODIFIED PRESSURE CHAMBER FOR USE IN A SMALL LABORATORY.—Bull. Exper. Biol. and Med., 45 (1): 125-126. Jan. 1958.

A pressure chamber was constructed from a vacuum drying cabinet connected with three instruments for measuring pressure: a dial type vacuum meter indicating pressure in millimeters of mercury, an aneroid altimeter indicating height in meters, and a membrane variometer indicating the rate of decompression. Pressure is maintained at a predetermined level by equalization of the amounts of air withdrawn from and supplied to the chamber.

12759
Pecoraro, J. N. 1960
THE NAVY'S ROLE IN ASTRONAUTICAL TRAINING DEVICES. — Military Systems Design, 4 (4): 24-27. July-Aug. 1960.

The crew trainer systems and equipment under consideration by the U. S. Naval Training Device Center for the simulation of orbital and space flight are described. Integrated system facility simulators will be designed to allow personnel and equipment to be subjected to the composite environment created by the interaction of vehicle flight and space conditions. The integrated simulators will consist of a fully equipped space capsule adaptable for use on a human centrifuge or, for long-term experiments, in a low pressure chamber for the testing of air conditioning systems, pressurization, and the completed ecological system. Many subsystem or task trainers will be utilized to simulate components of the complete facility, including procedure, re-entry, and recovery, space navigation, escape and survival, and principles of space and astronautical science.

12760
Petersen, P. 1958
[A NEW DECOMPRESSION CHAMBER] En ny undertryckskammare.—Meddelanden från flyg- och navalmedicinska nämnden (Stockholm), 7 (1): 12-19. 1958. In Swedish, with English summary (p. 19).

An illustrated and diagrammatic description is presented of a pressure chamber which may be adapted to explosive-decompression experiments. The equipment was designed by the author at the Aeromedical Laboratory of the Institute of Physiology in Lund. The chamber is capable of simulating extreme high-altitude conditions and rapid rates of ascent. Leakage is low enough to make it possible to stop the pumps and work under conditions of silence at practically constant pressure for at least one hour. (Author's summary, modified)

12761
Rathert, G. A., B. Y. Creer, and J. G. Douvillier 1959
USE OF FLIGHT SIMULATORS FOR PILOT-CONTROL PROBLEMS.—National Aeronautics and Space Administration, Washington, D. C. NASA Memo no. 3-6-59A, Feb. 1959. 14 p. AD 210 526

Comparisons were made between actual flight results and results obtained with fixed and moving flight simulators in a number of phases of flying airplanes with a wide range of characteristics. These results were used to study the importance of providing motion stimuli in a simulator in order that the pilot operate the simulator in a realistic manner. Regions of airplane characteristics where motion stimuli are either mandatory or desirable are indicated. (Authors' summary)

12762
Rigatto, M., and A. P. Fishman 1961
ALUMINUM DECOMPRESSION CHAMBER AND BODY PLETHYSMOGRAPH. — Jour. Applied Physiol., 16 (2): 391-392. March 1961.

A small, light, aluminum decompression chamber which may also be used as a body plethysmograph is described. The chamber has a capacity of 900 liters and accommodates a seated human subject and a spirometer. Steps for accomplishing decompression and recompression of the chamber are given.

12763
Rosenblatt, F. 1959
PERCEPTRON SIMULATION EXPERIMENTS.—Cornell Aeronautical Lab., Inc., Buffalo, N. Y. (Contract Nonr-2381(00)). Report no. VG-1196-G-3, June 1959. 34 p. AD 219 082, PB 161 065

A number of papers and reports have been published describing the theory of a new brain model called the perceptron. The perceptron is a minimally constrained "nerve net" consisting of logically simplified neural elements, which has been shown to be capable of learning to discriminate and recognize perceptual patterns. This paper is concerned with a report of digital simulation experiments which have been carried out on the perceptron, using the IBM 704 computer at the Cornell Aeronautical Laboratory. These experiments are intended to demonstrate the performance of particular systems in typical environmental situations, free from any approximations which have been used in the previously published mathematical analyses. In the simulation programs,

the action of every cell and every connection in the network is represented in detail, and visual stimuli are represented by dot patterns corresponding to illuminated points in a retinal mosaic. (From the author's introduction)

12764
SATELLITE CAPSULE AND TINY INSTRUMENTS WILL TEST MAN'S REACTIONS TO SPACE TRAVEL.—Elec. Eng., 78 (10): 1062-1063. Oct. 1959.

A space cabin simulator designed for occupancy by two astronauts, which reproduces as closely as possible conditions that will actually be encountered on a 30-day venture into space, is described. It is intended for research use to test the psychological and physiological stresses of man in space. Condensed within the cabin will be equipment for the astronaut's comfort (executive-type chairs, a bed, sanitary facilities, food, cooking utensils, recorded music, and an electrostatic filter to ionize and trap dust and smoke particles) as well as a complex maze of scientific equipment (atmospheric control system with delicate sensing equipment for measuring O_2, CO_2, pressurization, temperature, and humidity). Miniaturized instruments which will increase crew comfort and lighten the payload of the vehicle have been devised for the physiological recording of pulse, blood circulation, blood pressure, body temperature, respiration and heart action.

12765
Savely, H. E. 1960
APPLYING NATURE'S SECRETS TO MACHINES. —Missiles and Rockets, 7 (23): 30-31. Dec. 5, 1960.

Studies of (1) the sensory receptors of animals, (2) the integrative action of their nervous system, and (3) the storage and retrieval of information furnish impetus for the invention of machines with greatly increased capabilities. Examples are given of animal sensitivity to stimuli for which machine analogs have been or may be developed: the infrared-sensing organ of the rattlesnake; electrical sensitivity of certain fishes; velocity-perception of beetles; olfactory sensitivity of moths; the sonar system of bats and porpoises; and the sense of orientation of migratory birds. Integrative phenomena in the central nervous system of animals are very complex and should be studied first in simple organisms. The memory system of animals deserves a detailed study and analysis.

12766
Schohan, B. 1958
HUMAN FACTORS RECOMMENDATIONS FOR THE DESIGN OF COCKPIT PROCEDURES TRAINERS.—American Inst. for Research, Pittsburgh, Pa. (Contract AF 33(616)-2080); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7197, [Task no.] 71640). WADC Technical Report no. 56-527, Sept. 1958. ix+49 p. AD-110 654 PB 151470

The Cockpit Procedures Trainer (CPT) appears to have promising potential as a training aid to teach pilots knowledge about aircraft systems, nomenclature and location of cockpit controls and displays, and procedures required to operate aircraft safely. This report is intended to aid design engineers by presenting first a discussion of the cockpit procedures trainer's role in training, and, second, a set of human engineering recommendations pertinent to the design of such trainers for fighter-type jet aircraft. (Author's abstract)

12767
Schueller, O. 1959
SPACE FLIGHT SIMULATORS.—In: Vistas in astronautics. II. Second Annual Astronautics Symposium, p. 46-59. New York, etc.: Pergamon Press, 1959.

Means of inducing the proper atmosphere within a space cabin, solar, cosmic, nuclear, and X-rays, and zero gravity are considered. Three simulated space flight chambers are described. The need for such chambers in the development of space suits is examined. Devices and reasons for studying the effects of zero gravity, acceleration and deceleration forces, especially on small blood vessels, are surveyed briefly.

12768
Seltzer, L. J., and D. T. McRuer 1959
SURVEY OF ANALOG CROSS-SPECTRAL ANALYZERS.—Systems Technology, Inc., Inglewood, Calif. (Contract AF 33(616)-5822); issued by Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 71581). WADC Technical Report no. 59-241, Dec. 1959. x+72 p.

This report presents a survey of analog devices which have been used to compute cross-spectra in the processing of data from human response experiments. The machines described have been analyzed to show the principles upon which they depend. Where available, the results of calibration experiments have been included as a measure of specific performance. Correlation and spectral measurement are discussed, introductory to consideration of measurement fundamentals for closed loop human response tests. Theoretical ways of calculating cross-spectra are presented and referred to the mechanization of the cross-spectral machines. The effect of nonideal elements on the performance theoretically attainable is considered, together with a discussion of the accuracy of spectral estimates. (Authors' abstract)

12769
Tonndorf, J. 1959
BEATS IN COCHLEAR MODELS.—University Hospitals, Iowa City, Iowa; issued by School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-57, June 1959. 21 p.

Beats in cochlear models were studied from two aspects: (1) Their effect upon cochlear fluid motion which, occurring along elliptic orbits, essentially represent Lissajous figures. The orbits expanded and contracted synchronously with the beat rate. Thereby, a partial rectification (asymmetric expansion) became apparent which, occurring in opposite directions in the two scalae across the partition constituted the beat. This latter phenomenon was caused by the stiffness gradient of the cochlear partition. (2) Their effect on the traveling wave pattern along the partition was originally described by Békésy. Stroboscopic examination revealed that the beat frequency modulates the two primaries thus producing two additional side bands. The displacement pattern of the membrane when viewed by high-speed motion-picture photography, however, did not

give any evidence of these five frequencies. Only the intertone (and the beat) were present. It then became apparent that the model is really a pattern analyzer of complex sound. In terms of cochlear fluid motion, it is able to resolve complex Lissajous figures by a spatial filter action along the partition into simple Lissajous figures. Any deviation from steady Lissajous figures, which ordinarily result from primaries in relation of integral numbers, produces beats. Thus beats of imperfect unison as well as of mistuned consonances have essentially the same cause: a cyclic phase change between the two primaries. (Author's abstract)

12770

Vaeth, J. G. 1960

PREDICTION OF MAN'S PERFORMANCE IN SPACE USING FLIGHT SIMULATORS AND BALLOON-BORNE SYSTEMS.—In: International Astronautical Congress, Xth (London, 1959), Proceedings, vol. 1, p. 138-142. Wien: Springer, 1960.

The ability of space crews to carry out useful missions and tasks has until now been a matter of speculation, based mainly on extrapolation of aviation experience, philosophical reasoning, and fragmentary research. This paper proposes the development of advanced forms of ground-based flight simulators and the use of long-endurance high-altitude manned balloon flights to measure and determine the capability of men to perform in space. By comparing these measurements with corresponding data on the ability of automatic equipment to do the same, it is possible to specify and predict those tasks which can be achieved better by manned than by unmanned space systems. The characteristics of these simulators and balloon operations are described in some detail, together with the role each plays in determining optimum instrumentation, data displays, and cockpit layout for manned space vehicles. Their application to the effective training of space crews is briefly discussed. (Author's abstract)

12771

Vozhzhova, A. I., 1959
and A. S. Semenov

[A TRAINING BOAT SIMULATOR] Trenirovochnaia katernaia ustanovka.—Voenno-meditsinskii zhurnal (Moskva), 1959 (3): 25-26. March 1959. In Russian.

English translation in: Military Medical Journal, 1959 (3): 39-41. New York: U. S. Joint Pub. Research Service, No. 1702-N, June 26, 1959. (Available from Office of Technical Services, U. S. Dept. Commerce)

A ship motion simulator was constructed for simultaneous mass examinations of the vestibular analyzer and systematic vestibular conditioning of large groups. The model is equipped with inside and outside battle stations and a control panel through which the magnitude, character, and duration of mechanical oscillation are established. The following parameters of rolling and vibration are used: (1) roll, full period: minimum 4 seconds, with 30° roll angle; maximum 12 seconds with 45° roll angle; the angles of roll are changed by 5° intervals; (2) pitch, full period: minimum 3 sec., maximum 9 sec., with a 6-7° pitch angle; and (3) toss in a swell: wave amplitude 2 m. Parameters of the general vibration of the ship are: 3 mm. elasticity of flexure of the deck and 10 to 30 c.p.s. frequency of fundamental waves. Noise conditions can be changed in amplitude and frequency. At certain battle stations it is possible to regulate temperature and moisture, and to reproduce the odor of gasoline and oil vapors. This simulator also provides an on-the-shore opportunity for long-term conditioning of motion-sickness-prone individuals.

12772

Welch, B. E., 1961
T. E. Morgan, and F. Ulvedal

OBSERVATIONS IN THE SAM TWO-MAN SPACE CABIN SIMULATOR. I. LOGISTICS ASPECTS.—Aerospace Med., 32 (7): 583-590. July 1961.

Two pilots were maintained in a two-man space cabin simulator for 30 days and for 17 days. The 30-day flight was at a simulated altitude of 18,000 feet with 40% oxygen, 60% nitrogen atmosphere. The 17-day flight was at an altitude of 33,500 feet with essentially a 100% oxygen atmosphere. The men consumed an average of 1726 Cal./man/day during both flights. The food, plus container weight, averaged 1.14 lb./man/day. The daily liquid requirement was 1931 ml./man/day. Oxygen consumed, based on the energy intake, averaged 360 liters or 1.13 lb./man/day. (Authors' summary)

12773

Woodcock, A. H., 1959
H. L. Thwaites, and J. R. Breckenridge

CLOTHED MAN.—Mechanical Eng., 81 (8): 71-74. Aug. 1959.

Condensed from: AN ELECTRICAL ANALOG FOR STUDYING HEAT TRANSFER IN DYNAMIC SITUATIONS.—ASME Paper no. 58-A-252.

An electrical analog of the thermal system of temperature regulation in an ideal man was constructed, with substitution of thermal values for electrical data. The level of activity, type of uniform, ambient temperature, and wind speed were varied by the insertion of appropriate thermal resistances in the complete circuit. In preliminary experiments, the controls were regulated to produce conditions of light exercise, arctic uniform, 70° F. air temperature, and 0.5 m.p.h. wind speed. The air temperature was then reset to -40° F. When skin temperature had reached 86° F., air temperature was returned to 70° F., or activity was changed to heavy. Results indicate that exercise rewarms more rapidly than exposure to higher temperatures. A further experiment explored the activity levels necessary for skin temperature maintenance. The electrical analog instrument was considered to be a satisfactory tool, since indicated changes in skin temperature with variation in the environment were reasonable. It is suggested that the analog may be used as a rough guide to indicate which set of experimental conditions (environment, amount of clothing, etc.) would be most likely to provide useful information from volunteer subjects, in that it could indicate those conditions which would not be tolerable for the length of time planned for the experiment.

12774

Yaffee, M. 1959

CHAMBER SIMULATES SPACE ENVIRONMENT.—Aviation Week, 70 (15): 91-96. April 13, 1959.

Current and projected developments in space environment simulation are discussed. Sponsored by the Wright Air Development Center, present efforts are directed toward the simulation of all environmental factors from 75,000 ft. out through inter-

planetary space. Such a facility, called the Hyper Environmental Simulation Facility, is described in tabular form and presents all of the conditions to be simulated, along with their respective test units, required areas, estimated costs, capabilities, and ultimate purposes. Included are the anticipated conditions of high vacuum, high temperature, air cooling, solar radiation, ozone and ionization, vibration, acoustic excitation, shock, acceleration, high-speed particles, and explosive decompression.

e. Airplane and Space Cabins and Cabin Equipment

12775
Allen, P. S., 1959
E. M. Bennett, and D. K. Kemler
FORCED-CHOICE RANKING AS A METHOD FOR EVALUATING PSYCHO-PHYSIOLOGICAL FEELINGS.—Tufts Univ. Department of Sociology. Bio-Mechanics Lab., Medford, Mass. (Contract AF 33(616)-3068); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 7222, Task no. 71747). WADC Technical Report no. 58-310, Dec. 1959. ix+123 p.

Multiple forced-choice ranking methods were employed to assess comfort inducing or inhibiting characteristics of operational aircraft seats. The variety of new psychometric techniques used in this research proved efficient and comprehensive. The study involved judgment of subjective feelings based on the subject's selection of fixed numbers of stimuli from m, n from m-n, etc. The relevance of each stimulus was estimated by its place in the selection process. Two kinds of stimuli were judged: (1) descriptive terms selected by the subject to describe the sitting experience, and (2) portions of the posterior surface of the body (these were selected by the subject according to comfort level). In this way, the relative comfort profile of body parts was developed and compared with various seats and lengths of sitting time. The resulting profile patterns could be used in predicting success of seat design and suggesting design modifications. (Authors' abstract)

12776
Anderson, W. L. 1960
ATMOSPHERE CONTROL IN CONFINED SPACES.—Naval Research Rev. (Washington), 1960 (June): 7-11.

Methods are discussed for the maintenance of an equilibrium between the respiratory metabolism of man and the oxygen, carbon dioxide, and toxic trace content of the air in a closed space. The standard cyclic systems of atmospheric control in submarines and those proposed for use in prolonged submergence are described. The author states that the principles of atmospheric control in submarines are considered to be identical with those of manned cabins of proposed space vehicles, and that developments in one medium may be applied to the other.

12777
Arnest, R. T. 1961
ATMOSPHERE CONTROL IN CLOSED SPACE ENVIRONMENT (SUBMARINE).—Naval Medical Research Lab., New London, Conn. (Research Project no. MR005.14-3002-9.01). Report no. 367 (vol. 22, no. 21), Dec. 14, 1961. [38] p.

More than 25 atmospheric contaminants are listed, their sources, and their maximum allowable concentrations (MAC) are given, as well as the symptoms they cause, the long-term effects; tools for measuring the amounts of contaminants present are described and methods of removal indicated, in so far as known. Many aspects of research are involved and the author does not claim his summary is complete. (Author's summary)

12778
Ashe, W. C., 1958
C. C. Wright, J. W. Anderegg, H. N. Carlisle, and J. G. Haub
HISTORICAL SURVEY OF INHABITABLE ARTIFICIAL ATMOSPHERES.—Ohio State Univ. Res. Foundation (Contract AF 33(616)-5103); issued by Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio. WADC Technical Report no. 58-154, Sept. 1958. vi + 154 p. (Project no. 7-(77-6350); Task no. 63112).
PB 151 277 AD-155 901

The unclassified world literature on the production and control of aritifcial atmospheres for living organisms is surveyed. The survey covers the literature in the fields of human biology, medicine, microbiology, botany, and zoology. All pertinent articles are abstracted. Abstracts are arranged under the following groups: Carbon Dioxide, Carbon Dioxide Removal Systems, Carbon Dioxide at High Partial Pressure, Electromagnetic (Including Cosmic) Radiation, Variation of "G" Forces, Heat-Cold and Temperature Regulation, Noise, Oxygen, Oxygen Generation, Oxygen at High Partial Pressure, Oxygen Instrumentation, Oxygen at Low Partial Pressure, Odor, Pressure Low, Pressure Explosive Decompression, Sealed Cabins or Containers, Toxic Substances, Water and Moisture Control, and Miscellaneous Factors. Each abstract is supplied with a five-unit code symbol to facilitate cross-referencing among four major fields of investigation. (Authors' abstract, modified)

12779
Barkla, D. 1961
THE ESTIMATION OF BODY MEASUREMENTS OF BRITISH POPULATION IN RELATION TO SEAT DESIGN. — Ergonomics (London), 4 (2): 123-132. April 1961.

Reports of surveys of human measurements are not always easily accessible, and their information about dimensions relevant to seat design is often mixed up with other matter. This paper brings together the principal published information on relevant dimensions. Most of the populations surveyed are not themselves important to British designers, but estimates of the measurements of young British adults are derived from the published material. (Author's abstract)

12780
Bartlett, R. G., 1960
and N. E. Phillips
PROBLEMS OF NITROGEN-FREE AND CARBON DIOXIDE-RICH EXTRATERRESTRIAL ATMOSPHERES. — Naval School of Aviation Med., Pensacola, Fla. (Research Project no. MR005.13-3100, Subtask no. 4). Report no. 3, July 7, 1960. ii+6 p.

The engineering advantages afforded by the use of a nitrogen-free and carbon dioxide-rich atmosphere in space vehicles suggest the need for a program for the investigation of the physiologic effects of such a system. The use of a nitrogen-free atmosphere would reduce structural requirements for capsule construction by allowing a pressure decrease below one atmosphere, and would eliminate the need for continuous monitoring of the atmospheric gas mixture. A carbon dioxide-rich atmosphere would place lesser demands on physical or chemical scrubbers or regeneration systems and would improve the efficiency of a biotic carbon dioxide-oxygen converter. A brief review of experiments conducted in these fields suggests that short-term exposures to low nitrogen and high carbon dioxide atmospheres are easily tolerated, but that research is required on mice, primates, and man, to determine the effects of long-term exposures on the genetic heritage, reproductive ability, and growth and development processes of man.

12781
Bates, M. E.,
and J. H. Bates 1960
BLOOD VOLUME IN RATS EXPOSED TO POTENTIAL SPACE CABIN ATMOSPHERES: HEMATOLOGIC RESPONSES TO PURE OXYGEN ATMOSPHERES AT 190 MM. Hg TOTAL PRESSURE.— School of Aviation Medicine, Brooks Air Force Base, Tex. Report no. 60-64, July 1960. 13 p.

The hypothesis was proposed that exposure to reduced barometric pressures, if accompanied by an increased supply of oxygen, would result in no significant physiologic changes. Three experiments were conducted in which three groups of rats were exposed to an experimental space cabin atmosphere of pure oxygen at 190 mm. Hg total pressure for 7, 5, and 4 days, respectively. In phase I, animals showed no significant visible effects from exposure. No change occurred in the hematologic values determined. In phase II, no statistically significant change occurred in blood volume, hematocrit, and hemoglobin values. In phase III, no change occurred in blood volume, hematocrit, hemoglobin, erythrocyte, leukocyte, and leukocyte differential values. The nonsignificant physiologic changes and the animals' apparent tolerance of the experimental atmosphere suggest that the proposed hypothesis is feasible. (Authors' abstract)

12782
Berner, R. 1960
AERO-SPACE INDUSTRY OPENS NEW HORIZONS FOR AIR CONDITIONING DESIGN. — Heating Piping and Air Conditioning, 32 (8): 128-131. Aug. 1960.

A discussion is presented of the unique problems and concepts involved in the air conditioning of aircraft and missiles. The determination of temperature and humidity values and ventilation requirements as a basis for the design of aircraft air conditioning systems is complicated by the wide variation of exposures introduced by the mobility of aircraft, the heating effect of forward motion, the increased cooling and drying of aircraft caused by reduced air pressure, the proximity of passengers to the cold walls of the aircraft, and the biological oxygen and pressurization requirements at altitude. For the computation of heating or cooling loads it is necessary to consider the fin effect resulting from the metallic frame and skin construction of aircraft, the wide variations encountered in external air temperature, the effect of solar heating, the problem of outside air infiltration or leakage of pressurized cabins, the heat load produced by defrosting systems, and the necessity for the rapid removal of stored heat from parked aircraft.

12783
Billingham, J.,
and D. M. Kerslake 1960
SPECIFICATION FOR THERMAL COMFORT IN AIRCRAFT CABINS PROPOSED AS A BASIS FOR AN OFFICIAL SPECIFICATION. — RAF Inst. of Aviation Med. (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 133, June 1960. [24] p.

New specifications are proposed to replace thermally inadequate existing requirements for cabin conditioning and air-ventilated suit air-supply requirements in the newer types of high performance aircraft. Although further experiments are needed to verify the theory, the proposals are offered at this time because they are more precise in predicting the requirements for thermal comfort in aircraft. The existing specifications could render aircraft cabins dangerously hot if applied unmodified to some future high-performance military aircraft. Any modifications subsequent to experimental examination of the theory are expected to be small and should not affect the procedure for calculating conditioning requirements.

12784
Bogatkov, P. I.,
IU. G. Hefedov, and M. I. Poletaev 1961
[EXHALED AIR AS A SOURCE OF CARBON MONOXIDE CONTAMINATION OF THE AIR OF PRESSURIZED ROOMS] Vydykhaemyi vozdukh kak istochnik zagriazneniia okis'iu ugleroda vozdushnoi sredy germetichnykh pomeshchenii. — Voenno-meditsinskii zhurnal (Moskva), 1961 (2): 37-39. Feb. 1961. In Russian.

English translation in: Military Medical Journal, 1961 (2): 55-58. Washington: U. S. Joint Pub. Research Serv. No. 1374-N/39, May 19, 1961. (Available from Office of Technical Services, U. S. Dept. Commerce).

The accumulation of carbon monoxide in hermetically sealed rooms from endogenous sources, such as cutaneous and pulmonary respiration, was investigated in a number of experiments. Three healthy subjects were enclosed in a hermetically sealed cabin of 24 $m.^3$ during a daily routine of physical and mental work. The chamber air temperature and the length of stay were varied. Exogenous sources of CO (burning of organic substances, smoking, etc.) were excluded, and the air regeneration system employed a peroxide compound. The concentration of CO gradually increased with the length of stay, until on the 9th-10th day it reached 0.023-0.027 mg./liter. Changes in temperature did not affect CO concentrations. CO content in the air exhaled by smokers was twice that of nonsmokers. These findings should be considered if people are to stay in hermetically sealed rooms for long periods of time.

12785
Campbell, H. E. 1960
THE CASE FOR REAR FACING SEATS IN COM-

MERCIAL AIRCRAFT. — Clinical Med., 7 (12): 2529-2537. Dec. 1960.

In the experience of the Royal Air Force and the United States Military Air Transport Service, rear-facing seats in aircraft provide a greater area of contact and therefore a greater reduction of impact force per square inch in crashes than do forward facing seats. The incidence of serious injuries and deaths was reduced by 75 per cent or more after the installation of these seats in military planes. Only three per cent of 10,000 military passengers surveyed objected to rear-facing seats. It is suggested that the seats be required equipment in commercial aircraft. (Quoted in part).

12786
Christman, H. H. 1959
ENVIRONMENTAL CONTROL KEY TO SUCCESS OF THE MANNED EARTH SATELITE.—Heating, Piping and Air Conditioning, 31 (10): 151-166. Oct. 1959.

Space vehicle design factors that must be considered in providing a space crew with an acceptable environment are discussed. Important ones include oxygen supply and pressurization, evaluation of the heating and air conditioning loads, and reduction of cosmic radiation. In addition to discussing each of these variables, some system design concepts for controlling each are given. Schematic drawings and graphs depict algae-bacteria-plant-animal regenerative cycles, photo-synthetic gas exchangers for converting respired CO_2 to O_2, the conditions of importance (hypoxia, initial dysbarism, emergency dysbarism, and fire hazard) in selecting total cabin pressure and oxygen partial pressure, temperature molecular velocitites which control radiation exchanges at high altitudes, the components of vehicular energy balance, and intermittent absorption cooler for air conditioning a satellite, and a comparison of the radiation absorptive powers of an organic liquid (in an annular fuel tank) and aluminum as shielding materials against cosmic particles.

12787
Chun, V. 1960
AIR CONDITIONING AND PRESSURIZATION FOR MODERN COMMERCIAL AIRCRAFT. — Heating Piping and Air Conditioning, 32 (12): 129-132. Dec. 1960.

A discussion is given of the air cycle and vapor cycle systems of the air conditioning, comfort conditioning, and pressurization systems used in DC-7C and DC-8 aircraft. The advantages of the air cycle method used in the DC-7C are the light weight of the equipment and its adaptability to use for cabin pressurization without the need for major equipment additions. The vapor cycle method used in the DC-8 is more efficient from a thermodynamic standpoint, requires less power to operate, and is also capable of providing dehumidification. Thermal research is being directed to the solution of structural heating problems posed by the arrival of higher, faster flying jet liners.

12788
Clamann, H. G. 1958
PROBLEMS OF RESPIRATORY METABOLISM IN SEALED CABINS.—In: High altitude and satellite rockets: a symposium held at Cranfield, England, 18th-20th July 1957, p. 102-106. London: Royal Aeronautical Society, etc., 1958.

Also republished in 1959, with indentical pagination, by Philosophical Library, N. Y.

Above 80,000 feet flying altitude, a completely sealed cabin is mandatory. By metabolic oxidation, the amount of free water increases in a sealed cabin during a space trip. Regeneration and recirculation processes must be developed in order to maintain the storage space on oxygen, carbon dioxide, and water absorbers at a minimum. Algae, used as gas exchangers, are promising for use on long trips. (Author's conclusions, modified)

12789
Clemedson, C. -J. 1959
TOXICOLOGICAL ASPECTS OF THE SEALED CABIN ATMOSPHERE OF SPACE VEHICLES.—Astronautik (Stockholm), 1 (4): 133-158. 1959. In English.

A review is given of the main sources of irritating and toxic substances in a space cabin, including expiratory gases, volatile skin perspiration and urinary and fecal products, bowel gases, air contaminants originating from smoking and cooking and from paints, cosmetics, etc. The hazards of fire in electrical and electronic equipment and from propellants, exhaust gases and smoke, pyrolysis products of lubricants and plastics, hydraulic fluids, fire extinguishants, refrigerants and anti-freezing agents are also dealt with. Various methods of removing such substances, e.g. through freezing, burning, absorption in charcoal or chemical filters, or by molecular sieves are discussed. (From the author's abstract)

12790
Cornog, R. A. 1958
TEMPERATURE EQUILIBRIA IN SPACE VEHICLES.—Jour. Astronautical Sci., 5 (3-4): 64-67. Autumn-Winter 1958.

The equilibrium temperature reached within a space vehicle moving within the solar system is discussed. The effects of vehicle configuration, vehicle attitude, surface properties, and internal heat release are evaluated. Particular attention is given to methods of vehicle design whereby the range of equilibrium temperatures can be set at some desired value. (Author's abstract)

12791
David, H. M. 1961
AIRMEN LIVE 17 DAYS ON PURE OXYGEN. — Missiles and Rockets, 9 (4): 27, 44. July 24, 1961.

Two Air Force captains who breathed 100% oxygen for 17 days at 1/3 sea-level atmospheric pressure experienced no permanent adverse effects. Both men reported very minor "bends". Physical examinations revealed some irritation of the lungs and breathing passages and weight losses of 6 lb. by one subject and 3 lb. by the other. The 17-day period was chosen because it is the estimated length of time for a circumlunar mission using minimum energy. The two men also tested a water recycling device.

12792
Dickey, F. L., and G. H. Knipp 1959
SEALED CABIN RELIABILITY AS RELATED TO STRUCTURE AND INTERNAL ATMOSPHERE.—ARS Jour., 29 (9): 656-661. Sept. 1959.

Consideration is given to the advantages to the crew of an optimum internal atmosphere and pressure, and the effects on a sealed cabin structure. The reliability of the cabin and its resistance to fast fracture are discussed and shown to be essentially constant for various internal pressures with proper design. Certain safety advantages of a cabin designed for high pressure are pointed out, for example, a greater resistance to meteoroid penetration and a longer decompression time should a penetration occur. Means of decreasing the time of decompression to permit effective emergency action are discussed, and the need for complete reliability of the sealed cabin system is emphasized. (Authors' abstract)

12793
Ebersole, J. H. 1959
OCCUPATIONAL HEALTH PROBLEMS IN SPACE FLIGHT AS EXPERIENCED WITH NUCLEAR POWER PLANTS.—Military Med., 124 (10): 711-716. Oct. 1959.

Certain basic similarities between the nuclear submarine and the space ship are discussed, emphasizing their particularly close relationship through a common "sealed cabin" situation. Definite dissimilarities are also noted. Atmospheric contaminant problems in the submerged submarine are discussed, including carbon dioxide, carbon monoxide, Freon, amine hydrocarbons, benzene, aerosols, and ozone. Nuclear radiation is presented as less of a problem than the nonnuclear contaminants and metabolites listed above. The "sealed cabin" situation in either inner or outer space may be considered as a special case in occupational medicine. (Author's abstract)

12794
Ernsting, J., G. J. R. McHardy, and H. L. Roxburgh 1960
THE CHOICE OF GAS MIXTURE FOR BREATHING IN HIGH PERFORMANCE AIRCRAFT.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Report no. 1142, Oct. 1960. 12 p.
Also published in: Escape and survival, p. 94-103. Edited by P. Bergeret. New York, etc.: Pergamon Press, 1961.

The ideal pressure environment of the lung alveoli is examined with respect to cabin pressure and the gas breathed, and methods are discussed of ensuring the efficiency of the human operator, particularly after failure of pressure cabins. An ideal cabin pressure should prevent oxygen lack, decompression sickness, and barotrauma. At the time of loss of pressure, the factors to be considered are especially the immediate risk from the pressure change, the probability of acute anoxia, and the hazards of decompression sickness. The ideal gas lies between 100% oxygen and an enriched air-mix. Breathing oxygen before decompression protects against anoxia and performance decrement. Graphs are given for alveolar tensions of oxygen and carbon dioxide at varying times after decompression from 8000 to 38,000 feet in 1 to 5 seconds, the time course of washing-out of nitrogen, its relation to the electroencephalogram, inspired oxygen concentration required at various cabin altitudes to give alveolar oxygen tensions of 20, 30, and 40 mm. Hg after decompression to 40,000 feet, and the latter contrasted with air-mix.

12795
Foster, J. F., and J. S. McNulty 1961
STUDY OF A CARBON DIOXIDE REDUCTION SYSTEM. — Battle Memorial Inst., Columbus, Ohio (Contract AF 33(616)-6332); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). ASD Technical Report no. 61-388, Aug. 1961. xi+104 p.

An engineering model of a system for reducing CO_2 at a rate of 500 cc./min. by reaction with hydrogen over heated catalysts was developed. The primary products of the reaction were solid carbon and water vapor. To recover breathable oxygen, condensed water vapor would be fed to an electrolysis cell; the hydrogen by-product of the electrolysis would then be used to reduce more CO_2. Solid carbon is removed periodically from the apparatus and discarded. In the final test, the apparatus was operated continuously for a period of 11 hours at about 10% above the target conversion rate. It is estimated that the carbon deposits could be accumulated for at least 2 days in the present reactor before interrupting the process for removal of carbon and renewal of catalyst. With appropriate maintenance procedures the apparatus should operate for the specified maximum of 3 years without difficulty. (Authors' abstract)

12796
Gaito, J. 1959
HUMAN ENGINEERING INVESTIGATIONS OF AIRCRAFT COCKPIT VISUAL DISPLAYS. XX. THE RELATIONSHIP BETWEEN PHYSICAL AND APPARENT BRIGHTNESS FOR THREE DEGREES OF INSTRUMENT BACKGROUND HETEROGENEITY.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AE-7047). Report no. NAMC-ACEL-388, March 16, 1959. iv+9 p. AD 214 233

On account of complaints of pilots about the uneven illumination of cockpit instrument panels, three experiments using the method of average error were conducted to investigate the relationship between physical and apparent brightness as a function of degree of background heterogeneity. Even though there was some tendency for corner instruments in a 3 x 3 array to be set at a lower brightness level, and intermediate instruments to be set at a higher level, than the center one, the effect was of such small magnitude as to be of no practical significance. (ASTIA abstract)

12797
Green, C. D. 1959
BIO-PAKS: INSTRUMENTATION AND BIOMEDICAL RESEARCH. IV. CANISTER USING LiOH FOR H_2O AND CO_2 ABSORPTION.—In: Bioastronautics—advances in research, p. 53-57. School of Aviation Medicine, Randolph Air Force Base, Tex. [Unnumbered] Report, March 1959. AD 226 473

A new design for a canister of the carbon dioxide and water vapor absorber, lithium hydroxide, is presented, which can provide an absorbent capability of at least 24 hours for two men.

12798
Green, F. H. 1958
CO_2 DISPOSAL, LEAKPROOFING, ZERO GRAVITY: PROBLEMS FOR SPACECRAFT AIR

CONDITIONING.—Aviation Age, 29 (5): 174-179. May 1958.

Under space-flight conditions, and in the absence of gravity, the CO_2 exhaled by man would not be "heavier" than O_2, thus creating an immediate hazard. Therefore, a positive means of circulation is needed throughout the ship. The airconditioning equipment will be different from that used in current aircraft in that the gas in the cabin will be recirculated and heat disposal will be by radiation rather than convection. This favors Freon or any other vapor-cycle cooling equipment. The removal of moisture from the air produced by human exhalation is asserted to present one of the major airconditioning problems. If the cooling equipment is operated at a sufficiently low surface temperature, atmospheric moisture could be condensed and removed from the surface of the cooling coils. Possibly, even th CO_2 might be removed by surface condensation and reused later. Pressure control might be maintained by repressurizing or re-storing the air. As yet no satisfactory detecting device has been developed which would warn against the threat of airconditioning system failure; and no swift means for the pilot to protect himself and to locate and plug quickly a leak in the space ship has been worked out yet.

12799
Hertzberg, H. T. E. 1961
NYLON NET SEAT FOR A MODIFIED RB-57 AIRCRAFT.—Aeronautical Systems Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 71749). ASD Technical Report no. 61-206, Dec. 1961. iii+5 p.

A light-weight, adjustable easily demountable net seat for persons who must operate in cramped quarters is described. Tests lasting for more than a year in a modified RB-57 have shown the seat to be fully satisfactory. Design drawings and photographs of the method of installation are included. (Author's abstract)

12800
Hoffman, D. H. 1961
TRI-AXIAL AIRLINE SEAT LIMITS ACCELERATION. —Aviation Week and Space Technol., 75 (4): 95, 99-100. July 24, 1961.

Design ideas are presented for an aircraft passenger seat which should reduce crash fatalities. The rear-facing seat has top and bottom suspension points and would distribute and reduce the g forces encountered in a typical crash so that they are well within the limits of human tolerance. The seat would protect the passenger against accelerations in the vertical, longitudinal, and lateral directions; however, greatest protection would be afforded in the longitudinal direction, where the highest g component exists.

12801
Hoover, G. W. 1959
MAN-MACHINE INTEGRATION IN SPACE VEHICLES.—Aero-Space Eng., 18 (2): 54-58. Feb. 1959.

The psycho-physiological problems associated with spaceship design are discussed. It is suggested that a ship be built to fit the man, one with an environment providing the operator with the proper display of required information so completely integrated that he can perform as a link in the system which will not have redundancy except where it is an asset. Moreover, the ship should require an absolute minimum of maintenance, permit in-flight repair, and be a total man-machine system which will permit complete survival under any emergency. Consideration is given to the physical parameters involved in spaceship design (pressurization, ventilation temperature, noise, radiation, vibration, etc.) and to the metabolic requirements (food, water, waste disposal, and the work/rest cycle). The establishment and maintenance of minimum emotional stress, maximum morale, sufficient relaxation, and adequate habitability are also discussed.

12802
Hsu, J. P., 1960
and A. B. Schwartz
PHYSICO-CHEMICAL METHODS FOR REMOVING AND RECOVERING CARBON DIOXIDE AND WATER VAPOR FROM EXHALED GASES FOR SUBSEQUENT RECLAMATION OF OXYGEN FROM CARBON DIOXIDE.—In: Closed circuit respiratory systems symposium, p. 61-93. Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). WADD Technical Report no. 60-574, Aug. 1960.

Several possible physico-chemical methods are described for removing and recovering carbon dioxide and water vapor from the cabin atmosphere for subsequent reclamation of oxygen from carbon dioxide. Methods of removing and recovering water vapor include (a) condensation by cooling or compression and cooling, and (b) adsorption followed by regeneration. Possible methods of removing and recovering carbon dioxide include (1) chemisorption by solution of alkanolamines followed by regeneration, (2) chemisorption by solution of alkali carbonates followed by regeneration, (3) absorption by water followed by regeneration, (4) condensation by compression and cooling, (5) adsorption followed by regeneration, (6) reaction with metallic oxide followed by regeneration, (7) photosynthesis by green plants, and (8) artificial photochemical reaction. Each method is evaluated; advantages and disadvantages are discussed, and four over-all processes based on combinations of these methods are set forth. It is concluded that, within the present scope of technical knowledge, absorption is probably the most feasible and practical process to remove and recover carbon dioxide from the space cabin air.

12803
Jackson, C. B., 1960
G. R. Roush, and R. M. Bovard
ATMOSPHERE CONTROL.—Aero Space Eng., 19 (5): 40-41, 94, 96. May 1960.

Some of the approaches to the maintenance of a proper atmosphere in manned space stations are described. Consideration is given to nonregenerative systems, to regenerative systems, and to contamination removal methods. Some nonregenerative atmospheric control systems utilize high-pressure oxygen in a closed-cycle system with lithium hydroxide to remove CO_2 and charcoal to remove contaminants. Others employ concentrated hydrogen peroxide to furnish both oxygen for breathing and water for drinking. Superoxides of potassium and sodium are also employed in self-contained nonregenerative systems which supply oxygen and remove carbon dioxide, odors, and bacteria along with certain quantities of water. Oxygen candles consisting essentially

of sodium chlorate and oxidizable substances, usually iron, produce O_2 by the thermal decomposition of chlorate induced by the heat generated by the oxidation of iron with some oxygen. Regenerative systems of atmospheric control include utilization of photosynthetic gas exchangers as well as certain chemical methods of regenerating metabolic by-products. Recent investigations based on the adsorption of CO_2 in a molten mixture of lithium carbonate, lithium monoxide, and lithium chloride, followed by the electrolysis of the melt, have produced 100% O_2 at the cathode and 33 1/3% O_2 and 66 2/3% CO_2 at the anode. Contaminants arising from the occupants, machinery, and instrumentation have been cleaned from the atmospheres of submarines by catalytic oxidation of the contaminants.

12804

Keating, D. A., and R. W. Roundy 1961

CLOSED ECOLOGY. —— Wright Air Development Division. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373; Task no. 63120). WADD Technical Report no. 61-129, March 1961. iii+11 p.

The fundamental concepts of closed ecology as well as the design requirements for three degrees of closure in closed ecological systems are discussed. The degree of ecological system closure is dependent upon reliability, weight, bulk, energy input, and mission duration. The design of closed ecological systems is dependent upon future research, and design philosophy has been presented in place of actual design. (Authors' abstract, modified)

12805

Keating, D. A. 1959

DESIGN PARAMETERS FOR THE ENGINEERING OF CLOSED RESPIRATORY SYSTEMS.—Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio. WADC Technical Report no. 59-766, Dec. 1959. iii+15 p.

This paper contains a compilation of respiratory, environmental, toxicological, and radiobiological data considered to be pertinent physiological knowledge for designers of such closed respiratory systems as are used in high-altitude or space vehicles. Tables show variations of barometric pressure and partial pressure of oxygen at various altitudes; the amounts of O_2, CO_2, N_2, and water vapor in inspired air (atmospheric) as compared with the amounts of alveolar air; the maximum tolerable concentrations (in parts of substance per million parts of ambient atmospheric air) of various toxic gases and vapors; the approximate comfort conditions (dry bulb-wet bulb temperatures and per cent relative humidity) of a clothed person in a "still air" environment; and permissible levels of radiation dosage for the whole body and critical organs, for the skin of the whole body, and for hands, forearms, feet, and ankles.

12806

Kinsey, J. L. 1960

SOME TOXICOLOGICAL HAZARDS IN SUBMARINES. --- Federation Proceedings, 19 (3, Part II): 36-39. Sept. 1960.

Specific toxicological problems in the sealed-cabin environment of nuclear-powered submarines [similar to the environment anticipated for space vehicles] arise from intolerable accumulations of carbon dioxide, carbon monoxide, hydrocarbons, aerosols, and positive air ions. The major sources of these contaminants and the methods currently employed to control them (CO_2 scrubbers, CO and hydrogen burners, preventive elimination and substitution of volatile and hydrocarbon-containing materials, electrostatic precipitators, inert and activated charcoal filters, and air conditioning) are briefly discussed. Some of the control methods themselves have introduced new toxicological problems. For instance, phosphate-ester hydraulic fluids and lubricating oils are used to avoid the explosive hazard of ordinary paraffin-based oils, thus necessitating the development of methods for monitoring organic phosphates. The working principles of the Mark III submarine atmosphere analyzer are summarily described and brief mention is made of the military and civilian organizations concerned with the future efforts to identify and control the toxicological hazards in submarines and other sealed-cabin situations.

12807

Konecci, E. B. 1959

HAZARDS OF SEALED CABINS.—Astronautics, 4 (2): 40-41, 48-51. Feb. 1959.

Sealed cabin systems in space flight are exposed to certain physical conditions which may affect the physiological and psychological well-being of their occupants. The more obvious hazards are high acceleration at the launching and during ascent; weightlessness accompanied by circulatory, nervous, and digestive disturbances during orbital flight; temperature and humidity changes within the cabin, which may exceed the limits of human tolerance, and on the outer surface, which may affect the surface coating of the capsule and further disrupt the thermal balance; radiation storms such as those encountered by the Explorer satellites; and collisions with meteoroids or leaks through structures and seals, which might result in decompression. To remain alive in space, man will require an artificial environment defined by his physiology, and he must rely upon the spaceship, especially the complex sealed-cabin system, to fulfill and maintain this requirement. Environmental control is necessary, particularly with regard to carbon dioxide, carbon monoxide from smoking, overheating of equipment and fires, ammonia from urine, methane and hydrogen from flatus, evaporation of sweat and glandular excretions of the skin, and indole, skatole, H_2S, phenol, and various amines from the feces. This may necessitate the conservation of materials by conversion and recycling.

12808

Kopplin, J. O., J. R. Eaton, and J. E. Christian 1959

STUDIES ON THE ADSORPTION OF ODOROUS MATERIALS. I. SURFACE POTENTIAL CHANGES OF SOLID AND LIQUID ADSORBING SURFACES.—Jour. Amer. Pharmaceut. Assoc., 48 (8): 427-430. Aug. 1959.

The measurement and classification of odors have been greatly handicapped by the lack of an objective instrument for the measurement of odor. This paper describes experiments in which the detection of odorous material in low concentrations in an air stream was made by measuring the change in surface potential of an adsorbing surface in contact with the air stream. Various solid and liquid surfaces were used, including water. The effect of the presence of water vapor in the air stream on the changes

in the surface potential of various substances was studied, as well as the effect of increasing the temperature of the adsorbing surface. These tests indicate the possible use of surface phenomena for the detection of odorous material in the atmosphere. (Authors' abstract)

12809
Lawrence, J. S., 1960
H. A. Miller, and J. M.
CLOSED CIRCUIT RESPIRATION/VENTILATION SYSTEM: PHASE 1.—Air Reduction Company, Inc., Central Research Lab., Murray Hill, N. J. (Contract no. AF 33(616)-3856); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6333, Task no. 63612). WADD Technical Report no. 60-33, Jan. 1960. vii+104 p.

A literature survey was conducted to determine the physiological requirements of a man supported in an artificial atmosphere. Concurrently, a study was made of the environmental considerations which, combined with the physiological requirements, defined the desired characteristics of a closed-circuit respiration/ventilation system. A closed-circuit respiration/ventilation system was designed to support a man on a hypothetical twelve-hour mission. The design, fabrication, and testing of each component are treated separately and limited results of tests of the assembled system are included. A title listing of 61 references is given in the accompanying bibliography. (Authors' abstract, modified)

12810
McConnaughey, W. E. 1960
ATMOSPHERE CONTROL ON SUBMARINE.—Bureau of Ships Jour., 9 (5): 11-14. May 1960.

Atmospheric control equipment developed for use in submarines is reviewed from the standpoint of efficiency, power, weight, volume, reliability, and simplicity. The advantages of nonregenerative and regenerative control systems are illustrated by a comparison of the LiOH system and the monoethylamine scrubber for CO_2 removal. Removal of hydrogen, CO, and other gaseous contaminants from the atmosphere is affected by catalytic combustion units employing hopcalite (a mixture of copper and manganese oxides), carbon filters, and partially by the air-conditioning cooling coils. An electrostatic precipitator serves to remove smoke and aerosols. The major limitation of the above atmosphere control facilities is inherent in the O_2 supply system. A number of different processes of oxygen supply are discussed, including the chlorate candle, the sulfate cycle, and the photosynthetic gas exchanger.

12811
McFadden, E. B., 1958
and J. J. Swearingen
FORCES THAT MAY BE EXERTED BY MAN IN THE OPERATION OF AIRCRAFT DOOR HANDLES.—Human Factors, 1 (1): 16-22. Sept. 1958.

Six handle configurations were tested by 8 male subjects on a test arrangement simulating an aircraft door. The torques exerted by the subjects were measured in angular increments of 45°. Over 1200 static and dynamic tests were made. A limited check study of 10 females, totaling 120 measurements, was also made. The shape, length, direction of movement, arc of motion, effects of one-handed operation, maximum torques, and differences between sexes are discussed. (Authors' abstract)

12812
Miles, M. 1961
EXTENDING THE FRONTIERS OF ENVIRONMENTAL SYSTEMS. — New Frontiers (Garrett Corp., Los Angeles, Cal.), 9 (1): 2-11. Spring 1961.

A review is presented of the part played by the Garrett Corporation in the development of pressurized systems. A plan is given for the future development of multi-manned orbital space craft having an environmental system with its own physiological monitoring system, a breathing and pressurization system, and a water purification apparatus.

12813
Miller, J. H., 1960
E. B. Konecci, and N. E. Wood
AN APPROACH TO TEMPERATURE AND HUMIDITY CONTROL IN SPACE CABINS.—In: Closed Circuit Respiratory Systems Symposium, p. 333-342. Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). WADD Technical Report no. 60-574, Aug. 1960.

An approach to the problem of space-vehicle temperature and humidity control is presented, which is independent of orientation or position of the vehicle. Cabin air is drawn in through a screen, a self-charging electrostatic dust filter, and a bed of activated charcoal by an axial flow blower and then ducted to the radiating panel. The ducting on the radiating surface can have many different configurations and be made of many different materials. The system requires no external moving parts, and except for blower power requires no electricity or other external power or complicated control devices, and possesses high flexibility and reliability with minimum weight.

12814
Miller, R. R., 1960
and V. R. Piatt
THE PRESENT STATUS OF CHEMICAL RESEARCH IN ATMOSPHERE PURIFICATION AND CONTROL ON NUCLEAR-POWERED SUBMARINES. — Naval Research Lab., Washington, D. C. NRL Report no. 5465, April 21, 1960. iv+167 p.
PB 161518

The problem of the analysis and purification of submarine atmospheres is reviewed in a collection of reports by chemists of the Naval Research Laboratory. [Some of the procedures are applicable also to space cabin atmospheres.] Discussions are presented of the problems, recommended solutions, and status of research at the Laboratory in the fields of atmospheric sampling and analysis, removal of carbon monoxide, hydrogen, carbon dioxide, and organic contaminants, oxygen sources, dual systems for carbon dioxide removal and oxygen generation, and aerosols and ions.

12815
Moen, W. B., 1959
and P. Webb
A CLOSED-CYCLE BREATHING/VENTILATION SYSTEM.—Astronautics, 4 (2): 36-37, 102. Feb. 1959.

A working version of a self-contained, closed-cycle breathing/ventilation system for controlling the atmosphere of space cabins is described. Experimentally, the system was designed to fulfill the physiological and environmental requirements of a 12-hr. mission simulated in an environmental test chamber, and it establishes an oxygen supply for the support of metabolic processes, removes the products of metabolism (carbon dioxide, water, heat, odors, and toxic gases), and maintains a satisfactory ambient pressure. This system differs from earlier closed breathing systems, such as those used in balloon gondolas and underwater breathing devices, in that the two major functions of ventilation and respiration are served by the same confined gas stream. The combination single-stage pressure regulator, filling valve, and shut-off valve for delivering oxygen to the system pressure controller, the carbon-dioxide-removal equipment, and the small positive-displacement circulating blower are all packaged into a box measuring 7 x 22 x 28 in. and weighing 80 lb. when fully charged. The system is independent of the vehicle in all respects except one — the electric power needed to drive the pump. This type of closed, nonregenerating system appears to be well-suited for relatively short missions lasting from 12 to 48 hr. Flights of much longer duration will require equipment in which weight does not increase with time.

12816
Noble, H., 1961
and L. P. Domzalski
EVALUATION OF HUMAN SUBJECT REACTION IN THE FORWARD AND AFT FACING SEATED POSITIONS. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-424, Feb. 9, 1961. vi+7 p.

Tests were conducted on the linear accelerator using two male volunteers and anthropomorphic dummies representing the same percentile classes as the human subjects. Measurements of seat loading during acceleration were obtained, and acceleration and displacement of the accelerator sled, seats, and subjects were recorded on both the oscillograph and high speed motion picture films. Test studies revealed that the forward-facing occupant was not sufficiently restrained in the seat and his upper torso suffered ill effects during the acceleration stroke. The aft-facing occupant was capable of withstanding greater accelerations, but the structural integrity of this seat under a particular load was not superior to its counterpart. Specific recommendations are given for structural modifications in both seats for use in military passenger aircraft.

12817
Pierce, B. F. 1960
A TECHNIQUE FOR DETERMINING AND REPRESENTING THE MOBILITY ENVELOPE OF A SUPINE OPERATOR. — Perceptual and Motor Skills, 11 (2): 215-219. Oct. 1960.

The reach limitations of a supine operator were explored under simulated space flight conditions. The study employed a single subject with a functional reach of 29.6 in., clad in a light-weight, full-pressure, high-altitude suit. The suit was not inflated. The subject was harnessed in a semi-supine position to a specially constructed chair. Each reach point of the right arm was measured three-dimensionally from the side wall, the wall behind his head, and the floor. The data were then converted giving the location of each point along the mobility envelope (the space encompassed by the limits to which an individual can extend his arms and grasp objects in his hand) as a quantified distance from the Seat Reference Point (the point where the middle lines of the seat and the backrest intersect) in the vertical, lateral and longitudinal directions. A method of graphic representation of the mobility envelope was developed for a far more meaningful presentation of the data.

12818
Potts, P., 1960
and J. I. Bowring
EXERCISE IN A WEIGHTLESS ENVIRONMENT. — Physical Therapy Rev., 40 (8): 584-587. Aug. 1960.

A chair was designed to provide restraint for working, exercising, and eating in a weightless environment. The chair is constructed of adjustable nylon rochel mesh and is equipped with mesh supports for the chest, arms, and femurs. Opportunity for exercise is provided by reels attached to the arms and arm rests which can be adjusted to exert a desired amount of resistance, and by a spring attachment on the foot board.

12819
Ross, M. D. 1959
REACTIONS OF A BALLOON CREW IN A CONTROLLED ENVIRONMENT.—Jour. Aviation Med., 30 (5): 326-333. May 1959.

A subjective report is presented of observations made during two simulated and two actual high-altitude sealed balloon flights which are pertinent to the area of human factors for future altitude flights. System deficiencies should be further investigated, such as the effects of cold on the carbon dioxide analyzer, circulating fans, and mercury batteries. Storage provision should be made to eliminate litter. The individuals should be comfortable and not constrained by clothing and emergency equipment. Psychologically, there should be a definite reason or purpose for the crew, and the break-off phenomenon should be better understood.

12820
Ruderman, W., 1960
and L. Carr
REGENERATION OF OXYGEN FROM CARBON DIOXIDE IN CLOSED ECOLOGICAL SYSTEMS.— In: Closed Circuit Respiratory Systems Symposium, p. 157-177. Wright Air Development Division. Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 6373, Task no. 63120). WADD Technical Report no. 60-574, Aug. 1960.

Two reduction cycles are described for regenerating oxygen from carbon dioxide in closed ecological systems. One, the Methoxy system, comprises the reduction of carbon dioxide with hydrogen to methane and water, and the subsequent decomposition of the methane to carbon and hydrogen. This hydrogen, along with the hydrogen from the electrolysis of the water, is recirculated to convert more carbon dioxide. A closed system results in which carbon dioxide is converted to carbon and oxygen. The other, the Electrocarb system, involves the decomposition of carbon dioxide at the cathode in an electrolytic cell containing a mixture of fused carbonates. The complete system results in the conversion of carbon dioxide to carbon and oxygen only.

12821
Scano, A. 1958
[STAGNANT CABIN AIR PURIFICATION: CHEMICAL AND PHYSICAL ELIMINATION OF CARBON DIOXIDE AND OTHER SUBSTANCES PRODUCED BY MAN] La depurazione dell'aria nelle cabine stagne: sull'eliminazione chimica e fisica dell'anidride carbonica e di altre sostanze prodotte dall'uomo.—Rivista di medicina aeronautica (Roma), 21 (4): 705-714. Oct.-Dec. 1958. In Italian, with English summary (p. 712).

Also published in: Minerva medica (Torino), 50 (31): 1138-1141. April 18, 1959.

In order to find the most satisfactory absorbents of respiratory CO_2, breathing tests were carried out with various absorbents, and results tabulated. The following chemicals were found satisfactory (in order of rates of absorption): sodium hydroxide, lithium hydroxide, mono-ethanolamine in combination with aluminum-calcium silicate, and soda lime. In closed interior spaces such as airplane cabins, however, carbon dioxide is only one of many volatile substances of human elimination. Others, such as capronic, caprylic, valerianic, butyric, acetic, lactic, and formic acids, acrolein, skatole, indole, methane, hydrogen sulfide, etc., are contained in minimal quantities in exudations of the skin, in the breath, and in flatus. A method is proposed to eliminate these substances from the cabin atmosphere by employing a process of adiabatic expansion and subsequent cooling and condensation of all gases but O_2 and N_2. Practical difficulties are foreseen, however, as this process would require costly energies to produce the adiabatic expansion, a powerful filtering system, and low-temperature-resistant materials. On the other hand, it would offer a number of advantages: purification could be easily regulated according to demand, and water could be re-extracted.

12822
Schaefer, K. E. 1959
EXPERIENCES WITH SUBMARINE ATMOSPHERES. —Jour. Aviation Med., 30 (5): 350-359. May 1959.

Medical problems experienced during prolonged periods in submarines are reviewed. They include a reversal of the normal diurnal cycle of blood pressure and exposures to increased CO_2 and lowered O_2. Emphasis is placed on chronic CO_2 toxicity, which has been in the past the cardinal problem within submarines. During continuous and intermittent exposure to CO_2, pulse rate is lowered, blood alkali reserve is increased and the chronaxia prolonged. The subjective depression caused by increased CO_2 level can be reversed only by prolonged breathing of fresh air. Thermal exchange in a normal apartment and a submarine are compared. The role of trace substances and ionization patterns of the atmosphere in confined spaces is discussed. (Author's summary, modified)

12823
Schaefer, K. E. 1959
SELECTING A SPACE CABIN ATMOSPHERE.—Astronautics, 4 (2): 28-29, 104, 106. Feb. 1959.

Some of the parameters of environmental control in the space cabin are discussed, with emphasis on the carbon dioxide problem, the levels of oxygen and nitrogen, the role of trace substances in the atmosphere, and the effects of normal diurnal changes upon the endogenous physiological cycles of man. Laboratory tests, in which subjects spent 3-6 days in a sealed cabin breathing an atmosphere of 3% CO_2 and 21% O_2, revealed that the subjects developed a definite decrease in their sensitivity to CO_2, as indicated in their respiratory minute volume and alveolar carbon dioxide tension. 3% CO_2 produced a biphasic reaction—that is, a period of excitation followed by depression (corresponding to a period of uncompensated respiratory acidosis, followed by compensated acidosis during which an increase of the alkali reserve occurs owing to retention of alkali by the kidneys). Oxygen toxicity was observed in a sealed cabin after seven days at the equivalent of 10,000 ft. altitude with an O_2 partial pressure of 418 mm. Hg (corresponding to 55% O_2 at sea level). A decline in vital capacity was experienced by two subjects. Substernal distress was reported by all subjects from the second day on. Measurements were made of the breathholding time of subjects breathing pure oxygen and oxygen-nitrogen mixtures under increased pressure. With equal alveolar oxygen tensions at the breathholding breaking point, a significant increase in breathholding time was found when nitrogen was present in the atmosphere. Condensation droplets in the respiratory tract could play a role in concentrating impurities and trace substances (such as hydrocarbons, nitrites, sulfites, arsine, carbon monoxide, and ozone) which are present in the atmosphere in subthreshold doses, and thereby cause them to reach threshold values. The 24-hr. environmental cycles of light and darkness, temperature, humidity, and barometric pressure act as time-givers for the organism. Animal studies have shown that endogenous physiological cycles adapt to artificial days lengthened to 28 hrs. or shortened to 21 hrs. Human experience in submarines with 12- to 18-hr. periodicity of environmental time-givers dependent on submergence times indicates the desirability of simulating 24-hr. cycles with light, darkness, temperature, and humidity to maintain optimal or normal efficiency. A brief discussion is included of efforts to obtain adequate equilibrium between the respiratory metabolism of man and the system supplying O_2 and removing CO_2 by the use of a potassium superoxide system and photosynthetic gas exchangers, wherein a closed-cycle air purification system using algae is employed.

12824
Schnitzer, E. 1961
DESIGNING A SELF-ERECTING MANNED SPACE LAB. —Astronautics, 6 (1): 22-23, 56-60. Jan. 1961.

Specifications are given for a space laboratory to be orbited at an altitude of 400 miles and to carry 3 men and equipment for a minimum lifetime of one year. An inflatable torus is selected because of the ease in stabilizing spin, the uniform gravity produced by a spinning torus, and the fact that the gravity at low r.p.m. minimizes the effect of gyro torques on the inner-ear fluid. The laboratory is estimated to have a gross weight of 15,000 pounds with walls of rubberized nylon to resist the 7 p.s.i. of internal pressure. The station is heated by direct solar radiation, while an erectible solar collector supplies the powerplant. Equipment for humans includes air conditioning, water and air purification systems, dry food, and provisions for exercise and recreation. The station would be launched unmanned and later inhabited.

12825
Schunk, J. G. 1959
[PASSENGER COMFORT AND THE INTERIOR DESIGN OF AIRCRAFT] Passagierkomfort und Flug-

zeuginnengestaltung.—Deutsche Flugtechnik (Dresden), 3 (9): 269-273. Sept. 1959. In German.

The interior of an airplane forms a highly differentiated objective stimulus configuration which, in combination with the actual physiological condition and past flying experiences on the part of the passengers and the crew, exerts a strong influence on the subjective sense of well-being and efficiency. Considering all factors, the interior design should be balanced for maximum positive effect on passengers and crew. The selection and coordination of color and illumination is discussed in regard to the differential effect desired in the passenger cabin and in the cockpit. Research in construction and contouring of seats based on anthropometric and statistical data has shown that the following are optimum angles for backrests: 10° for sitting, 20° for reading, and 60° for sleeping. Problems of lay-out and instrumentation of the cockpit and of instrument design are summarized, using maximum readability as a criterion.

12826

Simons, D. G. 1959

THE "MANHIGH" SEALED CABIN ATMOSPHERE. —Jour. Aviation Med., 30 (5): 314-325. May 1959.

There are numerous factors involved in the selection of a sealed cabin atmosphere for space flight. The needs of the "Manhigh" balloon flights led to the selection of a cabin total pressure of 300 mm. Hg, 60% oxygen, 20% lithium, and 20% nitrogen. The factors tending to decrease pressure include a pressure leak, decrease in temperature, absence of oxygen supply, animal metabolism, pressure bleed, and decrease in water or carbon dioxide tensions. Seven ways in which these factors can combine to change the oxygen percent are related to its changes during the "Manhigh II" flight. The ambiguities and uncertainties arising from the attempt to interpret the available data would have been greatly reduced if: (1) accuracy of measurements had been increased by a factor of three; (2) the cumulative volume flow from the oxygen supply had been measured; and (3) the water and carbon dioxide pressures had been measured directly. Instrumentation that permits the astronaut to know at all times what is happening to his atmosphere will be very important in extended space flight. (Author's summary, modified)

12827

Simons, D. G., and E. R. Archibald 1958

SELECTION OF A SEALED CABIN ATMOSPHERE. —Jour. Aviation Med., 29 (5): 350-357. May 1958.

Also issued as: Air Force Missile Development Center, Holloman Air Force Base, New Mexico. Technical Report no. AFMDC-TR-59-36, Sept. 1959. 15 p. AD 228031

A discussion is presented of considerations involved in the selection of a sealed cabin atmosphere for a 24-hour balloon flight, with a human tolerance criterion of no performance decrement rather than comfort or survival. Breathing of ambient capsule atmosphere gas rather than use of an oxygen mask reduces the amount of gas needed by 1/20, allowing use of a standard liquid oxygen converter and equipment for removal of carbon dioxide and water vapor at a considerable weight advantage. Removal of water vapor to maintain relative humidity at a maximum of 30-50% may be accomplished by condensation or by chemical absorption with lithium chloride and magnesium perchlorate. A lithium hydroxide absorber would maintain carbon dioxide at the desirable maximum level of 1%. Protection against the occurrence of bends in the event of decompression of the capsule requires cabin pressurization no greater than 280 mm. Hg, with an emergency partial-pressure suit providing pressure of 140 mm. Hg. However, the oxygen enrichment required in a low-pressure atmosphere presents a fire hazard complicated by the greater flammability of materials with decreased barometric pressure. The best compromise for protection against dysbarism, hypoxia, and fire is a 50% oxygen atmosphere at a total pressure of 349 mm. Hg (20,000 feet). The possibility is suggested of the substitution of helium for nitrogen in the atmospheres of high-altitude sealed cabins.

12828

Slechta, R. F., J. Forrest, W. K. Carter, and E. A. Wade 1959

COMFORT EVALUATION OF THE C-124A CREW SEAT (HARDMAN MODEL 605).—Tufts Univ. Bio-Mechanics Lab., Medford, Mass. (Contract AF 33(616)-3068); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7215, Task no. 71724). WADC Technical Report no. 58-315, Dec. 1959. vi+16 p. AD 233 462

Certain design characteristics of the C-124A crew seat were evaluated in terms of their adequacy for maintaining human comfort. The evaluation method consisted primarily of subjective and behavioral laboratory tests administered by hourly questionnaires presented to 16 subjects during a voluntary sitting period of 7 hours maximum duration. The maximum permitted sitting time was 420 min., the average voluntary time was 296.4 min. On a comfort scale ranging from intolerable discomfort (-10) to ideal comfort (+10) the average of the ratings was -1.11. Hourly scale evaluations revealed that, although some comfort was afforded during the first 2 hours, thereafter the average rating fell sharply into and remained in the discomfort zone. Hourly evaluation of discomfort showed an average time of onset of 112.6 min. for all body regions, and that most discomfort was experienced in the thighs, buttocks, and back, in that order. Evaluation of individual seat parts revealed certain inadequacies in seat and back cushions and in the thigh pads, and in the manipulation of controls. Design recommendations for improvement of the seat comfort are included. (Authors' abstract)

12829

Slechta, R. F., J. Forrest, W. K. Carter, and E. A. Wade 1959

COMFORT EVALUATION OF THE C-124 CREW SEAT (WEBER).—Tufts Univ. Bio-Mechanics Lab., Medford, Mass. (Contract AF 33(616)-3068); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7215, Task no. 71724). WADC Technical Report no. 58-316, Oct. 1959. vi+15 p.

Certain design characteristics of the C-124 crew seat were evaluated in terms of their adequacy for maintaining human comfort. The evaluation method consisted primarily of subjective and behavioral laboratory tests administered by hourly questionnaires presented to 17 subjects during a voluntary sitting period of 7 hours maximum duration. The maximum permitted sitting time was 420 min., the average voluntary time was 297.5 min. On a comfort scale ranging from intolerable discomfort (-10)

to ideal comfort (+10) the average of the ratings was -0.97. Hourly scale evaluations revealed that, although some comfort was afforded during the first 2 hours, thereafter the average rating fell sharply into and remained in the discomfort zone. Hourly evaluation of discomfort showed an average time of onset of 134.5 min. for all body regions, and that most discomfort was experienced in the buttocks, back, and neck, in that order. Evaluation of individual seat parts revealed certain inadequacies in seat and back cushions and in the manipulation of controls. Design recommendations for improvement of the seat comfort are included in the report. (Authors' abstract)

12830
Slechta, R. F., and J. Forrest 1959
COMFORT EVALUATION OF THE C-97A/KC-97E PILOT SEAT (WEBER).—Tufts Univ. Department of Sociology. Bio-Mechanics Lab., Medford, Mass. (Contract AF 33(616)-3068); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio. (Project no. 7215, Task no. 71724). WADC Technical Report no. 58-313, Nov. 1959. vi+16 p.

The method of evaluation of the pilot seat consisted primarily of a battery of subjective and behavioral laboratory tests administered by means of hourly questionnaires presented to 16 subjects during a voluntary sitting period. While the permitted maximum duration of sitting time was 420 minutes, the average voluntary time spent in the seat was 365.6 minutes. On a comfort scale ranging from intolerable discomfort (-10) to ideal comfort (+10), the average of the ratings assigned was +3.57. Hourly scale evaluations of the comfort of the seat revealed that, although the comfort provided decreased with time, at no point during the first five hours did the average rating fall into the discomfort zone. Hourly evaluation of discomfort in specific body regions indicated that for all body regions the average time of onset of discomfort was 198.0 minutes, and that the most discomfort was experienced in the buttocks, back, and neck, in that order. Evaluation of individual seat parts revealed certain inadequacies in the seat and back cushions, armrests, headrest, and manipulative aspects of the adjustment controls. On the basis of test data and specific comments made by the subjects, recommendations for seat design improvement are made. (Authors' abstract)

12831
Smith, S. H. 1960
A DRY CHEMICAL SYSTEM FOR CARBON DIOXIDE REMOVAL FROM SUBMARINES.—Naval Research Lab. Chemistry Div., Washington, D. C. (Buships Project no. SF 013-08-03). NRL Report no. 5563, Nov. 23, 1960. i+7 p.

A system was developed for the optimum utilization of packaged dry chemical CO_2 absorbers, to replace the current use of bulk quantities of loose absorbent. In this system, a self-enclosed filter-blower apparatus holds five canisters, each with six pounds of lithium hydroxide. Under normal conditions, the unit will absorb the CO_2 produced by 35 to 40 men over an eight-hour period. The most recent version of this unit is commercially designed and appears ready for fleet use. A concurrent investigation was made of the value of lithium hydroxide as compared with commercial sodalime as a CO_2 absorbent aboard submarines, using the filter-blower apparatus. Lithium hydroxide was found to be, as expected, substantially more efficient as an absorber of CO_2, with a capability of absorbing about 85% of its own weight in CO_2, as compared with about 40% for sodalime. (Author's abstract)

12832
Stambler, I. 1959
ENVIRONMENTAL SYSTEM FOR MERCURY CAPSULE IS SIMPLE, RUGGED.—Space Aeronautics, 32 (1): 42-45. July 1959.

The air conditioning and pressurization system for the Mercury capsule is designed to operate under launch and re-entry conditions and in an elliptical orbit with a perigee of 105 mi. and an apogee of 120 mi., involving a range of temperatures from -20 to 200° F. and a zero-g (weightless) environment. The capsule is actually provided with two artificial environments: (1) the pilot's suit is pressurized by oxygen at five p.s.i.a., and (2) the capsule itself, once it is in orbit, has an essentially pure-oxygen environment maintained by a pressure regulator (also at 5 p.s.i.a.). The pressurized capsule, in turn, provides a redundant breathable atmosphere. The component parts of the environmental system include snorkels, fans, a purge system, pressure reducers, oxygen, pressure relief valves, a debris trap, odor, CO_2, and water absorbers, demand and pressure regulators, water and cooling tanks, and an evaporator, which, with the fan, constitutes the capsule air recirculating system. The main steps in the control operation of the system at launch, in orbit, and at re-entry are outlined.

12833
Tamas, A. A. 1960
TOXICOLOGICAL ASPECTS OF CLOSED ATMOSPHERIC SYSTEMS.—In: Life Support Systems for Space Vehicles, [Article 2] 7 p. Institute of Aeronautical Sciences, New York. Sherman M. Fairchild Publication Fund Paper no. FF-25. [1960].

A discussion is presented of submarine or space cabin toxicological problems which are generated either by cabin materials and related equipment or by man himself. Criteria for the establishment of physiological threshold limit values (TLV) for prolonged and continuous confinement in space and submersible cabins should be based on following activities: (1) research on k (ultimate toxic effect) values for continuous exposure; (2) research on response to stress during continuous exposure; (3) evaluation of applicable results of air pollution and smog studies; (4) consultation with the American Conference of Governmental Industrial Hygienists Committee for suggestions of TLV for space and submarine applications; (5) consultation with research and development engineering to insure proper selection of capsule materials and, if possible, substitution with the least toxic material.

12834
Taylor, R. S. 1960
IT IS POSSIBLE TO CREATE ARTIFICIAL GRAVITY AND USE REFRIGERATING EQUIPMENT FOR THE COOLING OF SPACE CABINS. — ASHRAE Jour., 2 (10): 50-52. Oct. 1960.

The atmospheric conditioning or cooling of space cabins in a gravity-free environment may be accomplished (1) by creation of an artificial gravity force through rotation of refrigerating equipment

or of the entire space vehicle, and (2) by applying cooling methods that will function in the absence of gravity, such as control of absorption and radiation of energy from the vehicle surface, evaporation of a stored refrigerant into space, diversion of a liquid oxygen supply through an expansion engine, use of "dense-air-" and heat-operated refrigeration units, or absorption of body water to allow self-cooling.

12835
Thompson Ramo Wooldridge, Inc. 1961
PROPELLANT-ATMOSPHERE SYSTEM STUDY.—Thompson RAMO Wooldridge, Inc. New Devices Lab., Cleveland, Ohio (Contract AF 33(616)-6514); issued by Wright Air Development Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63124). WADD Technical Report no. 60-622, March 1961. xiv+222 p.

Two broad aspects of using chemical energy to provide metabolic oxygen in a manned space capsule were studied: man's ecological requirements and supply of auxiliary power. The studies were restricted to chemicals used in propulsion systems with emphasis on by-products useful to man. A survey of methods for meeting environmental requirements included evaluation of (a) passive temperature control in terms of capsule size, shape, surface emissivity, orbital altitude, orientation, and internally generated power, and (b) weight and energy requirements for supplying oxygen, dehumidifying, and removing CO_2 in the cabin. The best of 40 fuels and 35 oxidizers were screened for other important factors. The unique adaptability of the hydrogen-oxygen fuel system was demonstrated. This system combined with a hydroxy fuel cell was used in developing a prototype designed to accommodate 1 man for 3 days and to supply 1 kilowatt of electric power. The prototype included optimization studies of the cryogenic storage system, an air-conditioning system, and a fuel cell power system. (Author's abstract) (53 references)

12836
Turner, W. R. 1960
REGENERATIVE ATMOSPHERE SYSTEMS FOR SPACE FLIGHT.—In: Life Support Systems for Space Vehicles, [Article 3]. 4 p. Institute of Aeronautical Sciences, New York. Sherman M. Fairchild Publication Fund Paper no. FF-25, [1960].

This paper briefly outlines broad aspects of the Wright Air Development Division program for the development and evaluation of regenerative life-support systems for space vehicles. Studies with basic respiration-ventilation systems have been initiated to obtain data which will be applied to the establishment of physiological tolerances to be allowed in regenerative systems, and to develop techniques for environmental and physiological data collection, processing and presentation. From these basic system studies, a program has been established to develop components and integrate these components into more elaborate life-support systems. Techniques of physiological evaluation of the systems are based upon continuous monitoring of atmospheric gases (O_2, CO_2, N_2), water, and system contaminants; the use of a medical analyzer to give readouts on blood pressure, arterial pO_2 and pCO_2, electrocardiogram and electroencephalogram; and visualization of the subject and of internal controls and displays by closed-loop television. The use of biological regenerative systems employing algae or bacteria is also discussed.

12837
Wachsler, R. A., 1960
and D. B. Learner
AN ANALYSIS OF SOME FACTORS INFLUENCING SEAT COMFORT. — Ergonomics (London), 3 (4): 315-320. Oct. 1960.

The techniques of factor analysis and correlation were applied to experimental data on the relative comfort of six Air Force pilot and crew seats and the following conclusions were drawn from the results obtained: (1) seats are rated in the same relative order of comfort after only five minutes of sitting has elapsed as after four or more hours of sitting on the seats; (2) people tend to rate the over-all comfort of a seat mainly on the basis of the comfort of their backs and buttocks. The comfort of the neck and shoulders plays a secondary role, while thigh and leg comfort seems to have little relationship to judgments of the over-all comfort of a seat. Re-analysis of several criteria of seat comfort revealed that either of the following measures over-all comfort: (a) actual time a subject is willing to sit in a seat, (b) ratings of over-all comfort after five minutes of sitting, (c) predictions of total time the subject would be willing to sit in the seat made after five minutes of sitting, (d) time of onset of first signs of discomfort, (e) ratings of over-all comfort after four to seven hours of sitting, (f) comfort of the back, and (g) comfort of the buttocks. (Authors' abstract, modified)

12838
Waggoner, J. N. 1961
KEEPING A MAN ALIVE IN SPACE. — Interavia (Geneva), 16 (12): 1658-1659. Dec. 1961. In English.

Physiological parameters necessary for the life support system of the Mercury capsule include the provision of adequate oxygen supply, atmospheric pressure, water vapor, temperature, suit ventilation, and carbon dioxide regulation. These parameters must be capable of working under such unusual and unfamiliar conditions as weightlessness, high acceleration loads, vibration, extremes of heat and cold, and dry and salt-water exposure. In considering the two-week three-man Apollo mission of the National Aviation and Space Agency the following changes beyond the Mercury system appear necessary: (1) an oxygen-nitrogen mixture to be used rather than pure oxygen; (2) the gas breathed to be stored cryogenically rather than in a gaseous state to reduce the size and weight of the tankage required; and (3) use of a space radiator as a heat sink with an intermediate heat transfer fluid (glycol-water mixture).

12839
Ward, J. E., 1958
and G. R. Steinkamp
HUMAN ENGINEERING OF THE SEALED SPACE CABIN.—Texas State Jour. Med., 54 (6): 356-357. June 1958.

Reprinted in: Reports on space medicine—1958. School of Aviation Medicine (U.S. Air Force), Randolph Air Force Base, Texas. [2] p. [Unnumbered Report], Feb. 1959.

The following provisions of the sealed space cabin are suggested for the physiological well-being of passengers in space craft: (1) maintenance of temperature and humidity between 50° and 70° F. and 40 and 60% respectively; (2) a means of removal

of odors and toxic vapors; (3) maintenance of an atmosphere equivalent to that which exists at 25,000 feet altitude or below to prevent dysbarism; (4) a meteor bumper consisting of a double outer skin for the sealed cabin to prevent explosive decompression as a result of a meteor strike; (5) protection of the crew against natural and synthetic radiations by shielding and/or maintenance of distance from the radiation source; (6) facilities for recreation and general psychological welfare of the crew for voyages of long duration; and (7) a balanced ecological environment utilizing algae in a closed biological cycle.

12840
White, S. C., 1961
R. S. Johnston, and G. J. Pesman
REVIEW OF BIOMEDICAL SYSTEMS FOR MR-3 FLIGHT. — In: Proceedings of a conference on results of the first U. S. manned suborbital space flight, p. 19-27. Washington, D. C.: National Aeronautics and Space Administration, 1961.

Data are given of the equipment of the space capsule in which Alan B. Shepard accomplished his suborbital flight on May 5, 1961. The environmental control system, located under the astronaut support couch, provided for a flight duration of 31-35 hours. The 8 lb. oxygen supply was twice the required amount. The cabin was pressurized with 100% oxygen at 5.5-4.0 p.s.i.a. Provision was made for a CO_2 output in excess of 400 cc./min., for a 5 p.s.i. suit ventilation flow (variable temperature) of 11.5 cu.ft./min., and for a suit circuit heat production of 1,000 B.t.u./hr. The cabin could be mechanically decompressed and recompressed in the event of fire or the accumulation of toxic gases. A "crushable" couch permitted impact acceleration peaks of up to 60 g to the occupant. Lateral acceleration protection was provided for by an "impact bag" and the pilot's restraint harness. Test flights with chimpanzees showed that high-level performance could be maintained through all normal stress loads. The astronauts themselves were given a complete dynamic training program in addition to an extensive course in body systems physiology.

12841
Whittenberger, R. K. 1959
IMPROVED SEAT AND BACK CUSHIONS. — Goodyear Tire and Rubber Co., Akron, Ohio (Contract AF 33(600)27477); issued by Wright Air Development Center. Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7215, Task no. 71724). WADC Technical Report no. 59-376, Nov. 1959. 26 p.

Development of an improved pilot seat and back assembly for the reduction of pilot fatigue is described in detail. The design criteria for these seat and back cushions are included. The study covers both seat design and seating materials; 25 experimental pilot seat cushions and 25 experimental back cushions were produced, both contoured and noncontoured, as well as foam rubber and polyurethane foam. The results of this study indicate that polyurethane foams of a proper density and compression resistance can be safely and efficiently used in aircraft pilot seat and back cushions. The combined advantages of lighter weight, solvent resistance, and closer quality control indicate that the polyurethane foams offer a superior body support material. (Author's abstract)

12842
Willard, T. L. 1961
RESEARCH AND DEVELOPMENT ON CLOSED RESPIRATORY SYSTEM ACCESSORIES: MOLECULAR SIEVES FOR CARBON DIOXIDE ADSORPTION. — Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. (Contract AF 33(616)-7270); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63120). ASD Technical Report no. 61-527, Oct. 1961. vi+69 p.

Present means for carbon dioxide removal for manned space capsules impose serious weight penalties for long missions. A regenerable adsorber is considered which would employ "molecular sieve" material from which adsorbed CO_2 can be removed and expelled or recovered. One type of molecular sieve, Linde Type 5A, was studied experimentally. These studies prove the feasibility of using molecular sieves to control the CO_2 level in a space cabin and indicate how operating variables such as temperature, pressure, humidity, gas velocity, etc., affect the design of an adsorption unit. Recommendations are given for additional experimental work to investigate more fully certain variables which influence the ultimate configuration of the adsorption system. Data for the design of a regenerable adsorption bed are presented, along with sample calculations illustrating the use of the data in designing a sorption bed for a three-man, fourteen-day prototype test system. (Author's abstract)

f. Kitchen and Sanitary Facilities

[*General sanitary aspects under 8-f*]

12843
KITCHEN IN SPACE. — Fast Food Mag., 60 (7): 36-40. July 1961.

Concepts are presented for the kitchen and dining needs of the astronauts. The absence of gravity is the primary consideration in designs for the packing, preparation, and eating of the food, which might include a large variety of palatable canned, dehydrated, frozen, and packaged items. Sanitation methods are given to prevent food spoilage.

12844
Rochman, M. H., 1960
H. S. Siegel, and R. A. Landes
ELECTRIC POWERED AND SOLAR POWERED FOOD WARMING UNITS FOR SPACE VEHICLES. — REF Manufacturing Corp., Mineola, N. Y. (Contracts AF 33(616)-6199 and AF 33(616)-6909); issued by Wright Air Development Division. Aerospace Medical Division, Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63121). WADD Technical Report no. 60-620, [Dec. 1960]. vii+54 p.

Two general classes of food warming methods for use aboard a space vehicle were studied: one class using electrical energy, the other using direct thermal energy. Electrical heating methods investigated were electromagnetic, electrically-produced ultrasonic energy, and electrical resistance; direct thermal energy sources evaluated were nuclear, solar, chemical, and a heat pump system. Electrical resistance heating, utilizing

direct conductance to transfer heat to the food, was considered the most feasible of the electrical methods, and a solar heat-sink the most feasible of the direct thermal methods. Each preferred method appeared to be the most compact, reliable, economical, and safe in relation to the energy source employed. The development and final design features of an electric powered food warmer and a solar powered food warmer are also included. (Authors' abstract)

12845
Stevens, W. E., and R. E. Hayes 1959
USAF FLIGHT FEEDING EQUIPMENT SURVEY AND PROPOSED ITEMS.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6371). WADC Technical Report no. 59-183, June 1959. iii+14 p.

An investigation was made to determine the amount and type of in-flight feeding equipment, difficulties encountered with equipment, and possible future equipment needs of the various commands. Ten commands were solicited, and replies returned. The results of the investigation are tabulated with the number of each type of equipment reportedly used or needed in USAF aircraft. Complaints were registered against hot cups, liquid containers, hot plates, ovens, mechanical refrigerators and toasters. The results received in this investigation indicate a need for emphasizing compliance with existing procedures designed as an engineering control over nonstandard equipment. This action would reduce or eliminate possible hazards and indirectly provide information for a more realistic development program. (Authors' abstract)

g. Flight and Space Feeding

[*Basic nutritional studies under 3-f; Emergency rations under 10-d*]

12846
Baar, J. 1959
SPACE FEEDING: BIG $$ MARKET.—Missiles and Rockets. 5 (25): 28, 32. June 15, 1959.

At present the four main types of space food developed under Air Force contracts are: semi-solid foods in tubes, bite-size solid foods, solid-food rods, and dehydrated foods. The containers may be utilized as food or eaten without ill effects. Although closed ecological systems may be disquieting psychologically, studies are underway to develop recycling systems for water recovery and food production. Various types of space food being developed in different industries are described, and the implications for commercial development are outlined.

12847
Barr, N. L. 1960
SPACE AGE LUNCHES.—Air Line Pilot, 29 (8): 16. Aug. 1960.

Different ways of processing food for nutrition in space are briefly discussed: converstion of indigestible items by enzymes into palatable food; use of dehydrated foods on short space trips; and reconversion of wastes to food and water for extended space voyages. The effects of time expansion at extremely high speeds on space food requirements are pointed out.

12848
Brehm, H. E.
COMPACT FEEDING CONSOLE DESIGN, FABRICATION, AND EVALUATION.—Whirlpool Corp., St. Joseph, Mich. (Contract AF 33(616)-7503); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63121). ASD Technical Report no. 61-569, Oct. 1961. viii+90 p.

The purpose of this research project was to design, fabricate, and evaluate a Compact Feeding Console which will meet the sustenance requirements of three men for an extreme altitude mission of 14 days duration. A comprehensive study of the human and environmental conditions revealed that the astronauts would need equipment, devices, and facilities for storage, preparation—cooling or heating—of canned, frozen, dehydrated, and ready foods; a water storage, cooling and heating system; a wet and dry waste treatment and storage system; and feeding tools. The equipment and systems were tested to evaluate expected performance under operating conditions from normal gravity and 1 atmosphere pressure to zero gravity and 1/2 atmosphere pressure, and acceleration forces from 2 to 8 g's, to insure both independent operation of the component sections and integrated operation of the total Console in compliance with predetermined optimal performance standards. (Author's abstract)

12849
Clamann, H. G. 1959
SOME METABOLIC PROBLEMS OF SPACE FLIGHT.—Federation Proceedings, 18 (4): 1249-1255. Dec. 1959.

The physiological maintenance of man in space flight, provisions for which are limited by the stringent weight and volume restrictions of the space vehicle, involves problems of respiration, nourishment, and removal of waste. Possible solutions to these problems are the provision of food with the lowest volume and weight compatible with nutritive value, and the utilization of recovery, regenerative, and recycling processes. Dehydration, provision of food with a high fat content or more calories per unit of weight, and a water recovery refrigeration unit are considered. In a feeding experiment, three subjects were fed a monotonous diet consisting of dehydrated, commercially-available food which was unrefrigerated, at least a year old, and paste-like or liquid in form. In one case the body weight dropped steadily on a diet of 2000-2800 calories per day. The quantity of feces did not change. The monotony of the food was well tolerated. The total quantity of supply for the maintenance of a space traveler on this diet would amount to about 22 lbs. per day, or with recycling of water and removal of CO_2 to 3.5 lbs. per day (excluding the recycling unit). The use of algae in the recycling process is the ultimate goal in the solution of this problem.

12850
Clark, C. C. 1958
A CLOSED FOOD CYCLE ATOMIC CONSERVATION FOR SPACE FLIGHT.—Jour. Aviation Med., 29 (7): 535-539. July 1958.

A synthetic diet for a closed food cycle is proposed which provides 3100 kilogramcalories per day and the essential amino acids, unsaturated fatty acids, minerals, and vitamins required for atomic balance. The diet consists of meals to be eaten 8 times a day, con-

taining 262 grams of water, 94 grams of glucose, 15 grams of cellulose fiber bulk, and small amounts of essential nutrients. Weight limitations of space craft will require synthesis of all essential foodstuffs by the crew or other species for extended space flight. Utilization of plants such as algae to convert carbon dioxide into oxygen and to provide organic molecules would be unsatisfactory because of the necessity for supplementation of the food manufactured, and the possiblity of death or mutation of the plants. Methods should be developed for the artificial synthesis of organic foodstuffs from waste products or previously made reactants, fractionation of food from other reactants, and identification of foodstuffs by infrared absorption spectra, X-ray diffraction patterns, and possibly mass spectrometry for gases.

12851
Ebbs, J. C. 1959
SPACE NUTRITION.—Jour. Amer. Dietetic Assoc., 35 (1): 13-16. Jan. 1959.

Some of the nutritional problems of space travel may be solved by the use of vacuum-dehydrated and dehydrated precooked meals, or of irradiated foods utilizing atomic or nuclear energy to sterilize or pasteurize foods in order to prolong storage life without refrigeration. Tube-type feeding of semi-liquid meals could be a successful means of ingestion, but might have adverse psychological effects the same as the use of pills for supplying necessary nutrients. By reclaiming water from body wastes or recovering it from the atmosphere of the sealed cabin, into which it has been expired by the lungs of the crew, the amount of liquid required to be carried along could be lessened. A closed ecological system using green algae to absorb and convert CO_2 and fecal wastes to useful oxygen and food is considered to be the best means of meeting space nutrition problems, particularly in prolonged flights.

12852
[NUTRITION OF THE SPACE TRAVELER] Die Ernährung der Weltraumfahrer.—Avitik (Chur, Switzerland), 1960 (2): 7. Feb. 1960. In German.

The utilization of the Chlorella alga as a projected solution of the problem of nutrition and gas exchange during prolonged space travel is discussed. Chlorella is the ideal component of a closed ecological system because of its total edibility, high rate of growth, and high protein content. The monotony of a diet composed simply of algae necessitates supplementation by other edible plants.

12853
FEEDING MEN IN SPACE. — Canad. Food Industries (Quebec), 32 (2): 22-27. Feb. 1961.

A review of research on space flight feeding is presented. Consideration is given to the following areas of investigation: (1) diet preference studies; (2) development of food containers; (3) effects of confinement on diet; and (4) balloon-trial feeding programs. Sample menus and proposed feeding plans encompassing pre-flight, in-flight, and post-flight diets are also presented.

12854
Finkelstein, B., 1960
and A. A. Taylor
FOOD, NUTRITION AND THE SPACE TRAVELER. --- Amer. Jour. Clinical Nutrition, 8 (6): 793-800. Nov.-Dec. 1960.

Current concepts of feeding during space travel are based on (1) our knowledge of aerodynamic flight-feeding requirements, (2) the experience of crews who have flown high-altitude, high-performance aircraft, and those who have made high-altitude balloon flights, and (3) the results of a variety of laboratory studies. Several experimental menus for astronauts are described, pending, however, further research on stresses peculiar to confinement in a sealed cabin. A final determination of nutritional requirements and feeding needs will come only when man goes into space and returns safely to earth. (Authors' summary, modified)

12855
Finkelstein, B., 1959
and B. McGhee
LIQUID DIETS FOR USE IN HIGH-ALTITUDE, HIGH-PERFORMANCE VEHICLES.—Wright Air Development Center. Aero Medical Lab., Wright-Patterson Air Force Base, Ohio (Project 7164, Task 71833). WADC Technical Report no. 59-32, March 1959. v+20 p. AD-209 064, PB 151786

The Aero Medical Laboratory, in its search for significant life sciences information which will enable crews of high-altitude, high-performance vehicles to function efficiently, recently conducted the preliminary phase of a liquid-diet evaluation. Fifteen males, ranging in age from 21 to 29 years, participated in the study for a 5-day period while performing their usual laboratory activities. Food consumption was controlled by serving meals consisting of two or three beverages in the nutrition laboratory. Fruit juices and a chocolate drink were made available for between-meal snacks. Each day's meals provided approximately 2600 calories and 115 grams of protein. Criteria used to evaluate the diet included food consumption records, acceptability data, physiological effects, and psychological changes. Preliminary data indicate that a high protein liquid diet will be acceptable for crews flying high-altitude, high-performance vehicles for extended periods of time and will induce no adverse effects. (Authors' abstract)

12856
Finkelstein, B., 1959
and A. Taylor
NUTRITION RESEARCH FOR MAN IN SPACE FLIGHT.—Military Med., 124 (10): 725-732. Oct. 1959.

Proposed feeding methods in fighter and bomber aircraft are outlined and research data relative to feeding in future space vehicles are reviewed. The following are the objectives of flight and space nutrition research: (1) creation of a greater variety of concentrated, precooked, dehydrated and ready-to-serve foods; (2) further development of food preservation methods using cold sterilization to eliminate the need of refrigeration; (3) improvement of methods of packaging foods; and (4) development of lighter weight food service equipment. Results of studies with a high-protein liquid diet indicate its feasibility for use in preliminary space flights. On the basis of nutritional studies in long-range aircraft, in isolated and confined areas, and in high-altitude balloon flights, the authors state that provision of adequate and highly acceptable food to crews does not constitute a problem.

12857

Finkelstein, B. 1960

NUTRITION RESEARCH FOR THE SPACE TRAVELER.—Jour. Amer. Dietetic Assoc., 36 (4): 313-317. April 1960.

Experiments involving the testing of a liquid diet and the evaluation of the role of nutrition in stress situations (isolation, high-altitude balloon flights, etc.) are briefly described in order to indicate the trend of research towards the development of a feeding system for space travelers. The operational conditions to be encountered in space, considerations of time schedules, cleanliness, and waste removal, and a proposed feeding plan for early space travelers are also considered.

12858

FOOD: SPACE AGE PROBLEM.—Jour. Agricultural and Food Chemistry, 7 (9): 600-604. Sept. 1959.

Two possible solutions to the problem of feeding man in space are offered: (1) storage of food in miniaturized form and (2) utilization of a closed ecological system for the continuous production of food during the space journey. Factors to be considered in the process of miniaturization (or dehydration) such as color, edibility, ease of eating, and stability, are briefly discussed. The use of algae as part of a closed ecological system for the production of food, exchange of oxygen and carbon dioxide, and the removal of waste is considered. Rate of generation and nutrient qualities are weighed against lack of variety in the diet and the adverse psychological impact of the astronaut's knowledge that he is eating his own waste. It is suggested that both algae and miniaturized food will contribute to the food supply of the future astronaut.

12859

Goldblith, S. A., 1960

S. A. Miller, E. Wick, P. M. Richardson, and H. Dymsza

HIGH-ENERGY METABOLITES. — Massachusetts Institute of Technology Department of Food Technology, Cambridge (Contract AF 33(616)-6008); issued by Wright Air Development Division. Aerospace Medical Division, Biomedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 71826). WADD Technical Report no. 60-575, Aug. 1960. ix+73 p.

Studies are made of known, artificial, or synthetic compounds which have greater caloric density than the more usual sources of nutrients, and which may be used along with, or admixed with, normal food supplies of astronauts. The utilization of such substances could reduce the weight of transported food in space vehicles to a minimum. Certain methylated fatty acids of intermediate chain length which may be oxidized in the body without producing ketosis are being investigated as high-energy dietary metabolites. A synthesis for one of these compounds, 2, 4-dimethylheptanoic acid, has been planned and is being carried out. Details are given for the construction of a direct calorimeter and metabolism cage for small animals. Using a newly-developed bio-assay technique, the caloric densities of 1, 3-butanediol and nonanoic acid were estimated to be 6.5 and 7.5 Cal./g., respectively. Feeding tests have indicated that ten per cent 1, 3-butanediol or nonanoic acid may be used to replace dietary carbohydrate and to increase the caloric density of experimental high-fat rat diets. (Quoted in part) (36 references)

12860

Grunzke, M. E. 1961

FEEDING DEVICES FOR USE WITH PRIMATES IN SPACE FLIGHT.—Air Force Missile Development Center. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 68930). Technical Documentary Report no. MDC-TDR-61-35, Dec. 1961. v+15 p.

This report describes two devices that can be employed for dispensing food and water to primates that are undergoing space flight. Also provided are the functional diagrams for basic conditioning and for more complex reinforcement schedules. (Author's abstract)

12861

Hanson, S. W. F. 1961

THE MAINTENANCE OF LIFE IN SPACE SHIPS—THE FOOD PROBLEM. — In: The biology of space travel, p. 33-41. Symposia of the Institute of Biology, 10. London, 1961.

Keeping in mind that food for space travel must be nutritious, palatable, psychologically pleasing and light in weight, a discussion is presented of the food problems in the three stages of space exploration. In the first phase, orbital or suborbital flight, the knowledge and equipment for high altitude, supersonic plane flight can be applied. The second phase, a flight to the moon, will radically change food problems. The use and advantages of dehydrated food are discussed. The third phase, interplanetary travel, presents problems that can not be solved by present knowledge. Due to the distances involved it will be impossible to carry even dehydrated food because of its immense weight. An analysis and criticism of present plans to culture algae as a food is given.

12862

Hursh, L. M. 1960

NUTRITION IN SPACE.—Military Med., 125 (8): 567-569. Aug. 1960.

The nutritional and respiratory-ventilatory requirements for man on speculative trips into space (a 1-hour trip from Washington, D. C. to Peking, China, a 1-week round-trip to the Moon, and a 1-year tour of duty on the Moon) are discussed. The application of current knowledge on the chemical removal of carbon dioxide and carbon monoxide from the atmosphere, and of the packaging and storing of oxygen, water, and food will suffice for a 1-week trip to the Moon and back. Enough food for a 1-year tour cannot be carried, however, and the utilization of unicellular organisms for this purpose is indicated. Current research on the use of algae for food and as closed-circuit gas exchangers is reviewed. Mention is also made of hydroponic research using volcanic ash, feces, and urine, and of experiments with rapidly growing animals such as rabbits and chickens which can use algae as food.

12863

Kamen, J. M., 1960

and D. R. Peryam

EFFECTS OF REPETITIVE EATING OF LIMITED GROUPS OF FOOD ITEMS ON FOOD ACCEPTANCE. —Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill. (MIPR 33(616)-59-19); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Lab., Wright-Pat-

terson Air Force Base, Ohio (Project no. 7164, Task no. 71833). WADD Technical Report no. 60-750, Dec. 1960. iii + 26 p.

The effects of the type of menu planning, and the number of different foods on food preferences and consumption are discussed. Seventy-two volunteers were assigned randomly to three 24-day feeding treatments: (a) 3-day, preplanned, fixed-menu-cycle, all meals in the same sequence; (b) 6-day, preplanned, fixed-menu cycle, same foods as above plus an approximately equal number of new foods; and (c) 3-day cycle, same foods as (a) but, after first 3 days, men planned their own menus. The foods, mainly canned or dehydrated, were from military and commercial sources. Experimental items, including a high-protein beef drink, high-calorie, high-protein chocolate drink, and cooffee drink, were also served. The over-all satisfaction with (b) and (c) was about equal and higher than with (a). (Authors' abstract)

12864
Kemp, J. D., 1960
R. M. Ballantyne, A. J. Ducker, and J. W. Haynes
THE COLLAPSIBLE POLYETHYLENE TUBE AS A FOOD PACKAGE.—Food Technol., 14 (3): 131-134. March 1960.

Polyethylene tubes, lined with polyvinylidene chloride resin and unlined, were filled with raspberry jam, grape jelly, honey, peanut butter, and creamery butter and stored at 0°, 70°, and 100° F. Samples were tested for as long as 2 years. Comparative assessment was made with the tubes and glass and metal containers. Unlined tubes were found to be permeable to oils within three months at 100° F., and the jam and jelly had changed color by six months at 100° F. The lined tubes were impermeable to oils, and the peanut butter and creamery butter were maintained satisfactorily for three months at 100° F. Oxygen transmission through the polyethylene was thought to add increased weight to the product, and it is suggested that this be studied further. Storage of jam, jelly, and honey at 100° F. in lined tubes was comparable to cans and bottles for up to three months.

12865
Lubitz, J. A. 1961
THE PROTEIN QUALITY, DIGESTIBILITY, AND COMPOSITION OF CHLORELLA 71105. — General Dynamics Corp. Electric Boat Division, Groton, Conn. (Contract AF 33(616)-7373); issued by Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63124). ASD Technical Report no. 61-535, Oct. 1961. vi+38 p.

Protein quality, digestibility, and composition of freeze-dried Chlorella 71105 were determined. This Chlorella contained 55.5% of crude protein. The digestibility of the protein was 86%, and the protein efficiency ratio (PER) was 2.19, which compares favorably with soy protein. The PER of Chlorella with 2% L-methionine was 2.90, which compares favorably with casein in the literature. The PER of casein was 3.30, that of defatted egg protein, 4.01 in these studies. Rats were fed at 10% protein levels. Chlorella contains all the essential amino acids. Available energy value was 3.3 Calories per gram. Carotene content is high. Autopsies revealed no gross pathological effects. Preliminary histopathological examination revealed anomalies in pancreas, salivary glands, kidney, and lens. Further study is indicated to resolve these anomalies. (Author's abstract) (22 references)

12866
NUTRITION OF MAN IN SPACE. — Nutrition Reviews, 18 (11): 325-329. Nov. 1960.

The present state of research on the nutritional problems of space travel is reviewed. Consideration is given to such subjects as the development of regenerative systems; the digestibility, toxicity, and general acceptability of algae as food; eating patterns and food preferences during extended periods of isolation; feeding programs during balloon trials (which provide short-term situations comparable to manned space flight); and the development of concentrated, synthetic diets for space travelers. The effects of such stresses as acceleration, deceleration, weightlessness, noise and vibration, and space radiation, upon food supplies and food intake are also discussed.

12867
Rich, L. G., 1961
W. M. Ingram, and B. B. Berger
THE USE OF VEGETABLE CULTURES AS THE PHOTOSYNTHETIC COMPONENT OF ISOLATED ECOLOGICAL CYCLES FOR SPACE TRAVEL. — Advances Astronaut. Sci., 6: 369-379. 1961.

A study was made of the use of higher plants as the photosynthate in human sustenance systems. Eight vegetable diets were devised, each providing energy sufficient to sustain one man-unit. The diets are evaluated in terms of the daily amino acid, vitamin, and mineral requirements of the adult male. A system of soilless culture is described and the plant growth requirements discussed. The relationship between the vegetable culture system and the other components of the overall sustenance system is demonstrated by a water and mineral balance. A comparison is made of the oxygen requirements of a man-unit with the quantity of oxygen produced in growing the crops from which the eight diets would be derived. Finally, the cubage and weight requirements of the vegetable culture system are estimated for each of the eight diets. (From the authors' abstract)

12868
Steensen, J. H. 1961
DAPHNIA IN OUTER SPACE.—Aquarium, 30 (5): 311-313. May-June 1961.

An analogy is presented showing the relationship of the sealed cabin of a spaceship to the aquarist's balanced aquarium. The balanced aquarium (oxygen-carbon dioxide balance) can theoretically be sealed off and a self sufficient unit could be established utilizing fishes feeding on plant material. To avoid a strict vegetarian diet in spaceflight, daphnia could be introduced into the cycle and used as food for the astronauts. The daphnia which are tasty could be served in the form of pellets, soups, or salads.

12869
[Stern, J., 1959
J. Liston, and A. Sparks]
GARDENS FOR SPACE.—Boeing Mag., 29 (7): 6-7. July 1959.

Scientists for the Boeing Airplane Company are investigating closed ecological systems which will produce food and oxygen for space travelers in the

confines of a vehicle whirling through space, or on the surface of a sphere now devoid of life. Areas under investigation include the production of algae in various combinations of purified wastes, the study of a fast-growing, edible fish (Tilapia) which can exist entirely on the algae, the culture of fast-growing, edible mushrooms, the growing of plants in various substances (ourlite, vermiculite, and powdered styro-foam) in lieu of soil, and studies of plant tropisms in a gravity-free environment. All attempts are aimed toward the development of a food-producing system which will run through a complete cycle in a matter of days.

12870

[Taufman, W., W. Telvey, H. Rind, and F. Benjamin] 1961

FOOD SUPPLY IN SPACE.—Interavia (Geneva), 16 (12): 1659-1660. Dec. 1961. In English.

Research to determine the feasibility of feeding man in space by growing his own food supply is reviewed. Included are studies on growing plants at four pressure levels (5, 8, 11, and 14.7 p.s.i.a. (sea level)) in bell jars where growth was not materially affected. Planting the common snap-bean, which reached maturity, and an Andean grain crop, which failed to survive, using two different soils, was tried. Wild pineapple plant seeds obtained from an altitude of 12,000 feet germinated and grew when they were planted at 18,000 feet and received 30 seconds of red light. In an effort to obtain some indications of gravitational effects, experiments on the growth of plants in a normal attitude were compared with others in an inverted position. Inverted rye grass was shown to grow at a rate approximately one-third of normally oriented plants. Germination development was apparently different in controls from those grown at simulated zero and lunar gravity. Further investigation is warranted to determine the effects of reduced gravity on other plant and animal systems.

12871

Taylor, A. A. 1960

FOOD FOR THE SPACE TRAVELER. — Jour. Applied Nutrition, 13 (3): 118-128. 1960.

The details of supplying nutritional support to space voyagers engaged in flights of short duration will be extensions of feeding practices currently used in high-performance, high-altitude aircraft. However, for longer space flights new concepts are needed. Space travel involving periods of time as long as several months will require the use of dehydrated and concentrated foods and the reprocessing of water and oxygen. Flights of still longer duration will, in addition, necessitate the production of food during flight. For these very long flights, a closed and balanced ecological system which can support life and supply man's needs must be developed. Current concepts of feeding during space travel are based on (1) our knowledge of flight feeding within the atmosphere; (2) the experiences of crews who have flown high-altitude, high-performance aircraft and those who have made high-altitude balloon flights; and (3) the results of a variety of laboratory studies. In spite of this wealth of information, a final determination of nutritional requirements and feeding needs will be established and tested only when man invades space and returns safely to earth. (Author's summary)

12872

Taylor, A. A. 1958

PREVENTIVE MEDICINE ASPECTS OF FLIGHT FEEDING.—Jour. Aviation Med., 29 (3): 206-211. March 1958.

Also published, with co-author B. Finkelstein, in: Amer. Jour. Public Health, 48 (5): 604-609. May 1958.

The importance of feeding during flight is due to the effect of poor food intake on flying safety, the effect of dietary dissatisfaction on morale, the special dangers of food-borne infections during flight, and the effect of dehydration on efficiency. A new system of in-flight feeding has been authorized by the Air Force for use in large aircraft, which provides five menu items in separate aluminum-foil containers. The meals are cooked during flight in lightweight ovens and are eaten from the foil containers. Data obtained during a field test in which nearly 9,000 meals were served showed that foil-pack meals were preferred to all other types currently authorized. A bacteriologic study of the meals showed little or no bacterial growth after 120 hours of storage at refrigerator temperatures. For high-performance aircraft, a compact box lunch providing six menus for consumption within 5 or 20 hours has been developed. The lunch features protection from dehydration at high altitude, compactness, bite-size components, and ease of eating.

12873

Thompson, G. V. E. 1960

HYDROPONICS WILL FEED MEN ON THE MOON. — Engineering (London), 190 (4923): 294. Aug. 26, 1960.

The absence of seas, atmosphere, and soil in the lunar and planetary environments will necessitate the development of new techniques for the production of food for travelers on extended journeys into space. It is suggested that soilless cultivation of plants in chemical solutions in tanks (hydroponics) may solve the food production problem. The tanks, pipelines, pumps, and chemical solutions which are utilized in hydroponic systems can be devised and serviced by the bioengineer; a sealed building for housing the system and a supply of artificial light during the long lunar night are also necessary. The hydroponically-grown plants could be eaten directly, thus reducing the biological cycle to its absolute essentials, although the introduction of a small animal (such as a battery hen) into the cycle would provide a more palatable and varied diet.

12874

Thompson, J. I., and Company 1960

INDIVIDUAL ALUMINUM FEEDING CONTAINERS. I. ENGINEERING EVALUATION PHASE. — John I. Thompson and Company, Washington, D. C. (Contract AF 33(616)-7080); issued by Wright Air Development Division. Aerospace Medical Division, Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63121). WADD Technical Report no. 60-522(I), Aug. 1960. v+19 p.

An evaluation was made of materials and techniques for fabricating a feeding container for astronauts traveling under anticipated conditions of zero gravity, possible less-than-normal atmospheric pressures, a cabin temperature of 75° F., and high acceleration forces (at launch). Detailed con-

sideration was given to pressure relief devices, quick opening devices (particularly of the resealable type), expelling devices suitable for forcing or removing the container contents, and a mouthpiece to permit eating directly from the container while permitting absolute control over the outward flow of the contents. It was concluded that after further design study, complex rectangular, aluminum containers and associated equipment can be produced with present materials and techniques.

12875
Thompson, John I. and Co. 1961
INDIVIDUAL ALUMINUM FEEDING CONTAINERS. II. (FINAL DESIGN) FEEDING CONTAINER ASSEMBLY FOR SPACE FLIGHT. —— John I. Thompson and Co., Washington, D. C. (Contract AF 33(616)-7080); issued by Wright Air Development Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63121). WADD Technical Report no. 60-522 (II), March 1961. iii+35 p.

Designs have been evolved of a container, quick opening device, inner seal, food expelling device, pressure relief method during heating, and mouthpiece for an individual aluminum feeding container for space flight use. The pertinent parameters of these designs are ability to function under zero gravity, and presentation of food in a palatable, acceptable condition. Many designs were conceived and discussed for the various components, and the most feasible designs were selected. The selected design consists of a rectangular container with a round dispensing end sealed by a foil inner seal and a screw-on cap for quick and easy access and hermetic sealing. The bottom plate also contains a screw-on cap for access to the enclosed expelling plate. The container will be fabricated by impact extrusion from 1100-F aluminum, the other metal components by forming, and casting. (Author's abstract)

12876
Tischer, R. G. 1959
A SEARCH FOR THE SPACE MAN'S FOOD.—— Space Jour., 2 (2): 10-12, 45-46. Dec. 1959.

Food requirements for space travel such as quality, attractiveness, weight, edibility, and storage stability are discussed. The advantages and disadvantages of canned frozen or dehydrated food are debated. A system of closed-cycle feeding utilizing the crewman and a microbiological regenerating component are described. A physical description of the system is given along with a discussion of the component parts. Algae, lichens, and higher plants are suggested for use in oxygen production, and their additional use as food is discussed. Because of the inability of man to utilize algae as a complete food, it is suggested that a daphnia-fish step be used in the closed cycle. Components for regulating oxygen and converting wastes are described. The by-products of the algal systems are discussed, and control of these compounds is stressed.

12877
Tischer, R. G. 1958
SPACE FEEDING CHALLENGES FOOD ENGINEERS. ——Food Eng., 30 (9): 49-50. Sept. 1958.

On the basis of our very limited knowledge about space-flight feeding it is suggested that acceptable fresh and prepared foods in easy-to-open packages, ready-to-eat, and needing no heating or cooling, be taken along on space flights lasting several days. Difficulties in eating and in retaining food will be encountered during the state of weightlessness. Hence, it might be necessary to produce a state of gravity artificially by rotating the space ship. Food-drug combinations or nose-tube or intravenous feedings would be less popular alternatives. Flights lasting for many weeks or, maybe, several months would call for ready-to-eat foods in light easy-to-store packages. These foods should be radiation-sterilized to eliminate the need for temperature-controlled storage space. Very long flights lasting for months or even years would require a closed-cycle feeding system. The author suggests that algae receiving their nourishment from human wastes be used to provide for food and oxygen; thus a small initial amount of biological material could be continuously recycled. Whether algae will really be acceptable has still to be proven. At any rate, much research will have to be done by food technologists, food processors, food engineers, and by pertinent trade associations. Experimental tests will have to be carried out under actual space conditions to find the final solutions to these problems.

12878
Ward, J. E., 1959
W. R. Hawkins, and H. D. Stallings
PHYSIOLOGIC RESPONSE TO SUBGRAVITY: MECHANICS OF NOURISHMENT AND DEGLUTITION OF SOLIDS AND LIQUIDS.——School of Aviation Medicine, Randolph Air Force Base, Tex. Report no. 59-2, Jan. 1959. 4 p.
Also published in: Jour. Aviation Med., 30 (3): 151-154. March 1959.

In order to study the mechanics of nourishment during weightlessness, 165 subgravity parabolas were flown in an F-94C aircraft. Twenty-five experimental subjects attempted to drink from an open container, a container fitted with pierced lid and plastic straw, and a plastic squeeze bottle. Observations were made regarding deglutition of solids, including swallowing of both well and poorly masticated boli. Drinking from open containers proved to be more difficult than had been anticipated. For reasons of safety, closed containers, such as squeeze bottles, must be used to transfer liquids to the mouth under conditions of zero-gravity; the use of straws is not practical. Deglutition of liquids or well masticated solids can be accomplished with little or no difficulty in the weightless state. However, a large solid bolus of food is a potential aspiration problem. Regurgitation of stomach contents may become a serious annoyance during orbital flight. Only a small quantity of liquids should be taken at one time. Movements or abdominal pressures, which may initiate vomiting, must be avoided. (Authors' abstract)

12879
Welbourn, J. L., 1961
and P. A. Lachance
SUITABILITY OF TUBED FOODS FOR IN-FLIGHT FEEDING. —— Aeronautical Systems Division. Biomedical Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71833). ASD Technical Report no. 61-456, Sept. 1961. iv+6 p.

Nineteen tubed foods were evaluated to determine their acceptability and suitability for in-flight feeding under restricted flight conditions. Ten of the foods were evaluated both at ground level and at a simulated altitude of 30,000 feet with the subjects wearing the MA-2 pressure helmet. The remaining nine foods were evaluated at ground level without a helmet. Results indicate that tubed foods are a practicable and acceptable method of feeding aircrews under the above conditions. Twelve of the nineteen foods in the tubes had sufficient degree of acceptability to warrant their use in operational situations. (Authors' abstract)

12880
Welch, B. E., 1961
T. E. Morgan, and F. Ulvedal
SEALED CABIN EXPERIMENTATION. — ARS Journal, 31 (11): 1541-1544. Nov. 1961.

Data are presented from four separate experiments in the two-man space cabin simulator. These experiments lasted for 14 days, 17 days, 30 days, and 30 days at altitudes of 18,000, 33,500, 18,000, and 18,000 feet, respectively. Food was supplied in a precooked, dehydrated form. Approximately 1 pound of food and container was required/man/day to supply from 1160 to 1915 kcal. This level of intake was not always adequate, as indicated by weight loss in both 30-day flights. The energy level was determined to be approximately 30 kcal/kg. body weight. Water requirements were met by stored supplies in the 14-day flight and by both stored supplies and recycled water in the other flights. Water requirements in these experiments were found to be about 2.0 liter/man/day. Urine produced approximated 1.0 liter/man/day. (Authors' summary)

h. Disposal and Utilization of Waste Pr

[*Basic studies on ecological systems under 2-b*]

12881
Bembenek, R. A., 1959
and J. D. Zeff
WATER RECOVERY IN A SPACE CABIN.—Astronautics, 4 (2): 34-35. Feb. 1959.

Factors determining the utilization of closed ecological systems in space vehicles are discussed. In a closed system, the materials for supporting life are recovered or regenerated, as opposed to an open system, wherein all materials are stored and discarded when used. Water (urine, wash water, sweat, and feces) constitutes most of the waste in an open system, therefore, a partially closed system that recovers only water could be of first consideration in space flight. Since the atmosphere within a space capsule will be treated to remove CO_2, heat, and water vapor, the water which comes from the lungs and skin will be collected by this system. This water, collected as vapor, has experienced a change of phase and will contain contaminants which can be easily removed by charcoal filtration or chemical sterilization. Methods which have been laboratory-tested for purifying urine and feces include absorption filtration and ion exchange, refrigeration, electrodialysis, freeze drying (sublimating water and then condensing water vapor as ice at low pressure—below the triple point of urine), and distillation, both at atmospheric pressure and in partial vacuum. Evaluation of these methods shows that change-of-phase processes (freeze drying and distillation) have the best possibilities for use in space cabins, and that water recovery by distillation is the more feasible of the two. A distillation system for recovering water from urine and wash water (a negligible amount is obtained from feces) is illustrated by a drawing. This system is mounted on the wall of the vehicle; it requires no electrical power for operation nor complicated heating techniques and collects the water, as well as the residue remaining after removal of the water, in sponges. By using them first to collect drinking water, then wash water, then urine, the sponges can be used at least three times before becoming saturated with contaminants. Contaminated sponges can be reused or dumped overboard. The recovery sponges can be adapted to contain activated charcoal, a sterilizing agent, or a washing agent.

12882
Bogan, R. H., 1961
D. D. Chapman, and L. H. Ericsson
AEROBIC BIOLOGICAL DEGRADATION OF HUMAN WASTE IN CLOSED SYSTEMS. — Advances Astronaut. Sci., 6: 390-398. 1961.

An investigation was made of the susceptibility of human waste matter to biological degradation over a 25° to 50° C. temperature range. The activated sludge process offers many advantages over alternative methods of treatment of human waste. In a bench-scale pilot facility designed about the activated sludge process, data were obtained on reaction velocity constants, chemical oxygen demand, and carbon dioxide and ammonia production at the various temperatures. The cultures were subjected to loads ranging over 3- to 25-day retention times. Based on these data, design criteria for inclusion of such systems in a closed environment have been developed. The results indicate that such a biological combustion unit, with supporting apparatus, may entail only 1 ft^3 per man. (From the authors' abstract)

12883
Bosee, R. A., 1961
P. R. Tiller, L. J. SantaMaria, and N. M. Burns
ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS: SPACE AGE UTILIZATION OF RECYCLED METABOLIC WASTES. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAMC-ACEL-459, Sept. 1, 1961. iv+[8] p.

Potable water reclaimed from metabolic wastes by means of the vacuum distillation technique of the Missile and Space Vehicle Department of the General Electric Company was the sole source of water intake in a one-man six day test. Urinary characteristics regarding pH and specific gravity were within normal ranges; qualitative albumin and sugar determinations were negative. pH of recovered water was excessively acidic early in the test period. No traces of epinephrine and norepinephrine were found in recycled urine. Daily water intake as might be influenced by palatability and odor was maintained constant, the whole of the experimental treatment effecting no embarrassment on the physiological state of the subject. (Authors' abstract)

12884
Colichman, E. L. 1959
SYNTHESIS OF STORABLE ROCKET FUEL DURING SPACE MISSIONS. — Astronautics, 4 (12): 32-35, 80. Dec. 1959.

An alternative is proposed to the closed ecological algae system for sustaining man in space for long periods of time. The system would provide: (1) transportation of sufficient food so that biological regeneration would be unnecessary; (2) continuous regeneration of needed oxygen from exhaled carbon dioxide and water by simple radiolytic or chemical degradation; (3) conversion of by-products from oxygen production into storable fluids to complement the normal rocket fuel in the propulsion process; and (4) reduction of the initial load of rocket fuel to counterbalance the additional weight carried as food. A model was constructed to study the extent to which maximum total impulse can be achieved from degraded fuel products of carbon dioxide and water while sustaining a man in space. The idealized cyclic process (for dextrose) is limited by the respiration reaction, by the dextrose needed equivalent to oxygen intake, by required oxygen intake determined from carbon dioxide exhaled, and by drinking water produced by distillation of perspiration, respired water, and urine. The equimolar ratio of carbon monoxide and hydrogen gas formed in the oxygen regeneration cycle suggests a process for the production of formaldehyde as the fuel required to allow maximum transport of food.

12885
Goldblith, S. A., 1961
and E. L. Wick
ANALYSIS OF HUMAN FECAL COMPONENTS AND STUDY OF METHODS FOR THEIR RECOVERY IN SPACE SYSTEMS. — Massachusetts Inst. of Technology, Cambridge, Mass. (Contract AF 33(616)-6136); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63122). ASD Technical Report no. 61-419, Aug. 1961. ix+57 p.

Human fecal constituents were investigated for possible use in waste recovery systems aboard a space vehicle during a journey of long duration (1-3 months); first it was necessary to isolate them and then to evaluate their potential usefulness. A review of the literature indicated that there is very incomplete knowledge of human fecal components, that detailed knowledge of the chemical nature of only a small proportion of fecal components exists, and that these have rarely been isolated in any quantity. However, protein, minerals, and trace elements present in feces are possibly useful materials. Investigation indicated that use of fecal protein or its component amino acids as nutrients for man would require supplementation of the diet. Insufficient information (e.g., authentic space diets and identification of useful fecal components) exists to compare or recommend feasible methods for recovery of usable materials from feces in space vehicles. (From the authors' abstract) (42 references)

12886
Hawkins, W. R. 1958
THE FEASIBILITY OF RECYCLING HUMAN URINE FOR UTILIZATION IN A CLOSED ECOLOGICAL SYSTEM.—Jour. Aviation Med., 29 (7): 525-535. July 1958.
Reprinted in: Reports on space medicine—1958. School of Aviation Medicine (U.S. Air Force), Randolph Air Force Base, Texas. [10] p. [Unnumbered Report], Feb. 1959.

A discussion is presented of methods for the reconstitution of urine into potable water in a closed ecological system. Distillation of the urine may be accomplished by boiling or by evaporation in a vacuum or with solar energy. In space, a method would be required to collect the condensate and to remove heat from a condensing surface in the wall of a space cabin. Each distillation method would require about 2,480,000 calories for purification of the minimum required amount of 4 liters of water/man/day. Purification by freezing would reduce the energy requirement to 400,000 calories/day, but would necessitate provision of an additional volume of water to wash ions from the surface of the crystals. An electroosmosis process would occupy a very small space, and would not require cooling to accomplish condensation. Chemical methods such as an ion exchanger might be useful in addition to other methods of purification, but regeneration of the chemical agents would require large amounts of heat, electrical energy, or extra chemicals. Filtration and treatment with urease or some other method to remove urea would be necessary as a first stage in any purification method. Carbon adsorption or aeration would also be required to improve the taste and odor of the water.

12887
Ingram, W. T., 1959
B. Newman, G. Palevsky, and L. Slote
EXPLORATORY RESEARCH ON THE THEORETICAL CONSIDERATION OF WASTE WATER CYCLES IN A CLOSED ECOLOGICAL SYSTEM.—New York Univ. Coll. of Engineering, N. Y. (Contract AF 18 (603)-71); supported by Air Force Office of Scientific Research, Washington, D. C. AFOSR Technical Note no. 57-87, [1959]. 16 p. AD 210 087
Also published in: Advances in Astronautical Sciences, 4: 444-455. 1959.

Sources and quantity of waste water which may be expected from closed-space occupancy include feces, urine, respiration and skin excretions, food preparation, personal hygiene, clothes washing, cabin cleaning, and working operation. Liquids resulting from bodily discharges may be about two liters per capita per day under normal circumstances; liquids resulting from closed-space occupancy may be 6.5 liters per capita per day, and may range from 8 to 22 liters per capita per day. The total metabolic water requirement per day is approximately two liters. Of the total water required, 40.2% must be of high quality, 46.0% should have reasonably high quality, and 11.5% may be of quite low quality. A series of experiments were performed to determine the feasibility of recovering water from urine by distillation process followed by adsorption on different materials. The water obtained was toxic to in vitro cultures of HeLa (human cancer) cells. The Hela cells afford a rapid toxicity study. A brief résumé of other techniques used to treat wastes is also given.

12888
Ingram, W. T. 1958
ORIENTATION OF RESEARCH NEEDS ASSOCIATED WITH ENVIRONMENT OF CLOSED SPACES.—Jour. Astronautical Sci., 5 (3-4): 51-57. Autumn-Winter 1958.

A commentary and discussion is presented of research needs related to closed-space environments in long-term extra-terrestrial flights. The essential problems of living in a closed ecological system (treatment of bodily wastes, CO_2 - O_2 conversion, recovery of usable water from contained air, urine, and other sources, and removal of pollutants from contained air) and some of the processes offered for their alleviation are reviewed.

12889
Konikoff, J. J. 1960
A FEASIBLE ECOLOGICAL SYSTEM FOR SPACE FLIGHT.—General Electric Co. Space Science Laboratory, Philadelphia, Pa. Technical Information Series, Report No. R60SD371. May 1960. ii+35 p.

An ecological system is described for use in space vehicles. The system includes apparatus for air purification (activated charcoal and desiccant), oxygen recovery (Fischer-Tropsch synthesis), and water recovery (vacuum distillation-catalysis). Total weight of the system is estimated to be about 200 pounds, and it will be able to supply a man with his metabolic and oxygen requirements for an indefinite period of time. Utilization of urine and other body wastes will supply these needs. This system offers a number of advantages: (1) for a flight-time exceeding 20 days this will be the lightest existing system; (2) the apparatus has been proven experimentally; (3) pre-storage for any material, except for the first day, is not necessary; (4) energy requirements for operation are about 9 kilowatt-hours; and (5) reliability should be high. Purity of the recovered water appears to meet and exceed the water standards (Coliform tests) of the city of Philadelphia. (Author's conclusions, modified)

12890
Konikoff, J. J. 1961
A PARTIALLY CLOSED CYCLE LIFE SUPPORT SYSTEM FOR LONG-TERM SPACE FLIGHT.—Ballistic Missiles and Space Technol. (Oxford), 8: 370-377. 1961.

For man to survive in the hostile environment of outer space, he must be maintained in an environment that will essentially duplicate that existing on the Earth's surface. Studies have shown that with the exception of the manufacture of food, the problems connected with supplying all of man's necessities, i.e., temperature, pressure, and humidity control, air purity, oxygen requirement, and metabolic water supply, are amenable to solution using available knowledge. In particular the purification of air and the recovery of potable water and oxygen are examined in the light of their reclamation from man's biological wastes. A particular approach in the design of a partially closed cycle system is presented. This utilizes man's wastes, but carries prestored foods. Results to date indicate the feasibility of the overall approach and further show that this particular system will probably be more efficient weight-wise than an open cycle storage system for space flights in excess of 15-20 man-days. (Author's abstract, modified)

12891
Lowe, H. N. 1961
WATER SUPPLY ON THE MOON. —Jour. Amer. Water Works Assoc., 53 (9): 1106-1110. Sept. 1961.

The water supply for man's exploration of the moon will have to come from the Earth, man's own excreta, and other wastes. For any semi-permanent or permanent type of inhabitation it will be imperative to have some type of recycling operation to recover the estimated 2500 g./day of water available from a human's excreta. The price alone of transporting water to the moon as well as the limited time of technological development makes it important to begin a research program now. The author suggests various approaches to be used in solving the problem.

12892
Oswald, W. J., and C. G. Golueke 1961
MAN IN SPACE—HE TAKES ALONG HIS WASTES PROBLEM! —Wastes Engineering, 32 (9): 456-459. Sept. 1961.

Studies on the broad and basic problems involved in adapting biological cycles to space vehicle requirements for a closed-cycle wastes disposal-recovery system are briefly reviewed. The following systems have been devised: (1) an algal-bacterial closed system, (2) the "Little Daisy Waste Converter" which handles the wastes of one man with 2 to 3 gallons of algal-bacterial culture, (3) the "Microterella" system which functions as a completely enclosed ecological system including one mouse and a combined culture of algae and bacteria, and (4) an algal-bacterial culture situated on the inner part of the outside wall of the vessel and held there by artificial gravity. As a result of the dehumidification operation from algal-bacterial systems, enough water will be obtained for drinking, cooking, and minor washing purposes. The chief disadvantages of this system are the high initial weight and possibly the skilled attention which the space man must give to his cultures.

12893
Pipes, W. O. 1961
WASTE-RECOVERY PROCESSES FOR A CLOSED ECOLOGICAL SYSTEM. —National Academy of Sciences-National Research Council, Washington, D. C. Publication no. 898. v+22 p. April 1961.

To fully utilize all forms of energy in a closed ecological system it will be imperative to recover human wastes and convert them into usable food, oxygen, and water. A plan of materials flow in a closed system, including flow diagrams and estimates of the waste produced, is given. The processes of waste recovery among which are incineration, wet oxidation, chemical oxidation, anaerobic digestion, and algal production of oxygen are discussed both qualitatively and quantitatively. (27 references)

12894
Pote, H. L., R. D. Gafford, and D. E. Richardson 1961
ANAEROBIC WASTE PROCESSING FOR CLOSED ECOLOGICAL SYSTEMS. —Advances Astronaut. Sci., 6: 399-403. 1961.

This is a preliminary report on the processing of human waste to provide suitable nutrient material for the growth of food plants and algae. The point of view of man's input and output requirements, or unit function, is contrasted with the material cycle concept. A general table of the chemi-

cal element content of these inputs and outputs is given. An anaerobic thermophilic digester system for processing human waste is described. (Authors' abstract)

12895
Redden, R. J. 1961
URINE COLLECTION AND DISPOSAL DEVICE FOR PRESSURE SUIT. — International Latex Corp., Dover, Delaware (Contract AF 33(616)-7344); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 71831). ASD Technical Report no. 61-329, Aug. 1961. v+18 p.

The design, fabrication, and testing of a urine collection and disposal system to provide a means to remove urine from within a full pressure suit during long periods of use in a weightless environment and to provide a means of sampling each individual specimen of urine are discussed. The prototype system consists of three basic parts: (1) a urinal to collect the urine within the suit, (2) a valve to allow removal of the urine from the suit, and (3) a collecting bag with valving to provide for disposal of the urine. The testing program provides a means of checking conformance to the design objectives as far as possible in the presence of gravity. Tests were performed both with and against gravity. Some of the components, designed for optimum performance in a weightless condition, could be adequately tested only under that condition. Weightless tests have not been conducted. (Author's abstract)

12896
Reynolds, L. W., 1960
and J. J. Konikoff
STUDY OF THE PURIFICATION OF WATER FROM BIOLOGICAL WASTE: FIRST ANNUAL REPORT OCTOBER, 1960.—General Electric Co. Space Science Laboratory, Philadelphia, Pa. (Contract NASW-127). i+24 p.

A system of vacuum distillation with catalysis of vapors for the recovery of potable water from urine and feces has been developed. The apparatus will produce 180 milliliters water/hour with a system pressure of 60 millimeters Hg. The temperature of the catalyst was maintained at 1000-1200° C., and at this temperature the pH of the end product is 3.5 to 9.5. The energy requirements for the catalytic-oxidation reaction for a man-day quantity is 0.013 kilowatt-hour. One human male was fed water extracted from his own urine, and 30 rats were also given water processed from human urine. Results to date indicate no detectable physiological effects. The application of this apparatus to space travel has required various design modifications for reducing the over-all volume requirements. (Authors' conclusions, modified)

12897
Sendroy, J., 1959
and H. A. Collison
POTABLE WATER RECYCLED FROM HUMAN URINE.—Naval Medical Research Inst., Bethesda, Md. Research Report no. NM 19 02 00.01.01 (Vol. 17, p. 275-284), May 29, 1959. AD 220 837
Also published in: Aerospace Med., 30 (9): 640-649. Sept. 1959.

Two laboratory procedures were used to recover potable water from urine: distillation following acidification with sulfuric acid or treatment with potassium persulfate, and freeze-drying untreated urine in a vacuum with the recovery of a sublimate yielding almost all the original water content. In each case, the water was further purified by passage through activated carbon. The water obtained was neutral or nearly so, colorless, odorless, and tasteless, with traces of impurities such as ammonia, chloride, and some presumably organic material. When such water was made available to a colony of rats for over 30 days, their consumption averaged 12% of their body weight (the equivalent of 8 liters per day per man). Weight gains, lack of clinical symptoms, and no pathological findings at autopsy indicated an absence of any toxic effect. The analytical results and the toxicity test provide strong presumptive evidence that the water produced is suitable for human consumption. An analysis of the data leads to the conclusion that the lyophilization method is superior to the distillation procedures in yield and purity of water but requires additional time. (Authors' summary, modified)

12898
Wallman, H., 1960
and S. M. Barnett
WATER RECOVERY SYSTEMS (MULTI-VARIABLE). —Electric Boat Division, General Dynamics Corp., Groton, Conn. (Contract AF 33(616)-6425); issued by Wright Air Development Division. Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63122). WADD Technical Report no. 60-243, March 1960. vi+73 p.

A study was conducted to determine the optimum design of several urine-to-potable-water recovery systems for use on space flights having different flight durations and crew sizes. Phase change processes, solvent extraction, ion exchange, membrane processes, and integrated systems are covered. On this basis of the evidence presented, it is recommended that: (1) a simple distillation unit be used for flights of six days or more with up to two men, (2) a vapor compression system be used for long flights (four days or more) having large crews (three to twenty men), and (3) sufficient water be stored aboard the vehicle for flights of short duration. Recommendations are also made for a laboratory study of other promising methods of water recovery. A literature search is presented on the implications of a possible slow build-up of constituents or breakdown products from urine. It has been concluded that a healthy man can ingest water reclaimed from urine without incurring any harmful effects. (Authors' abstract)

12899
Zeff, J. D., 1959
and R. A. Bambenek
DEVELOPMENT OF A UNIT FOR RECOVERY OF WATER AND DISPOSAL OR STORAGE OF SOLIDS FROM HUMAN WASTES. I. THE PHASE STUDY. —American Machine and Foundry Co., Alexandria, Va. (Contract AF 33(616)-5783); issued by Wright Air Development Center. Aeromedical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63122). WADC Technical Report no. 58-562 (I), Nov. 1959. vii+47 p.

This report summarizes the results of a laboratory evaluation utilizing known techniques of water purification. Urine and feces were introduced as

raw material, and the recovered water was analyzed for solid content, presence of bacteria, color, turbidity, pH, and odor. Results of the water analyses indicate that techniques employing a change of phase are best for recovering water from human wastes. A design evaluation of the most successful laboratory techniques was then undertaken. The design considerations indicate that a vacuum distillation system is advantageous on a weight basis, providing the duration of flight is longer than three days and the number of crew is not more than two men. Compression distillation was found to be advantageous if the number of crew was larger than two and the duration of flight longer than seven days. It was found that vacuum distillation can utilize the excess heat of the cabin as energy, whereas the compression distillation energy requirement is ten watts of electrical energy per man per day. (Authors abstract)

12900

Zeff, J. D., 1961
R. B. Neveril, M. W. Norell, D. A. Davidson, and R. A. Bambenek

STORAGE UNIT FOR WASTE MATERIALS. — American Machine and Foundry Co., Niles, Ill. (Contract AF 33(616)-6861); issued by Aeronautical Systems Division. Life Support Systems Lab., Aerospace Medical Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63122). ASD Technical Report no. 61-200, June 1961. viii+64 p.

An engineering evaluation of storage techniques has indicated that the wastes generated onboard a manned aerospace vehicle are best stored at temperatures above 120° C. in a liquid disinfectant, or at temperatures below 0° C. Disposal of these wastes can be satisfactorily accomplished only by incineration and/or decomposition. No single technique has been found which would be suitable for all types of missions. A freeze drying storage unit is considered best for servicing two crew members on a three-day mission, unless the wastes can be stored in vacated refrigerated food storage compartments. Tests with a laboratory model of a freeze-drying storage unit have shown that the wastes can be easily maintained at -20° C. and that the evolved gases can be sterilized while passing through a sponge impregnated with a disinfectant. The apparent specific volume of the solid wastes was determined to be 11.2 cc./g. (Authors' abstract)

12901

Zeff, J. D., 1960
and R. A. Bambenek

SYSTEM FOR RECOVERY OF WATER FROM URINE. II. DESIGN, FABRICATION, AND TESTING OF THE PROTOTYPE SYSTEM. — Amer. Machine and Foundry Co., Niles, Ill. (Contract AF 33(616)-5783); issued by Wright Air Development Division. Aerospace Medical Division, Life Support Systems Lab., Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 63122). WADC Technical Report no. 58-562 (II), Aug. 1960. v+30 p.

A prototype vacuum distillation system for the recovery of potable water from urine was designed to operate without auxiliary power, and to function in a weightless environment. The system was tested under conditions simulating the thermal transport environment that would be found in a vehicle in extraterrestrial flight. It was found that (1) the water recovered from the system was of potable quality; (2) the over-all yield of recovered water was only 80% because of imperfect sealing in the vacuum system; and (3) the system operated satisfactorily in an inverted position (evaporator over condenser).