AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA SP-7011 (49)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA Information System during March, 1968.

Scientific and Technical Information Division
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. APRIL 1968

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In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis will be placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. The contents of this issue are comprised of abstracts that were prepared by the three contributing organizations.

Each entry consists of a standard citation accompanied by its abstract. It is included in one of three groups of references that appear in the following order:

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(continued)

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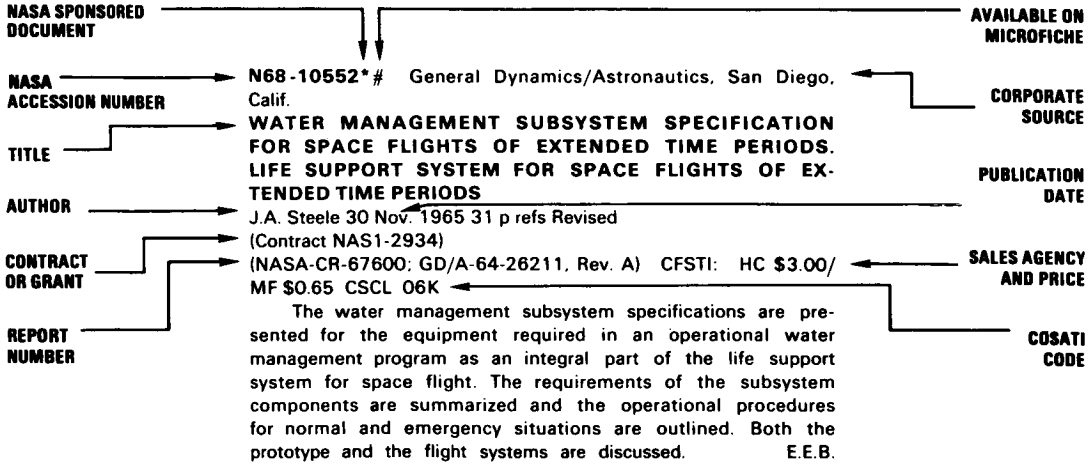
TYPICAL CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

a continuing bibliography APRIL 1968

STAR ENTRIES

N68-13920 Joint Publications Research Service, Washington, D. C.

A SPIRAL DESIGN FOR SPACE-STATION GREENHOUSES

V. G. Chuchkin 10 Jan. 1968 24 p refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1967 p 58–69

(JPRS-43943)

Various types of spacecraft greenhouses are discussed in terms of obtaining the maximum increase in plant productivity with the most economical expenditure of light energy. Equations are derived for calculating the quantity of radiant energy required, the planting area, and the coefficients of absorption and conversion of radiant energy. To achieve maximum light absorption, a method is proposed whereby the planted area is divided into gradually increasing sectors with the plants moved each day from smaller areas to larger. Three necessary conditions can then be combined into a single garden: constant leaf index, constant size of planted area, and daily harvesting. The technical difficulties of automating this method for cosmic greenhouses are assessed, and variants of the spiral-radial planting concept are discussed. It is pointed out that the development of such a technique will allow the operating regime of the greenhouse to be rapidly altered, and will permit transition from vitamin to carbohydrate plant growth in order to change the rations of the space crews. M.G.J.

N68-13947*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.

THE BIOCHEMICAL, PHYSIOLOGICAL, AND METABOLIC EVALUATION OF HUMAN SUBJECTS WEARING PRESSURE SUITS AND ON A DIET OF PRECOOKED FREEZE DEHYDRATED FOODS

Bernard J. Katchman, George M. Homer, and Dorathea P. Dunco Wright-Patterson AFB, Ohio AMRL, Jun. 1967 61 p refs Prepared jointly with AMRL

(NASA Order R-85; Contract AF 33(657)-11716)

(NASA-CR-91680; AMRL-TR-67-8) CFSTI: HC $3.00/MF $0.65 CSCL 06S

Eight human male volunteers participated in two 6-week simulated aerospace studies. During this time the subjects wore an unpressurized MA-10 pressure suit for 16 consecutive days and ate a 4-day cycle diet composed of precooked freeze dehydrated foods or a matched 4-day cycle diet composed of fresh foods. The food was served at room temperature. Each diet was comprised of about 330 g of carbohydrate, 95 g of crude protein, 87 g of fat, and 2500 kcal per day. The diets were organoleptically acceptable and efficiently utilized. Only minimal weight changes were observed. Metabolic balances showed adequate adjustment to the diets; all subjects were in positive balance for nitrogen and for the major inorganic constituents. The wearing of the MA-10 pressure suit did not affect protein or caloric requirements but water intake did increase significantly by 17%. There were no significant changes in blood pressure or oral temperature. All other clinical measurements were in the normal range of clinical values. All subjects maintained excellent health throughout all the test periods. Author

N68-13949*# Naval School of Aviation Medicine, Pensacola, Fla.

TWO DEVICES FOR ANALYSIS OF NYSTAGMUS

Fred E. Guedry, Jr. and Gene T. Turnipseed 31 Oct. 1967 22 p refs

(NASA Order R-93)

(NASA-CR-91674; NAMI-1021) CFSTI: HC $3.00/MF $0.65 CSCL 06B

An electromechanical slope computer requires manual alignment of a crosshair with the nystagmus slope. This process is much faster than unaided manual scoring because (1) the mechanical aid in slope measurement is very effective, (2) time measurement is virtually automatic, and (3) all steps after the crosshair alignment, including tabulation of digital information and plotting of analog information, are accomplished automatically. Another device comprises a standard recorder with plug-in units for area summation and timed switching. It is less versatile than the first device and is not equivalent to advanced electronic computation, but it does provide an immediate analog display and (with a digital voltmeter-printer) an immediate digital display of analyzed nystagmus. Topics discussed include sources of error in rapid processing of nystagmus and advantages of rapid processing for experimental purposes, for aviator evaluation, and for clinical application. Author

N68-13980*# Brandeis Univ., Waltham, Mass.

[A COMPARATIVE STUDY OF THE EVOLUTION OF ENZYMES AND NUCLEIC ACIDS] Semiannual Progress Report, 1 May–30 Nov. 1967

Nathan O. Kaplan, Lawrence Levine, and William S. Allison 30 Nov. 1967 5 p refs

(Grant NsG-375)

(NASA-CR-91672) CFSTI: HC $3.00/MF $0.65 CSCL 06A

The immunological approach is discussed, and it is reported that antibodies to a highly acid, brain-specific protein found in vertebrates (S-100 protein) were obtained with the purified bovine S-100 complexed with methylated bovine serum albumin as immunogen. The presence of antigenic activity in brain extracts from a number of vertebrates measured by a quantitative complement fixation technique indicated an unusually close serological

relationship among these S-100 proteins. In the enzymological approach, experiments on the heterogeneity of the multiple forms of aldolase in chicken tissues demonstrated that a third parental type (aldolase C) occurs in chicken tissues along with its hybrid forms. Summary information is included on the purification of soluble aspartate aminotransferase from chicken hearts; the purification of arginine kinase from the lobster, blue crab, and the hermit crab; the amino acid sequence of dogfish M_4 lactate dehydrogenase (LDH); the physical properties of LDH from the tail muscle of the American lobster; and the behavior of pseudomonas mutant enzymes. M.G.J.

N68-13989* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAN'S ROLE IN EARTH-ORBITING APOLLO
T. C. Helvey 23 Nov. 1966 33 p refs
(NASA-TM-X-53541) CFSTI: $3.00 CSCL 05H

The concept of man as a component in a space system is discussed from the viewpoint of acquainting engineers with the complexities involved in integrating man with the Apollo and especially of designing useful activity in the empty fuel container, the S-4-B stage. The idea of using the container as an environmental test chamber is proposed for retesting components and subsystems under true space environment conditions; the results might provide data for increasing mean time between failure during long duration space flights. Man–machine and man–man–machine relationships are discussed in relation to the new dimensions which will be required in the thinking of the design engineer, and the performance enhancements which will be achieved. Cybernetic concepts are examined in terms of the man–machine feedback process, the modification of man's rate and gain capability, and human transfer functions between visual perception and command. Problems dealing with the psychophysiological machinery of the human body are considered. M.G.J.

N68-13999* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CARDIAC R-WAVE DETECTOR
Vernon D. Gebben Washington Jan. 1968 13 p refs
(NASA-TM-X-1489) CFSTI: $3.00 CSCL 06B

A method of detecting the R-wave of the electrocardiac signal was developed for controlling the timing cycle of heart-assist pumps. Dependable separation of the R-wave from high-level electrical interferences was obtained from a circuit that contains high common-mode rejection, a band-pass filter, an amplitude detector, and a pulse-width discriminator. An experimental circuit was tested using copper surface electrodes located on the right arm and left leg. All false signals except those generated by vigorous motion or extreme muscle tensions were rejected by the circuit. Author

N68-14106*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF THE PIGTAIL MONKEY, *MACACA NEMESTRINA*, IN SPACE BIOSCIENCE STUDIES
J. W. Parcher 4 Oct. 1967 12 p Presented at 18th Ann. Meeting of Am. Assoc. for Animal Sci., Washington, D. C., 2–10 Oct. 1967
(NASA-TM-X-60822) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Project Biosatellite was established to study effects of space flight on a variety of living organisms. The study includes placing a *Macaca nemestrina* in orbit for a month. Physiological changes due to a 30-day period of weightlessness will be used to estimate the hazards to man of extended space flights planned for the near future. Colony management is designed to yield animals free of disease or other stress. Approximately 500 pigtail monkeys will be used in preliminary studies to establish a basis for evaluation of flight data. Early baseline data reveal the *Macaca nemestrina* is very similar to man in blood chemistry and serum enzyme levels. Hematological values, rate of growth, and responses to stress are comparable to those of humans of equivalent age. Author

N68-14126# Sloan-Kettering Inst. for Cancer Research, New York.
RADIATION STUDIES. 1: FREE RADICAL PRODUCTION IN BIOLOGICALLY SIGNIFICANT COMPOUNDS. 2: EXPERIMENTAL STUDY OF ELECTRON SPECTRA INSIDE IRRADIATED TISSUE FROM INTERNALLY LOCATED RADIONUCLIDES. 3: THEORETICAL INVESTIGATION OF ELECTRON LET SPECTRA AND DOSE RELATIONSHIP FOR IONIZING RADIATION Progress Report, May 1, 1966–May 1, 1967
John S. Laughlin, Ira S. Pullman, and Nikitas D. Kessaris 15 Aug 1967 10 p refs
(Contract AT(30-1)-910)
(NYO-910-57) CFSTI: HC $3.00/MF $0.65

Progress is reported on the following studies: protective mechanisms in X-irradiated systems of sulfhydryl compounds with nucleic acids; electron spin resonance spectroscopy of irradiated bone samples; studies on negative ions of polycyclic hydrocarbons; and ESR spectra of uv-irradiated purine N-oxides. NSA

N68-14166* California Univ., Santa Barbara.
INTERRELATIONS OF PERCEIVED SIZE AND DISTANCE Semiannual Progress Report, Jun.–Dec. 1967
Walter C. Gogel Dec. 1967 8 p refs
(Grant NGR-05-010-010)
(NASA-CR-91702) CFSTI: $3.00 CSCL 05J

An experiment is described which investigates the existence of a tendency to perceive objects at some particular specific distance. It is felt that there may be such a tendency, and the significance of such a tendency is discussed. Theory on the perception of size in a distorted room is briefly described. N.E.N.

N68-14195*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF PASSIVE TEMPERATURE AND HUMIDITY CONTROL SYSTEMS FOR ADVANCED SPACE SUITS. Interim Report, 1 Jul. 1966–1 Sep. 1967
Arnold P. Shlosinger Sep. 1967 77 p refs
(Contract NAS2-3817)
(NASA-CR-73168; TRW-06462-6002-R000) CFSTI: HC $3.00/MF $0.65 CSCL 06K

Investigations were performed to develop techniques for control of temperature in an extravehicular space suit by passive means. These techniques are intended to be integrated with techniques for passive control of humidity in space suits. The techniques investigated are based on the use of the external suit surface as thermal radiator for rejection of excess metabolic heat and on a space suit shell of controllable overall thermal conductance. The controllable thermal conductance is achieved by a system of thermal insulation which is bypassed by devices similar to "Heat Pipes", modified to provide controllable heat flow rates and geometries applicable to a space suit. Theoretical and experimental investigations demonstrated feasibility of the concept of a variable thermal conductance heat pipe. Concepts for the integration of a variable thermal conductance heat pipe into the fiberglass shell of a hard space suit were developed and fabrication techniques generated. Author

N68-14206*# Bellcomm, Inc., Washington, D. C.
MEDICAL REQUIREMENTS IN SUPPORT OF LONG DURATION MANNED SPACE FLIGHT
D. B. Hoffman and A. N. Kontaratos 20 Nov. 1967 48 p refs
(Contract NASw-417)
(NASA-CR-91806; TR-67-710-1) CFSTI: HC $3.00/MF $0.65 CSCL 06S

The objective of this study is to suggest a broad medical program in support of advanced manned missions. Twelve factors which concern the general health and performance of the crew are examined; appropriate decisions necessary to prevent or rectify possible failures are established; engineering implications are discussed; and pertinent ground-based or in-flight studies are proposed. These factors include: weightlessness, radiation, meteoroids, extraterrestrial life, magnetic fields, habitability, atmospheric contaminants, mechanical forces, artificial atmospheres, nutrition, and medical care. From this analysis eleven major medical decisions were identified, their significance discussed and their implications reviewed. Finally, research activities were integrated into a program sequence and medical decisions were time phased to illustrate both the type of planning required and the extent of interoffice coordination needed to support a pacing goal. Author

N68-14221*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
[SCOPE OF WORK FOR SCIENTIFIC AND TECHNICAL ASSISTANCE FOR THE PLANETARY QUARANTINE MISSION] Quarterly Report, Period Ending 31 Dec. 1967
Dec. 1967 13 p refs
(NASA Order R-09-019-040; NASA Order H-13245A)
(NASA-CR-91668; QR-7) CFSTI: HC $3.00/MF $0.65 CSCL 06M

Various activities being studied in spacecraft contamination control are outlined. These pertain to (1) sterilization model for microbial deactivation, (2) statistical estimates of space vehicle microbial burdens, (3) retrieval of terrestrial microorganisms from the lunar surface, (4) laminar flow clean rooms, and (5) contamination control principles and study. B.S.D.

N68-14243*# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Biotechnology and Power Dept.
ANALYTICAL SIMULATION OF THE LANGLEY RESEARCH CENTER INTEGRATED LIFE-SUPPORT SYSTEM, VOLUME 1
B. N. Taylor and R. S. Barker Jan. 1968 48 p refs
(Contract NAS1-6448)
(NASA-CR-66454; DAC-59177, V. 1) CFSTI: HC $3.00/MF $0.65 CSCL 06K

Two analytical models were prepared for the simulation of the integrated life support system (ILSS) and the oxygen recovery system. Sample problems for the ILSS model include performance analyses of the design and off-design, an improved modified subsystem component, the failure mode, and a potential servo system for control of compartment temperature. A sample problem for the O_2-regeneration system model was formulated to determine component characteristics required to achieve performance goals. Compared analytical and experimental data show good agreement in values obtained for cabin temperature, absolute humidity, and CO_2 partial pressure. Recommended are long-range improvements, corresponding to advances in the state of the art of simulation methods, and short range improvements consisting of minor changes of input data. B.S.D.

N68-14258# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A LOOK AT SIMULATION THROUGH A STUDY ON PLANKTON POPULATION DYNAMICS
C. R. Cole Aug. 1967 19 p ref
(Contract AT(45-1)-1830)
(BNWL-485) CFSTI: HC $3.00/MF $0.65

The annual cycle observed in the population dynamics of estuarine phytoplankton and zooplankton was simulated according to the model developed by Davidson and Clymer. This simulation demonstrated the usefulness of analog computer modeling in studying ecological systems. The report contains several examples in which the effect of parameter changes are predicted by the model. A typical result indicated that an increase in phytoplankton death rate increased the magnitude of the spring algal bloom. Results such as this, that contradict intuition, bring ecological mechanisms to light that might otherwise remain undiscovered. Author (NSA)

N68-14262*# Serendipity Associates, Chatsworth, Calif.
A DESCRIPTIVE MODEL FOR DETERMINING OPTIMAL HUMAN PERFORMANCE IN SYSTEMS, VOLUME 1
Washington NASA Jan. 1968 166 p refs
(Contract NAS2-2955)
(NASA-CR-876) CFSTI: HC $3.00/MF $0.65 CSCL 05H

CONTENTS:
1. A SIMPLE MODEL OF A MAN-MACHINE DEVELOPMENT CYCLE, PART A J. J. Wulff and J. N. Leonard 129 p refs (See N68-14263 05-05)
2. A SIMPLE CALCULUS FOR DISCRETE SYSTEMS, PART B J. J. Wulff, A. F. Pixley (Harvey Mudd Coll.), and J. N. Leonard 31 p refs (See N68-14264 05-19)

N68-14263*# Serendipity Associates, Chatsworth, Calif.
A SIMPLE MODEL OF A MAN-MACHINE DEVELOPMENT CYCLE, PART A
J. Jepson Wulff and John N. Leonard *In its* A Descriptive Model for Determining Optimal Human Performance in Systems, Vol. 1 Jan. 1968 129 p refs (See N68-14262 05-05)

A model is presented for system managers who predict and control the course of a complex aerospace system development cycle so that the system will include man in an optimal manner. Emphasis was placed on serving the needs of system managers concerned with personnel products rather than the needs of hardware engineers. Technical terms used in evolving the model are discussed. An eight-function index model was prepared to provide both detail in a small area and also an overview of the whole. Details are given on the full development cycle model, and uses of the model are described. It is pointed out that the management set includes technical and general management at all levels, and that the modeling technique is readily translated into a PERT model. N.E.N.

N68-14274*# Naval School of Aviation Medicine, Pensacola, Fla.
EFFECT OF HYPOXIA ON MYOCARDIUM IN HEART–LUNG PREPARATION
N. S. Nejad and Eric Ogden 13 Nov. 1967 14 p refs Prepared jointly with NASA
(NASA-CR-91676; NAMI-1024) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Starling heart–lung preparations were ventilated with various mixtures of oxygen, nitrogen, and carbon dioxide, and the performance of the heart was evaluated by relating stroke work to left atrial pressure. At oxygen tensions of arterial blood between 65 mm Hg and 25 mm Hg performance improved. At 20 mm Hg or lower the performance was impaired but the impairment was reversible. The impairment was accompanied by an accumulation of lactate and pyruvate in the blood which also was reversible as oxygen tension was restored. Possible mechanism of these changes is discussed. Author

N68-14326# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PACIFIC NORTHWEST LABORATORY. VOLUME 2: PHYSICAL SCIENCES. PART 4: INSTRUMENTATION Annual Report, 1966

D. W. Pearce, ed. and M. R. Compton, ed. Aug. 1967 51 p ref

(Contract AT(45-1)-1830)

(BNWL-481, V. 2, Pt. 4) CFSTI: HC $3.00/MF $0.65

Instrumentation development for work in the physical sciences is reviewed. Fourteen studies are described under the following headings: aquatic environment dose rate monitor; miniature dose rate measurement instrument; life-time and half-life control of scanner for whole body radiation counter; measurement of mixed field neutron and gamma dose rates; wound counting with solid state detectors; counting of plutonium in the lung; animal activity monitor apparatus; tidal volume air measurement; accelerator ion beam current regulator; electronics development for solid state diode detectors; surface contoured diodes; X-ray/alpha studies with solid state detectors; neutron sensitive criticality alarm system; and raindrop charge measuring systems. E.C.

N68-14329* Naval School of Aviation Medicine, Pensacola, Fla.

A COUNTERROTATOR FOR HUMAN CENTRIFUGE APPLICATION

W. Carroll Hixson and John J. Anderson 27 Oct. 1967 13 p refs

(NASA Order R-93)

(NASA-CR-91677; NAMI-1020) CFSTI: $3.00 CSCL 06B

A man-rated vestibular research device, the Counterrotator (CORO), has been developed to investigate man's response to the dynamic linear acceleration environment afforded by counterrotation aboard a centrifuge. The device proper is a small earth-vertical rotator which utilizes a dc torque motor operated as a closed-loop position servo to turn a seated subject about his *z* head axis. When installed aboard the radial arm of the Coriolis Acceleration Platform (CAP), a centrifuge-like rotator, the CORO drive system will track the angular motions of CAP over the 0- to 100-deg/sec velocity range at angular accelerations extending to 15 deg/sec^2. The device is rated to achieve this 1:1 counterrotation capability in low-level, variable magnitude, centripetal acceleration fields extending from 0 to 1.75 *g* nominal. Author

N68-14330*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.

THE POTENTIAL HAZARD OF STAPHYLOCOCCI AND MICROCOCCI TO HUMAN SUBJECTS IN A LIFE SUPPORT SYSTEMS EVALUATOR AND ON A DIET OF LIQUID FOODS

Leonard R. Lotter, Bonnie S. Horstman, and Joseph V. Rack Wright-Patterson AFB, Ohio AMRL Sep. 1967 43 p refs Prepared jointly with AMRL

(NASA Order R-85; Contract AF 33(657)-11716)

(NASA-CR-91678; AMRL-TR-67-21) CFSTI: HC $3.00/MF $0.65 CSCL 06S

Two groups of 4 human male subjects participated in 6-week simulated aerospace studies. The subjects were confined and kept under controlled metabolic conditions; during this time, 28 consecutive days were spent in the Life Support Systems Evaluator. The subjects ate diets composed either of fresh food or liquid food. The subjects were exposed to simulated aerospace stress of confinement, (wearing an unpressurized MA-10 space suit), experimental diet, and minimal personal hygienic conditions. Body and environmental areas were sampled and the catalase-positive gram-positive cocci isolated were tested for production of coagulase, deoxyribonuclease, hemolysin, gelatinase, and utilization of mannitol. The results show that there were no significant differences in the frequency of occurrence of biochemical types among subjects and among environmental areas. There were significant differences in frequency of occurrence of biochemical types on ear, nose, throat, mouth, axilla, groin, and glans penis. There was no buildup of biochemical types with time in any test condition. Two phage types, UC-18 and 79, were recovered. Phage type UC-18 was transferred from subject to environment but not vice versa or among other subjects. Phage type 79 was not transferred at all. The subjects remained healthy without any decrease in resistance to infection throughout all test conditions. Those body areas most likely to harbor potentially pathogenic staphylococci are the ears and nose. Author

N68-14335* National Aeronautics and Space Administration, Washington, D. C.

CONTRIBUTION OF A DEVELOPMENTAL INTEGRATED LIFE SUPPORT SYSTEM TO AEROSPACE TECHNOLOGY

J. N. Pecoraro, A. O. Pearson (NASA. Langley Res. Center), G. L. Drake (Gen. Dyn./Convair), and J. R. Burnett (Gen. Dyn./Convair) 1967 17 p refs Presented at the AIAA 4th Ann. Meeting and Tech. Display, Anaheim, Calif., 23–27 Oct. 1967

(NASA-TM-X-60799) CFSTI: $3.00 CSCL 06K

The Integrated Life Support System (ILSS) at NASA Langley (LRC) is discussed. The ILSS program to date has demonstrated: (1) the feasibility of the regenerative integrated life support system concept; (2) that designs which provide ease of maintenance, high reliability, and minimal logistics are not now within the state-of-the-art; (3) that fluid leakage problems, both liquid and gaseous, will continue to be a significant challenge for development; (4) many of the limitations existing within the technology to meet the crew comfort requirements of long duration missions especially as related to air circulation, noise, and vibration. Author

N68-14359# Florida Presbyterian Coll., St. Petersburg. Neuro-Sciences Lab.

BIOPHYSICS OF INTRACRANIAL SELF-STIMULATION Final Report, 1 Nov. 1966–31 Jul. 1967

W. F. Angermeier and Darryl Boyd Neill Holloman AFB, N. Mex. 6571st Aeromed. Res. Lab. Nov. 1967 53 p refs

(Contract F29600-67-C-0011)

(ARL-TR-67-25; AD-662617)

A self-stimulation and E-controlled stimulation study was completed in one rat. The study supports the two-factor model of the self-stimulation mechanism which predicts (1) the shape of self-stimulation curves and changes in stimulation rate as a function of stimulation parameters, (2) dual autonomic effects of self-stimulation, (3) stimulus-bound feeding and self-stimulation at the same electrode site, (4) on-off behavior, and (5) changes in the above with changes in anatomical locus. Author (TAB)

N68-14365# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

PROVISIONAL AEROSPACE WATER STANDARDS—1964 Final Report, 1962–1963

A. R. Slonim and A. J. Roth, Jr. Dec. 1966 25 p refs

(AMRL-TR-66-252; AD-662611)

Provisional potable water standards, patterned after the 1962 USPHS Drinking Water Standards, were formulated for application to aerospace systems. In comparison with USPHS standards, the recommended maximal allowances have been raised (relaxed) at least 80%, with the majority increased from two- to five-fold, for the following 16 out of 20 chemical constituents: alkyl bensene sulfonate, arsenic, barium, cadmium, chloride, copper, cyanide, iron, lead, manganese, nitrate, phenols, selenium, silver, total dissolved solids, and zinc. Four constituents, carbon chloroform extract, chromium, fluoride and sulfate, remain relatively unchanged. The radiological requirements are the same as USPHS for

radium226, strontium90 and gross beta emitters. The only change in the physical properties concerning turbidity, color, odor and taste in these standards as compared with USPHS is a fivefold increase in the turbidity level. For the microbiological quality of water, it has been recommended (at this time) that the potable water be free of all microorganisms to minimize potential health hazards to aerospace personnel. The importance of selection of materials for aerospace systems, improvement in analytical methods (e.g., detection of organic contaminants), and resolution of problems needing attention to the development of permanent potable water standards is discussed. Author (TAB)

N68-14380 National Institutes of Health, Bethesda, Md. Translating Unit.
OPTICAL INVESTIGATIONS OF COMPLEXES AND NUCLEIC ACIDS AND DYES
V. I. Permogorov, L. A. Serdiukova, Iu. S. Lazurkin, and I. A. Sladkova 30 Nov. 1967 26 p refs Transl. into ENGLISH from the Publ. "Struktura, Svoistva i Geneticheskie Funktsii DNK", 1966 p 111–138 Presented at Conf. of the Radiobiol. Div. of the I. V. Kurchatov Inst. of Atomic Energy, Moscow, 8–11 Jun 1966
(Rept.-11-32-67)

The anomalous optical rotatory dispersion (AORD) of pinacyanol (PNC) complexes with DNA has been studied. The dependence of AORD on the concentration and highly asymmetrical form of its curve permitted us to come to a conclusion, that PNC becomes optically active only when PNC dimeres are bound to the native DNA. The temperature dependence of amplitude of AORD PNC–DNA complexes also has been studied. It is demonstrated, that the magnitude of optical activity increases markedly with increasing temperature not far from the melting point and then decreases practically to zero, when DNA becomes wholly denatured. The cause of the increase of AORD is as follows: PNC is better bound to the native DNA, than to the denatured DNA, and in partially denatured DNA the dimerization increases. The form of the AORD curves is highly dependent on the conformation of the nucleic acids. The AORD was also observed in cases of formation of PNC–RNA and PNC—synthetic polynucleotides complexes. Author

N68-14426# United Kingdom Atomic Energy Authority, Harwell (England).
DOSIMETRIC AND RADIOBIOLOGICAL EXPERIMENTS WITH FAST NEUTRONS, PART 1
K. G. Zimmer [1967] 18 p refs Transl. into ENGLISH from Strahlentherapie (Munich), v. 63, 1938 p 517–527
(NP-TR-1575) CFSTI: HC $3.00/MF $0.65

The adaptation of a small tissue-equivalent ionization chamber for use in fast neutron dosimetry is described. Fundamental principles and fundamental testing of the method are discussed NSA

N68-14500# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
VALIDITY OF THE HUMAN 17-HYDROXYCORTICOSTEROID/CREATININE RATIO Final Report, Apr. 1966–May 1967
Henry B. Hale and Ira L. Shannon Sep. 1967 6 p refs
(SAM-TR-67-89; AD-662609)

Short-term and long-term trends for urinary creatinine excretion rate, 17-hydroxycorticosteroid (17-OHCS) excretion rate, and the 17-OHCS/creatinine ratio were investigated, utilizing data obtained from 11 healthy men during forenoon and afternoon periods on 5 consecutive days in each of 4 consecutive weeks. Creatinine excretion rate did not show significant forenoon-afternoon variation, but there was forenoon-afternoon variation ($P < .01$) for both 17-OHCS excretion rate and the 17-OHCS/creatinine ratio, each declining as time proceeded. Using creatinine as the base for 17-OHCS did not cause distortion; instead, there was a statistical gain, as the variance was then lessened. Significant week-to-week variation was detected only in afternoon data, and it was limited to creatinine excretion rate ($P < .001$) and 17-OHCS excretion rate ($P < .01$), both declining progressively over the 4-week test period. Since the 17-OHCS/creatinine ratio did not show week-to-week variation, it was concluded that creatinine acted as a correction factor, eliminating the long-term variation in 17-OHCS. Author (TAB)

N68-14505# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
GENERAL DESCRIPTION AND EVALUATION OF AN ON-LINE OXYGEN UPTAKE COMPUTER
Abbott T. Kissen, Donald W. McGuire (Dayton Univ.), and John J. Sterling (Technol., Inc., Dayton, Ohio) Jun. 1967 44 p refs Prepared jointly with Dayton Univ. and Technol., Inc.
(Contracts AF 33(615)-2182; AF 33(615)-3230)
(AMRL-TR-67-17; AD-662624)

A series of experiments has been designed to evaluate the performance of an oxygen uptake computer. The Model OCC-2500 oxygen uptake computer is an electronic instrument including a mask-sensor assembly and a special-purpose analog computer. Intended for the analysis of respiratory gases in human subjects, the system produces a real-time analog voltage proportional to the oxygen uptake in one minute or other time periods controlled by the operator. Expired air samples, monitored by the polarographic oxygen sensor and mass gas flowmeter of the computer system were simultaneously collected in a gasometer and analyzed by gas chromatography. Oxygen uptake values (200-3200 cc/min) obtained from 15 subjects (297 observations) during rest and after exercise produced a sample correlation coefficient of 0.998. Subjects enjoy virtually unrestrained mobility using the device, in that attachment to monitoring equipment is limited to electrical leads. Personnel support requirements and errors, associated with conventional procedures, are significantly reduced. The compact nature of the device permits application in almost any experimental design situation including presurized suits and underwater studies. Author (TAB)

N68-14511# Tech Development, Inc., Dayton, Ohio.
THE DEVELOPMENT OF A TURBINE-DRIVEN CIRCULATING BLOWER FOR MANNED AEROSPACE ENCLOSURES Final Report, Jun. 1965–Feb. 1967
Joseph Flatt Wright-Patterson AFB, Ohio AMRL Aug. 1967 28 p refs
(Contract AF 33(615)-2965)
(AMRL-TR-67-126; AD-662623)

Analytical and experimental studies were conducted to determine an optimum turbine-driven circulating blower powered by energy available from high- pressure breathing oxygen. The studies included experimental determination of optimum turbine and nozzle geometries and the development of a complete circulating blower, with an available oxygen flow of 0.2 pound per hour, the blower can circulate 3.93 CFM at a back pressure of 0.2 inch of water in an ambient temperature, 5-psia atmosphere. Total weight of the unit was 3 ounces. The experimental unit operated reliably; however, additional testing is necessary to establish its suitability for use in a manned space enclosure. Author (TAB)

N68-14512# School of Aerospace Medicine, Brooks AFB, Tex.
DESIGN AND DEVELOPMENT OF A DIGITAL CARDIOTACHOMETER

Adolph W. Foeh, Jr. Apr. 1967 8 p refs Presented at the 19th Ann. Southwestern IEEE Conf. and Exhibition, Dallas Submitted for publication
(SAM-TR-66-334; AD-662329)

The paper describes the design of a digital cardiotachometer with an accuracy of greater than one beat per minute and a range of 40 to 200 beats per minute. At each beat of the heart, the time interval between that beat and the previous beat is converted to rate and presented on output lines in parallel binary form suitable for recording on digital magnetic tape. Author (TAB)

N68-14611# California Univ., Berkeley. Lawrence Radiation Lab.
OPTICAL PROPERTIES OF RIBONUCLEIC ACIDS PREDICTED FROM OLIGOMERS
C. R. Cantor, S. R. Jaskunas, and I. Tinoco, Jr. *In its* Chem. Biodyn. 1 May 1967 p 18–19 refs (See N68-14606 05-06)

In view of the complexity of the problem of RNA conformation, what is needed is a set of simple model systems. These are the oligoribonucleotides. We expect that most of the properties of RNA should eventually be explainable in terms of the properties of its smaller components. Towards this end we are studying the conformational properties of oligonucleotides. In this paper we shall use some of the results obtained with oligomers to analyze the properties of polymers. Here we shall be mostly concerned with ultraviolet optical properties. The major advantage of ultraviolet spectra and optical rotatory dispersion is that experiments can be performed with very small quantities of material. Thus there is available a wealth of experimental data. Author

N68-14612# California Univ., Berkeley. Lawrence Radiation Lab.
CHLOROPHYLL–CHLOROPHYLL INTERACTIONS
Edward A. Dratz, Alfred J. Schultz, and Kenneth Sauer *In its* Chem. Biodyn. 1 May 1967 p 20–30 refs (See N68-14606 05-06)

The circular dischronism and absorption spectra of dimers of chlorophylls A and B and bacteriochlorophyll in carbon tetrachloride solutions and of suspended crystalline chlorophyll A are presented. The dimers of all three chlorophylls seem to have a very similar structure. The chlorophyll–chlorophyll interactions in the dimer give rise to very large optical activity relative to the monomer. The circular dischroism and absorption spectra of photosynthetic particles (barley quantasomes containing chlorophylls A and B, quantasomes prepared from a barley mutant that lacks chlorophyll B, and R rubrum and R spheroides chromatophores that contain bacteriochlorophyll) are also presented. Author

N68-14613# California Univ., Berkeley. Lawrence Radiation Lab.
FREEZE-ETCHING OF CHLOROPLASTS FROM GLUTARALDEHYDE-FIXED LEAVES
Roderic B. Park and Daniel Branton *In its* Chem. Biodyn. 1 May 1967 p 33–38 refs (See N68-14606 05-06)

Freeze-etching as a preparative technique for electron microscopy has been in use almost 12 years. Its initial application was to studies of virus morphology, but improvements in methodology have opened many new applications. The technique basically consists of rapidly freezing biological material and then breaking the frozen specimens in a vacuum. The surface so exposed is replicated, and the replica is observed by electron microscopy. The degree of etching is controlled by the time elapsed between breakage and replication and by the temperature of the specimen. Studies on chloroplast morphology by this technique have been reported by Muhlethaler, Moor, and Sarkowski and by Branton and Park. These two studies, although based on almost identical data, have produced very different interpretations. The major points of interpretive disagreement between the two studies are reviewed here, and some new data pertinent to the arguments are presented. Author

N68-14614# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOSYNTHESIS BY ISOLATED CHLOROPLASTS
R. G. Jensen and J. A. Bassham *In its* Chem. Biodyn. 1 May 1967 p 40–43 refs (See N68-14606 05-06)

Intact and freshly harvested and healthy spinach leaves gave a CO_2 fixation rate of 245 μmoles CO_2/mg Chl/hr. Chloroplasts prepared the same day from leaves from the same plants gave a fixation rate of 155 μmoles CO_2/mg Chl/hr. This rate with isolated chloroplasts was obtained over a period of 6 min following 3 min preillumination. Thus the isolated chloroplasts, for a limited period of time, assimilated carbon dioxide at a rate that was 63% of the in vivo photosynthetic rate. Author

N68-14615# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOSYNTHESIS BY ISOLATED CHLOROPLASTS. 2: DISTRIBUTION OF ^{14}C-LABELED PRODUCTS BETWEEN CHLOROPLASTS AND SUPERNATANT SOLUTION
J. A. Bassham, R. G. Jensen, and Martha Kirk *In its* Chem. Biodyn. 1 May 1967 p 44–48 refs (See N68-14606 05-06)

In these studies, chloroplasts were isolated from freshly grown spinach and then suspended in the usual assay medium. In the first experiment, after a period of 3 min preincubation, ^{14}C-labeled bicarbonate was added to the chloroplasts and, over a period of 40 min photosynthesis, samples were taken for analysis. In a second experiment, chloroplasts were isolated and preilluminated as just described. However, ^{32}P-labeled phosphate was added at the beginning of the preillumination period and ^{14}C-labeled bicarbonate was added after 4 min of preillumination with the radiophosphorus. One sample was taken just before the addition of $^{14}CO_2$, and other samples were taken periodically after the addition of bicarbonate. Author

N68-14616# California Univ., Berkeley. Lawrence Radiation Lab.
SEARCH FOR δ-AMINOLEVULINIC ACID AS A PRODUCT OF METHANE–AMMONIA–WATER IRRADIATION
Margaret A. Smith, Ahmed Choughuley, and Richard M Lemmon *In its* Chem. Biodyn. 1 May 1967 p 77–79 refs (See N68-14606 05-06)

Our understanding of how the porphyrins may have appeared on the primitive, prebiotic Earth is still in an unsatisfactory state. It is generally assumed that they may have appeared abiogenetically following the now established biosynthetic route. That a similar route may have been followed on the prebiotic Earth is indicated by the recent work of Szutka in this Laboratory. He found that the ultraviolet irradiation of δ-ALA, under primitive Earth conditions, converted about half of this compound to a pyrrolic compound—the latter was not specifically identified. The question remains: is δ-ALA a product of CH_4–NH_3–H_2O irradiations? This report details our efforts, so far unsuccessful, to establish it as such a product. Author

N68-14671* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY—A CONTINUING BIBLIOGRAPHY WITH INDEXES
Nov. 1967 172 p refs
(NASA-SP-7011(43)) CFSTI: $3.00 CSCL 06S

The abstracts and annotated indexes were selected from those introduced into the NASA Information System during October 1967. The references were previously announced by the Library of Congress, the American Institute of Aeronautics and Astronautics, and NASA. The emphasis is placed on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. N.E.N.

N68-14672 National Institutes of Health, Bethesda, Md.
TYPES OF VEGETATIVE SHIFTS IN MAN DURING EMOTIONAL STRESS
L. P. Grimak and V. A. Ponomarenko 1967 8 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 17, no. 3, 1967 p 408–412

The reactions of the cardiovascular and respiratory systems produced by negative emotions were studied in novice parachutists and also in experienced aviators under conditions of failures in the automatic control. The subjects were put under hypnosis and the jump or emergency situation was reproduced. Stenosis in the peripheral blood vessels was noticed in all individuals. Shifts in the minimal and maximal arterial pressure are described for the parachutists. The differences between the reactions of the experienced and those of the inexperienced men are discussed. N.E.N.

N68-14725* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY—A CONTINUING BIBLIOGRAPHY WITH INDEXES
Oct. 1967 153 p refs
(NASA-SP-7011(42)) CFSTI: $3.00 CSCL 06S

The abstracts and indexes were selected from those introduced into the NASA Information System during September 1967. They appeared previously in the separate journals of the Library of Congress, the American Institute of Aeronautics and Astronautics, and NASA. The emphasis is placed on the biological, physiological, psychological, and environmental effect to which man is subjected during aerospace flight. N.E.N.

N68-14737*# Harvard Univ., Boston, Mass. Thorndike Memorial Lab.
A STUDY OF PHYSIOLOGICAL MECHANISMS AND INTER-RELATIONS BETWEEN SYSTEMIC AND REGIONAL BLOOD VOLUME, BLOOD FLOW AND ELECTROLYTE BALANCE Interim Progress Report, Jun. 30–Dec. 31, 1967
Walter H. Abelmann and Laurence E. Earley 31 Dec. 1967 6 p refs
(Grant NsG-595)
(NASA-CR-91703) CFSTI: HC $3.00/MF $0.65 CSCL 06P

Mechanisms for regulating sodium excretion in dogs were explored, and the role of atrial size and function upon the excretion of a sodium load in both men and dogs were investigated. The circulatory response of patients with cardiovascular disease to upright title was studied. L.S.

N68-14739# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
ON THE FORMULATION OF CONSTITUTIVE EQUATIONS FOR LIVING SOFT TISSUES
William Prager Nov. 1967 12 p refs
(Grant AF-AFOSR-1186-67)
(AFOSR-67-2599; AD-662594)

Soft living tissues deform freely under negligible stresses until a certain strain level is reached at which their stiffness increases sharply. Constitutive equations are developed that describe this kind of mechanical behavior and include Hookes law as a limiting case. It is shown that, similar to Hookes law, these constitutive equations assure uniqueness of solution for a broad class of boundary value problems. Possible extensions of the theory are briefly indicated. Author (TAB)

N68-14752 Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
A PORTABLE DEVICE FOR THE MEASUREMENT OF EVAPORATIVE WATER LOSS
G. E. Funkhouser and S. M. Billings Aug. 1967 10 p refs
(AM-67-17)

A portable device was developed for the precise measurement of evaporative water loss. Under appropriate conditions the measurement of evaporative water loss may be used as an index of emotional stress in flying personnel. The apparatus incorporates a thermal conductivity cell as a moisture sensor, a proportional heater control to maintain the cell at the proper temperature, and a compressed air circuit to act as a carrier for water vapor. The unit is entirely battery powered. Author

N68-14770# Utah Univ., Salt Lake City. College of Medicine.
PERIODICITY IN THE AUTONOMIC DISCHARGE Final Report
Edward R. Perl 1 Nov. 1967 5 p refs
(Grant AF-AFOSR-748-65)
(AFOSR-67-2742; AD-662596)

Rhythmic activity of short duration is well known in the autonomic nervous system. There is evidence of rhythmic activity on a much longer phasic basis, something like one hour. This research investigates the longer phasic activity and attempts to determine its causes. Author (TAB)

N68-14788# Southwest Research Inst., San Antonio, Tex.
HIGH SENSITIVITY NUCLEAR MAGNETIC RESONANCE FOR THE QUANTITATIVE ANALYSIS OF BODY FLUIDS Final Report, 1 Aug. 1966–1 Feb. 1967
G. A. Persyn, J. M. Victor, and W. L. Rollwitz Brooks AFB, Tex. School of Aerospace Med. Aug. 1967 27 p refs
(Contract F41609-67-C-006)
(SAM-TR-67-70; AD-662323)

Magnetic resonance measurements on the electronic (free radicals) and nuclear (protons) moments in diphenylpicrylhydrazil were made using a superconducting tuned circuit as the sensing element. Two operating frequencies, 30 MHz and 0.95 MHz, were used in these experiments. Signal-to-noise improvements between 5,000 and 16,000 were obtained over the non-superconducting mode. The quality factor of the superconducting resonant circuits ranged from a low of 10,000 to a high of 2,800,000. A major limitation to high quality factor was the low temperature loss properties of the dielectrics used in the construction of the tuned circuit. Three types of detection schemes were used: (1) Rollins type, (2) Rollins type with MOS Fet amplifier held at 4.2K., and (3) Robinson-type marginal oscillator. Design criteria are presented to circumvent line broadening due to magnetic flux expulsion of the Meissner effect from the superconducting radiofrequency coil. Author (TAB)

N68-14795# Melpar, Inc., Falls Church, Va.
CRYOGENICALLY TRAPPED TRACE CONTAMINANTS ANALYZED BY IONIZING GAS CHROMATOGRAPHY
Hannibal De Schmertzing, Sol S. Nelson, and Harold G. Eaton Brooks AFB, Tex. School of Aerospace Med. Aug. 1967 15 p ref
(Contract AF 41(609)-2958)
(SAM-TR-67-68; AD-662330)

The purpose of this work was to determine quantitatively the concentration of microcontaminants in a sealed environmental system. The separation and identification of the cryogenically trapped trace contaminants were accomplished with liquid gas chromatography using a flame ionization detector. Thirty-nine sets of samples were analyzed, each set consisting of 3 cylinders. Nine sets of samples were taken during a manned simulator run

conducted at Brooks Air Force Base in October to November 1965, 29 sets from a similar run conducted in March to April 1966, and one sample set from a trapping efficiency run. The compounds contained in the sample cylinders were identified by their time of elution from a column and the amount measured with the aid of peak areas. The response characteristics of the chromatography were calculated from responses obtained with standard mixtures. Author (TAB)

N68-14799# Bureau of Mines, Pittsburgh, Pa.
PERFORMANCE OF OPEN CIRCUIT SELF CONTAINED BREATHING APPARATUS AT −25°F
E. J. Kloos, L. D. Raymond, and L. Spinetti Feb. 1968 21 p refs
(BM-RI-7077)

Self-contained breathing apparatus of the compressed air demand type were evaluated at low temperature. Apparatus durations, breathing resistances, and airflow rates were measured on machine tests at room temperature and −25°F. Man tests under actual wearing conditions verified the machine test results. Many serious functional changes in apparatus performance occurred at low temperature. Pressure regulators malfunctioned when diaphragms lost flexibility. Under certain conditions frozen condensed moisture sealed exhalation valves and fogged eyepieces. High-pressure leaks, not encountered at ordinary temperature, developed at low temperature. Tests results are discussed for each apparatus, recommendations are given to obtain optimum performance. Author

N68-14807*# George Washington Univ., Washington, D. C.
BIBLIOGRAPHY ON PLANETARY QUARANTINE. VOLUME 2: ENVIRONMENTAL MICROBIOLOGY
Donald E. Wright Nov. 1967 74 p refs
(Contract NSR-09-010-027)
(NASA-CR-91805) CFSTI: HC $3.00/MF $0.65 CSCL 06M

Citations concerned with microbial growth, detection, identification, and monitoring throughout spacecraft fabrication are presented. A permuted index of key works appearing in the title of each of the articles is included. C.T.C.

N68-14889*# Northrop Corp., Hawthorne, Calif. Systems Labs.
ORBITING EXPERIMENT FOR STUDY OF EXTENDED WEIGHTLESSNESS. VOLUME 2: SYSTEM DEFINITION
Dec. 1967 151 p refs
(Contract NAS1-6971)
(NASA-CR-66508; NSL-67-300, V. 2) CFSTI: HC $3.00/MF $0.65 CSCL 06S

Summary results are presented on a definition study of a spacecraft system, planned as a lunar excursion module substitute on an Apollo Applications Program (AAP) flight, and intended to support two primates in unattended, weightless, earth orbit for periods of 6 months to one year. The primates are to be recovered by astroxaut extravehicular activity and returned to earth in retrieval canisters within the command module. Experiment requirements are delineated as to mission profiles, primate environment and life support, metabolic exchange, and environmental control. The Saturn/AAP interfaces are examined in relation to operational constraints, launch vehicle configurations, and the acceleration, acoustical vibration, and thermal environments. The overall mission profile indicates the major events and time intervals, communications requirements, and astronaut participation. The functional requirements of the subsystems are defined, and alternate missions and configurations are considered. Preliminary reliability assessments and subsystems evaluation are also included. M.G.J.

N68-14947*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LIFE SUPPORT SYSTEMS FOR EXTRAVEHICULAR ACTIVITY
Harold J. McMann, Elton M. Tucker, Marshall W. Horton, and Frederick T. Burns *In its* Gemini Sum. Conf. 1967 p 67–77 (See N68-14941 05-30)

Life support systems designed for manned extravehicular activities which were developed during the Gemini Program are described. The system described consisted of a space suit, a portable environmental control system, and an umbilical link with the spacecraft. Analyzed is the development of this system and related components from the original concepts through the modifications imposed by specific missions. S.C.W.

N68-14948*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BODY POSITIONING AND RESTRAINTS DURING EXTRAVEHICULAR ACTIVITY
David C. Schultz, Hilary A. Ray, Jr., Eugene A. Cernan, and Antoine F. Smith *In its* Gemini Sum. Conf. 1967 p 79–90 (See N68-14941 05-30)

Described are body positioning and restraint problems encountered during extravehicular activity in the Gemini Program, and the types of restraint equipment which were used. The requirements for body restraints which were indicated during extravehicular activity on Gemini IV, IX-A, XI, and XII missions are discussed. The restraints that were found to be most satisfactory during the Gemini Program included: (1) Gemini XII foot restraints which were used for rest and localized work; (2) Gemini XII waist tethers which were used for rest and localized work; (3) rectangular handrail used for translating across a spacecraft surface; (4) pin–pin devices for combination tether-attach points and handholds. One of the foremost conclusions obtained from experiences during these missions was that man's capability to perform work was drastically reduced without the proper restraint provisions; however, with the proper restraint provisions his capability was quite comparable to his 1g capability. These missions also indicated that during extravehicular activity, restraints must be provided for rest as well as for work. S.C.W.

N68-14949*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXTRAVEHICULAR MANEUVERING ABOUT SPACE VEHICLES
Harold I. Johnson, William C. Huber, Edward H. White, II, and Michael Collins *In its* Gemini Sum. Conf. 1967 (See N68-14941 05-30) p 91–106

Maneuvering equipment used for extravehicular activity during the Gemini Program is described. Considered is the hand held maneuvering unit which was scheduled for the Gemini IV, VII, X, and XI missions; and the astronaut maneuvering unit which was designed for the Gemini IX-A and XII missions. Also described are ground training equipment and the methods used in preparing the flight crews for extravehicular maneuvering. Flight results obtained with the hand held maneuvering unit during Gemini IV and Gemini X are summarized, and comparisons are made between flight performance and ground training indications. S.C.W.

N68-14950*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MEDICAL ASPECTS OF GEMINI EXTRAVEHICULAR ACTIVITIES

G. Fred Kelly and D. Owen Coons *In its* Gemini Sum. Conf. 1967 p 107–125 (See N68-14941 05-30)

Medical aspects of Gemini extravehicular activities which are primarily concerned with the physiological responses to high workloads, high thermal stresses, and low fatigue tolerance, are discussed. Analyses of these factors indicated that: (1) Major factors which appear to have produced the highest workload during the extravehicular activity were high suit forces, insufficient body position aids, and thermal stress. (2) Much can be learned about the physiological responses to extravehicular activities from simulations in the zero-g aircraft and in an underwater mockup; however, without specific knowledge of the thermal and environmental condition, a realistic simulation of extravehicular activities will be incomplete and possibly misleading. (3) The successful completion of the Gemini extravehicular activities indicates that life support planning has been essentially sound. (4) Within the limitations of experience gained (Gemini XII), time lines and work tasks can be tailored so that flight objectives can be accomplished. S.C.W.

N68-14951*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SUMMARY OF GEMINI EXTRAVEHICULAR ACTIVITY

Reginald M. Machell, Larry E. Bell, Norman P. Shyken (McDonnell Aircraft Corp.), and James W. Prim, III *In its* Gemini Sum. Conf. 1967 p 127–146 (See N68-14941 05-30)

Summarized are extravehicular activities achieved during Gemini IV, VIII, IX-A, X, XI, and XII missions. Included is a discussion of (1) extravehicular capabilities which were demonstrated during the Gemini missions, as for example, the ability to control the extravehicular workload and to maintain the workload within the limits of the life support system and pilot capabilities; and (2) a discussion of significant limitations encountered, such as space suit mobility restrictions; and their solutions. Results of the Gemini extravehicular activity led to several significant conclusions among which are cited: (1) Extravehicular operation in free space is feasible and useful for productive tasks if adequate attention is given to body restraints, task sequence, workload control, realistic simulations, and proper training. (2) Underwater simulation provides a high fidelity duplication of the extraterrestrial environment and should be used for procedures development and crew training for future missions. (3) The hand held maneuvering unit is promising as a personal transportation device in free space; however, further evaluations in orbital flight are warranted to define its full capabilities and limitations. (4) The Gemini Program has provided a foundation of technical and operational knowledge on which to base future extravehicular activity in subsequent programs. S.C.W.

N68-14956*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PRE-GEMINI MEDICAL PREDICTIONS VERSUS GEMINI FLIGHT RESULTS

Charles A. Berry and Allen D. Catterson *In its* Gemini Sum. Conf. 1967 p 197–218 (See N68-14941 05-30)

Medical predictions concerning the effects of (1) the space environment on man and (2) human responses to prolonged space flight are evaluated, and results are compared to flight results from Mercury and Gemini missions. Medical objectives focused on determining: (1) How long man can be exposed to the space flight environment without producing significant physiologic or performance decrement; (2) the causes of observed changes; and (3) preventive measures or treatment if needed. It is concluded that although man was far more capable in the space environment than predicted, and stresses had less effect than predicted, knowledge gained during the Gemini Program should be focused on possible problems of very long duration for future flights. It is suggested that consideration be given to the following: (1) obtaining additional information on normal baseline reactions to stress in order to predict crew response; (2) determining psychological implications of long duration confinement and crew interrelations; (2) solving the difficult logistics of food and water supply and of waste management; and (3) providing easy, noninterfering physiologic monitoring. S.C.W.

N68-14985*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.

SECONDARY-SIGNAL CONTROL IMPULSES, ELECTRICAL REACTIONS AND SENSITIVITY OF ANALYZERS [GLAVA VI: VTOROSIGNAL'NYYE UPRAVLYAYUSHCHIYE IMPUL'SY, ELEKTRICHESKIYE REAKTSII I CHUVSTVITEL'NOST' ANALIZATOROV]

N. I. Chuprikova Washington NASA Jan. 1968 36 p Transl. into ENGLISH from the book "Slovo Kak Faktor Upravleniya v Vyshey Nervnoy Deyatel'nosti Cheloveka" Moscow, Prosvesh-cheniye, 1961 p 217–252

(Contract NASw-1692)

(NASA-TT-F-11432) CFSTI: HC $3.00/MF $0.65 CSCL 06B

Many investigators have shown conclusively that the amplitude and latent period of evoked potentials (in direct stimulation in man) are dependent on secondary-signal effects produced by verbal instructions used in the experiment. In addition to the evoked potentials, other aspects of the electrical activity of the human brain may undergo significant changes under the influence of verbal stimuli (depression of alpha rhythm, etc.) Many recent works indicates that the sensitivity of analyzer systems is a much more complex function than was heretofore believed. There may be a difference in the excitability of various links in the ascending afferent pathway, and regulatory mechanisms may alter the functional states of all the structures in the analyzer. Author

N68-14989# California Univ., Livermore. Lawrence Radiation Lab.

A POWERED AIR-PURIFYING RESPIRATOR

William A. Burgess (Harvard School of Public Health) and William Nettleton 23 May 1967 13 p refs Prepared jointly with Harvard School of Public Health, Boston

(Contract W-7405-ENG-48)

(UCRL-50263) CFSTI: HC $3.00/MF $0.65

The advantages of a personal powered air-purification respirator were previously described. The device considered satisfies the design aim to provide a unit with a protection factor of 1000 against particulates when used with half-masks, full-face masks, rigid helmets, and hoods. The size, shape, and weight of the device are consistent with normal restraints of emergency and routine use. The design reflects the need for an inexpensive, all-purpose device for wide industrial application. Although the initial application of this device was with ultrahigh efficiency filters, its performance was also evaluated with medium-efficiency felt filters, activated charcoal canisters, and combination canisters. The design of the unit permits operation with a variety of battery packs. The standard pack is a rechargeable battery system that provides a life of approximately 3 hr with a nominal delivery of 5 cfm. Alkaline batteries provide an economical "one-shot" power supply with a battery life of approximately 14 hr with reduced delivery. Author (NSA)

N68-15003* Baylor Univ., Houston, Tex. Dept. of Psychiatry.

PERIOD ANALYSIS OF THE ELECTROENCEPHALOGRAM FROM THE ORBITAL FLIGHT OF GEMINI 7 Final Report

Neil R. Burch, Ronald G. Dossett (Tex. Res. Inst.), Abbie L. Vorderman, and Boyd K. Lester (Okla. Univ., Norman) 22 Nov. 1967 58 p refs

(Contract NSR-44-003-021; Grant PHS-FR-00254)

(NASA-CR-91661) CFSTI: $3.00 CSCL 06E

Analysis of over fifty continuous hours of electroencephalogram recordings on Gemini 7 pilots under conditions of orbital flight confirmed disturbed sleep patterns. A data reduction process by computer with a smoothing step generating a single statistic related to arousal yielded thirty-three parameters which characterized each ten second sample of the EEG record. Period count, weighted total count, and discriminant function classification of the EEG indicated that these parameters are sensitive indicators of the state of consciousness during space flight and demonstrated the qualitative and quantitative changes in the sleep patterns during flight. G.G.

N68-15033# International Training Centre for Aerial Survey, Delft (Netherlands).

LOGICAL THOUGHTS ON THE PSYCHOLOGY OF PHOTO-INTERPRETATION

S. A. Hempenius, W. G. L. de Haas, and A. P. A. Vink Mar. 1967 23 p refs *Its* Series B, No. 41

A series of slides is presented to illustrate a multidisciplinary effort to relate ideas on photointerpretation with trends in behavioral and natural sciences. Physiological and psychological theories are advanced on problems pertaining to visual perception, expectations about the visual environment, adaptation of the visual process, stereovision, projection, and the three overlapping and related perceptual activities of expectation, filtering, and observation. The importance of logical deduction and associative thinking in professional photointerpretation is stressed. M.G.J.

N68-15072# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

ON THE PROSPECTS OF THE USE OF SOME BIOLOGICAL REACTIONS FOR STUDYING THE FLUCTUATIONS OF COSMIC RADIATION

A. V. Kovaltchuk *In its* Cosmic Rays, No. 8 1967 p 206–208 refs Presented at the All-Union Conf. on Cosmic Ray Phys., Apatity, USSR, Sep. 1964 (See N68-15050 06-29)

To further investigate cosmic radiation influence upon biological objects, the study of some physiological indications of human organisms were carried out daily in various regions in the European part of the U.S.S.R. On the basis of the vast statistically reliable material, it has been established that the erythrocyte content in the periphery blood may be considered as the most sensitive indication of the daily cosmic radiation changes. Usually the erythrocyte number varies synchronously with the solar activity changes (the trend of the changes also depends upon the solar activity level), and the expressiveness of the trend is increased from the south to the north. While comparing the flattened daily mean values of the erythrocyte content with the corresponding flattened values of the solar activity expressed in Volf's numbers the following values of the correlation coefficient were obtained: at medium solar activity the connection is reverse $r \approx -(0.6–0.7)$; at high solar activity ($W > 70–100$) the erythrocyte number is changed in parallel with the solar activity ($r \approx +0.5$). Author

N68-15115# Institute for Perception RVO–TNO, Soesterberg (Netherlands).

PHASE SHIFTS IN THE PERCEPTION OF SINUSOIDALLY MODULATED LIGHT

G. S. A. M. van de Ven and J. J. Vos [1967] 22 p refs (IZF-1967-20; TDCK-49228)

Phase shifts in the visual system were investigated as a function of the parameters: average luminance, wavelength, and frequency. The measurements are not absolute, but relative to the value at a certain luminance level or wavelength. With the luminance as parameter a nearly linear relation between frequency and phase shift is found, except for frequencies below 1 Hz. The slope is dependent on the average luminance. With changing wavelength no significant shifts are found. The results are compared with related experiments, described in the literature. Several models predicting phase characteristics are discussed. Suggestions are made for a different approach, from which the shifts also at very low frequencies might be calculated. Author

N68-15120*# Serendipity Associates, Chatsworth, Calif.

A DESCRIPTIVE MODEL FOR DETERMINING OPTIMAL HUMAN PERFORMANCE IN SYSTEMS. VOLUME 2: PART A: SYSTEM DEVELOPMENT ACTIVITIES CONCERNED WITH PUTTING MAN IN AN AEROSPACE SYSTEM. PART B: DEVELOPMENT OF MAN–MACHINE SYSTEMS: SOME CONCEPTS AND GUIDELINES

Washington, D. C. NASA Jan. 1968 380 p refs (Contract NAS2-2955)

(NASA-CR-877, V. 2) CFSTI: HC $3.00/MF $0.65 CSCL 05H

The design and control of each of the identified man-related activities in an aerospace system model are described. Consideration is given to planning and controlling each activity in the system development cycle which pertains to the production of man-related end products such as trained personnel, job aids, and human-engineered interfaces. Each man-related activity is discussed in the context of the overall development cycle objectives which are dependencies upon other activities, demands of other activities, activities interactions, and the process of conducting the activity The identified man-related activities are described in terms of activity groups. Selected terms are given for the common vernacular of the biotechnology and system engineering community. Tools for synthesizing aerospace systems are included with emphasis on the design and development of the man-related features of man–machine systems. B.S.D.

N68-15127# RAND Corp., Santa Monica, Calif.

INPUT–OUTPUT RELATIONS FOR AXO-SOMATIC ACTIVATION IN A NEURON MODEL

R. J. MacGregor Nov. 1967 29 p refs (P-3672; AD-662334)

Previous experimental findings have suggested that axo-dendritic activation is the primary source of nonlinear integration among input pulses while axo-somatic activation mediates a relatively inflexible driving influence on the cell. Our own previous work has examined a theoretical basis for this distinction and presented a model to account for the nonlinear properties of axo-dendritic activation. The present paper addresses the properties of axo-somatic activation with a digital-computer simulation of the elicitation of spikes by postsynaptic potentials. Input-output relations for regular and irregular temporal patterns of excitatory activation, and for combined excitatory and inhibitory activation are presented. The results corroborate the hypothesis. Author (TAB)

N68-15135# School of Aerospace Medicine, Brooks AFB, Tex.

A METHOD TO MANUFACTURE PELLETIZED FORMULA FOODS IN SMALL QUANTITIES

Norman D. Heidelbaugh and Marvin A. Rosenbusch Aug. 1967 11 p

(SAM-TR-67-75; AD-662328)

A pelletizer was developed for manufacturing pellets from powdered formula food. Details for the construction of the pelletizer are presented. Tests on the use of the pelletizer showed it to be practical for production of small quantities of pellet foods such as might be needed in scientific studies involving feeding of human subjects. Author (TAB)

N68-15139* Public Health Service, Phoenix, Ariz. Planetary Quarantine Unit.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS Quarterly Report, Oct.–Dec. 1967
M. S. Favero 19 Jan. 1968 21 p
(NASA Order R-137)
(NASA-CR-91815; QR-20) CFSTI: $3.00 CSCL 06M

Studies in support of NASA planetary quarantine requirements are reported, and numerous tables and graphs summarize the results. Data from the study of the probability of release of spores of Bacillus subtilis var niger from fractured plastic were analyzed, and two vacuum probes developed for microbiological surface sampling were obtained and used. Studies concerning the use of ultrasonics for recovering microorganisms from surfaces were continued, as were studies on the kinetics of dry heat inactivation of naturally occurring spores. Also continued were investigations of the levels of microbial contamination in intramural environments in a clean room, sterilization and assembly laboratory, and Surveyor fuel-loading room; and results from swab samples from Surveyors 6 and 7 are included. A 98% reduction in aerobic mesophilic microorganisms was noted after final cleaning of the Surveyor 6 spacecraft. M.W.R.

N68-15166*# Techtran Corp., Glen Burnie, Md.
AMINO ACIDS OF FULVIC AND HUMIC ACIDS IN CERTAIN TYPES OF SOILS [AMINOKISLOTNYY SOSTAV GUMINOVYKH KISLOT I FUL'VOKISLOT NEKOTORYKH TIPOV POCHV]
N. G. Zyrin, M. F. Ovchinnikova, and D. S. Orlov Washington NASA Jan. 1968 15 p refs Transl. into ENGLISH from Agrokhimiya (Moscow), no. 4, 1964 p 108–120
(Contract NASw-1695)
(NASA-TT-F-11484) CFSTI: HC $3.00/MF $0.65 CSCL 06A

One-way paper chromatography is used to study the relationships between various amino acids and groups of acids in various soils under various plant covers. Seventeen amino acids were determined. The content of amino acids correlated well with condensation of the humic materials. The relative contents of amino acids were found to be quite consistent, varying mostly with plant types; the relative contents of types of amino acids was determined by microbiological activity in the soil, not soil type. The nitrogen in the amino acids was 30–50% of the total hydrolyzable forms present in the soil. Author

N68-15180# Army Aeromedical Research Univ, Fort Rucker, Ala.
EFFECTS OF DOWNWASH UPON MAN
William P. Schane Nov. 1967 44 p refs
(USAARU-68-3; AD-662208)

The threats imposed upon man by helicopter and VTOL downwash are explored. Information is derived from (1) reference material, (2) mathematical calculation, (3) individual data collection, and (4) personal experience. Eight types of threat are explored in some detail, and conclusions are drawn concerning needs for protection. Author (TAB)

N68-15196# Federal Aviation Agency, Oklahoma City, Okla. Dept. of Transportation.
CUE-ENHANCEMENT AS A FUNCTION OF TASK-SET
Walter C. Gogel Aug. 1967 6 p refs
(AM-67-18) CFSTI: HC $3.00/MF $0.65

Under flight conditions, as well as in other situations, judgments of the distances between objects may depend upon a variety of possible cues. In this study, the hypothesis was tested that the intention to use a particular cue relation would enhance the effectiveness of that particular cue in determining the resulting perception. For this purpose, a situation was presented in which the apparent depth position of an object in a configuration of objects would differ depending upon which of two possible cue relations (size cues) were used. The results support the conclusion that the perceived depth position of the object differed in the expected directions as a function of the task-set. The data of the study are discussed with respect to the "adjacency principle" which states that cue efficiency is determined by the relative adjacency of objects between which the cues occur. Although the effect of cue-set upon the perception seems to be small compared with that of adjacency, it cannot completely be ignored. Author

N68-15204# Naval School of Aviation Medicine, Pensacola, Fla.
EFFECTS OF PERCEIVED SCORING FORMULA ON SOME ASPECTS OF TEST PERFORMANCE
Lawrence K. Waters 22 Jun. 1967 16 p refs
(NAMI-1010; AD-662392)

The study examined the effects on test performance of systematic variations in the scoring formulas which examinees were told would be used in scoring their tests. Two equivalent 50-item vocabulary tests were constructed. Form A was administered without scoring formula specified to 420 pre-flight students. Three days later Form B was administered to the same groups subdivided six ways, i.e., same instructions as Form A; zero weight for wrongs; 1/4, 1, 2, or 4 points off for wrongs. Increases in the penalty for wrong responses were accompanied by consistent increases in the mean number of omitted items, but the mean number correct remained fairly stable over the various penalties. In general, interest correlations were largest when all items were attempted and smallest when random responses were substituted for omitted items. The scoring formula appropriate to the structure of the items, (R–W/4), was generally superior to the scoring formula appropriate to the penalty that examinees were told would be used in scoring the test. Author (TAB)

N68-15205# Oxford Univ. (England). Nuffield Dept. of Orthopaedic Surgery.
STUDY OF THE EFFECTS OF OXYGEN TENSION ON OSTEOGENESIS Final Technical Report, Apr. 1966–Mar. 1967
H. C. Ezra Aug. 1967 65 p refs
(Contract DA-91-591-EUC-4048)
(E-1085; AD-660445)

The purpose of this research project is to investigate the role of oxygen in osteogenesis. It was necessary to develop a method which would allow for the direct quantitative measurement of oxygen in the extracellular fluid of living bone cells. The system developed for this purpose is the oxygen microelectrode ear chamber. The results indicate that there is an overall reduction of oxygen tension in the part of the chamber occupied by the living bone culture. There is also a reduction in oxygen tension of the chamber as a whole compared with that prior to the introduction of the graft. It is concluded from the results that the ear chamber is a reliable, reproducible system with respect to quantitating directly gas tensions of in vivo cultures and their surrounding media. It is uniquely suitable for studying at the cellular level the diffusion of gases in viable calcified tissues. Author (TAB)

N68-15267# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
APPLICATION OF LUCE'S CHOICE AXIOM IN FORM-DISCRIMINATION
W. A. Wagenaar 1967 16 p refs
(IZF-1967-17; TDCK-49339, III)

Luce's choice axiom should be tested for different kinds of stimuli. In the present experiment the axiom is tested for confusion matrices obtained in a form-discrimination experiment. Results show that the error introduced by the choice axiom is relatively small. Author

N68-15290# Buenos Aires Univ. (Argentina).
RADIATION DAMAGE IN MUSCLE MEMBRANES AND REGULATION OF CELL METABOLISM Final Report, Feb. 1962–Mar. 1963; Feb. 1964–Apr. 1967
Adolfo Portela Sep. 1967 14 p refs
(Grant DA-ARO-49-092-66-G131)
(Rept.-3; AD-662723)

The study is concerned with the effect of x-radiation upon those properties and function of muscle cells. The research program was additionally extended to the study of cell membrane behaviour under the presence of cesium and quaternary ammonium ions, as well as to chemical damage studies with enzyme upon the molecular membrane structure. Unfortunately it was not possible to accomplish the proposed idea of studying the effects of x-radiation on the membrane mechanisms related to the Ach, Ch interaction, as well as the comparison of the radiation changes and the enzymatic alteration on the muscle membrane. The comparison between, mechanical, electrochemical, biochemical and structural changes in frog muscles following x-irradiation have contributed fundamentally to a basic understanding of the effects of irradiation on membrane system and control mechanism. Basically, the contribution was again oriented to obtain a better understanding of the effects of ionizing radiation in the sequence of processes taking place in the membrane and responsible for regulating the membrane potential as well as the membrane organization and function. Changes in the membrane permeability, and processes of membrane potential regulation, as well as in the processes related to uncoupling of oxidation and phosphorilation, due to radiation were considered an important observation of cell damage. Author (TAB)

N68-15306*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EXTENDED DURATION, RECOVERABLE PRIMATE SATELLITE
Washington NASA Jan. 1968 147 p
(NASA Order R-21-009-014)
(NASA-CR-926) CFSTI: HC $3.00/MF $0.65 CSCL 06K

The results are presented of a brief engineering study of a proposed six-month orbital physiological experiment generally referred to as the Primate Orbital Experiment. In this proposed Apollo application experiment, two live squirrel monkeys would be placed into a low earth orbit, then recovered alive approximately six months later, for examination on the ground. This study includes all spacecraft systems, life support, and instrumentation for an experiment package which could be transported into orbit by an Apollo spacecraft and function autonomously until picked up six months later through rendezvous with a second Apollo spacecraft. Presented are approaches to possible ways of integrating the animal-carrying satellite with Apollo during launch, and feasible life support and instrumentation techniques to maintain the animals alive in orbit for six months. Techniques for retrieval are suggested. Author

N68-15314# Federal Aviation Agency, Washington, D. C. Dept. of Transportation.
TYPE AIRMAN CERTIFICATION AS RELATED TO ACCIDENTS
Everett J. Veregge Oct. 1967 12 p refs
(AM-67-23) CFSTI: HC $3.00/MF $0.65

An analysis of 1964 aircraft accidents, using type of airman certificate as a measure of pilot proficiency, is presented. Data show that student pilots generally have a better accident record than any other of the certification groups. Analysis confirmed that, as light and weather conditions deteriorated, accident rates increased. Also, as the higher level of airman certification was achieved (excluding students) the percentage of accidents decreased. Author

N68-15339# Joint Publications Research Service, Washington, D. C.
PECULIARITIES OF PHYSIOLOGICAL REACTIONS OF PILOTS DURING SIMULATED EGRESS FROM A SPACECRAFT
D. G. Maksimov 31 Jan. 1968 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 5, Sep.–Oct. 1967 p 682–693
(JPRS-44209) CFSTI: HC $3.00/MF $0.65

The physiological reactions of pilots who have undergone training for space flight, in emerging from a Voskhod spacecraft placed in a rarefied atmosphere in a thermobarochamber, were recorded. Results indicate that egress is accompanied by clearly marked changes in pulse and respiration rate, body temperature, weight, and (in some cases) changes in the shape of the electrocardiogram complexes of the command pilots, which show appreciable nervous-emotional strain. The degree of physiological function change drops off sharply in repeat testing. L.S.

N68-15346# Federal Aviation Agency, Oklahoma City, Okla. Dept. of Transportation.
CROSS-MODALITY MATCHING OF LOUDNESS TO BRIGHTNESS FOR FLASHES OF VARYING LUMINANCE AND DURATION
Mark F. Lewis Aug. 1967 9 p refs
(AM-67-16) CFSTI: HC $3.00/MF $0.65

On occasion pilots must make judgments about the brightness of signal lights during night flight. The current study was directed to determining the relation between brightness and flash luminance and duration without use of a visual comparison stimulus. Each subject adjusted the intensity of a 1000 Hz tone presented nonaurally by earphone until the subject was satisfied that the tone was as loud as the flash was bright. The results showed the intensity of the matching tone increased as a function of both flash luminance and duration. Agreement with Bloch's law was obtained. The critical duration of Bloch's law was shown to decrease as stimulus energy increased. No evidence of Broca–Sulzer maxima was obtained. The results were interpreted as indicating that the Broca–Sulzer effect may only be obtained when a visual comparison stimulus is presented. Author

N68-15422*# California Univ., Berkeley. Space Sciences Lab.
ENZYME ACTIVITY IN TERRESTRIAL SOIL IN RELATION TO EXPLORATION OF THE MARTIAN SURFACE Semiannual Progress Report, 1 Jul.–31 Dec. 1967
J. J. Skujins and A. D. McLaren 15 Jan. 1968 150 p refs *Its* Ser. No. 9, Issue 4
(Grant NsG-704-05)
(NASA-CR-92528; SAPR-7) CFSTI: HC $3.00/MF $0.65 CSCL 06M

The behavior of enzymes in nonclassical systems are discussed with emphasis on the action of soluble enzymes on insoluble substrates, and of insoluble enzymes on soluble and insoluble substrates. Rate equations and locus effects are given along with the elementary kinetic and thermodynamic features. Several models are presented in the steady state studies of nitrification in soil, and procedures for the estimation of surface pH in soils are mentioned. Experiments on the enzymatic activities in stored and geologically preserved soils are reported, and the continuing investigation of chitinase and lysozyme activity in adsorbed state on chitin is discussed. A brief summary is given on the study of organic-matter-exhausted soils. B.S.D.

N68-15477*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF SPACE BIOLOGY. VOLUME 5: DYNAMICS OF THE CEREBRAL BLOOD VOLUME UNDER NORMAL CONDITIONS AND GRAVITATIONAL STRESSES

Yu. Ye. Moskalenko Feb. 1968 193 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom V. Dinamika Krovenapolneniya Golovnogo Mozga.v Norme i pri Gravitatsionnykh Nagruzkakh" Leningrad, Nauka Press, 1967

(NASA-TT-F-492) CFSTI: HC $3.00/MF $0.65 CSCL 06S

The basic mechanisms responsible for compensating changes in the blood volume of the closed cranial cavity are described, based on data obtained by electroplethysmography, which makes it possible to judge the dynamics of the cerebral blood volume directly; and on critical analyses of other experimental material. A detailed assessment is made of some aspects of active and passive compensation of changes during gravitational stresses of more than 1 g, such as are encountered in space flight. Analytical data are also presented on the nature and activity of the basic mechanisms during compensation of periodic fluctuations in the blood volume resulting from cardiac activity, respiratory movements, third-order waves, and vascular reaction of the brain under normal conditions, including longitudinal gravitational accelerations of up to +1 g. To define these mechanisms, the dynamics of the cerebral blood volume as a partly isolated system are examined. M.G.J.

N68-15480# Agricultural Research Service, Ithaca, N. Y. Northeast Branch.

THE ENERGY BUDGET AT THE EARTH'S SURFACE: COMPARISON OF MOMENTUM AND ENERGY BALANCE METHODS OF COMPUTING VERTICAL TRANSFER WITHIN A CROP

J. L. Wright and K. W. Brown Jun. 1967 26 p refs Prepared in cooperation with Cornell Univ.

(Cross Service Order 2-67)

(ECOM-2-67I-1; RR-394; AD-662721)

Measurements of windspeed, air temperature, wet-bulb depression, and net radiation were made at several levels within and above a corn crop. Soil heat flux and incident radiation were also measured. Transfer coefficient distributions were computed separately from the windspeed data by a momentum balance approach, and from the other data by the energy balance method. The agreement between the two methods was better near the top of the crop than near the soil. Drag coefficients computed from the energy balance results were not independent of height within the crop as was assumed in the momentum balance analysis. The low Reynolds numbers for the lower portion of the crop could account for the deviation. The energy balance approach required more measurements, but was easier to apply in calculating the distribution of the transfer coefficient for the computation of the vertical flux of such entities as heat, water vapor, and carbon dioxide within the crop. Author (TAB)

N68-15526# Geoscience, Ltd., La Jolla, Calif.

WHOLE ORGAN FREEZING AND THAWING HEAT TRANSFER AND THERMAL PROPERTIES Quarterly Report, Jul. 1–Sep. 30, 1967

Heinz F. Poppendiek, Norman D. Greene, Rosemarie Randall, Helen G. Furgerson, and James J. Kacirk 30 Sep. 1967 14 p ref

(Contract Nonr-4095(00))

(GLR-57; AD-662673)

A number of freezing experiments were performed with bovine liver samples, using liquid nitrogen and dry ice-acetone as refrigerants. The experimental time-temperature results were compared to predicted values obtained from a numerical analysis for an idealized liver slab. Several improvements in the thermal conductivity apparatus were made. The system involved was checked using water. Also some preliminary thermal conductivity measurements for bovine kidney at room temperature and at -45F were obtained. The heat capacities of bovine suet, heart muscle, and brain were measured at liquid nitrogen temperatures with the thermal gradient calorimeter; preliminary measurements for bovine kidney and pure NRG protein were also obtained. Author (TAB)

N68-15540# Texas Univ., Austin. Labs. for Electronics and Related Science Research.

BIOMEDICAL ELECTRONICS

In its Tex. Biann. of Electron. Res. 15 Nov. 1967 p 1–16 refs (See N68-15539 06-10)

(Grants PHS-GM-11111-04A1; NSF GB-5448X)

Baby chick electrocorticogram research activities are reviewed, and a pattern recognition program is described that uses a computer algorithm to discriminate and classify vitamin deficient chicks. A procedure was developed for the numerical classification of biological taxonomic problems, particularly at the infraspecific level or lower; and the research algorithm strategy for this procedure is detailed. M.W.R.

N68-15652# CBS Labs., Stamford, Conn.

DEVELOPMENT OF AUDIO TRANSDUCER HELMET ASSEMBLY Quarterly Report, 1 Apr.–30 Jun. 1967

Allan J. Rosenheck and Alfred L. Di Mattia Nov. 1967 17 p ref

(Contract DAAB07-67-C-0204)

(ECOM-0204-2; QR-2; AD-662068)

The program objective is the development of an Audio Transducer Helmet Assembly to be used in the Army Air Crewman Helmet. The Assembly includes earphones mounted in attenuating earcups along with auxiliary hardware, wiring and ancillary devices. A further goal is the development of a miniature moving-coil noise-cancelling microphone having improved noise-cancellation characteristics. Study of Mutual Stiffness Coupled (MSC) and Bellows Coupled Enclosures was initiated with an assessment of helmet stiffness requirements. It was found that an APH-5 helmet could be made adequately stiff by attaching two yokes fitting within the helmet. An experimental MSC enclosure was installed and noise attenuation measurements confirmed that the helmet was sufficiently rigid for this purpose. Designs for a practical method of assembling the ear enclosures into the helmet were conceived and evaluated. Work on the Low Frequency Coupled Volume (LFC) included further study of the spring design for mounting the LFC enclosures into the helmet. Several spring types were fabricated and of these, spiral springs appeared most practical and simple to produce. Initial models of the noise-cancelling microphone magnetic circuit were constructed and tested. They indicated the potentiality of considerably higher flux densities. Diaphragm dimensions were computed, a coil design was generated, and calculations of the predicted microphone sensitivity were performed. Author (TAB)

N68-15695# Indiana Univ., Bloomington. Dept. of Psychology.
ELECTRODERMAL AND PLETHYSMOGRAPHIC OR COMPONENTS: REPETITION OF AND CHANGE FROM UCS–CS TRIALS WITH SURROGATE UCS
John J. Furedy (Toronto Univ.) Nov. 1967 14 p refs Prepared in cooperation with Toronto Univ.
(Contract Nonr-908(15))
(TR-21; AD-662030)

For 40 Ss a tone and a light were repeatedly paired (P) in the same order (e.g., tone-light) for 15 trials, after which the 2nd member of the pair (e.g., light) was presented alone as the change trial. For another 40 Ss the repetition consisted of 15 single (S) tone (or light) presentations followed by the light (or tone) as the change trial. The duration of both stimuli and the interstimulus interval (on P trials) was .3 sec. and .75 sec., respectively, while the mean intertrial interval approximated 45 sec. GSR and digital-blood-volume-pulse-change (VPC) were recorded. The GSR habituated reliably and at the same rate to both repeated patterns over trials 1-15, but the VPC did not habituate to either pattern. Change from both S and P repetition produced response increases, but the increase under the P condition was not so pronounced as to inspire confidence in explanations of UCS-CS conditioning in terms of OR reinstatement to change. Author (TAB)

N68-15701*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.
THE POTENTIAL HAZARD OF STAPHYLOCOCCI AND MICROCOCCI TO HUMAN SUBJECTS IN A LIFE SUPPORT SYSTEMS EVALUATOR WITH ELEVATED CABIN TEMPERATURE
Leonard P. Lotter and Bonnie S. Horstman Wright-Patterson AFB AMRL Sep. 1967 26 p refs Sponsored by NASA and the AF
(Contract AF 33(657)-11716)
(NASA-CR-92557; AMRL-TR-67-43) CFSTI: HC $3.00/MF $0.65 CSCL 06M

Four human male subjects participated in a 6-week simulated aerospace study and were confined under controlled metabolic conditions. The subjects ate a diet composed of fresh foods while exposed to simulated aerospace stress of confinement, wearing an unpressurized MA-10 pressure suit, increased environmental temperature, experimental diet, and minimal personal hygienic conditions. Body and environmental areas were sampled and catalase-positive, gram-positive cocci isolated were tested for production of coagulase, deoxyribonuclease, hemolysin, gelatinase, and utilization of mannitol. The results showed no significant differences in frequency of occurrence of biochemical types among subjects and among environmental areas during the chamber period. There were significant differences in the frequency of occurrence of biochemical types on nose, throat, gingiva, axilla, groin, glans penis, anus, and toe. Though 3 phage types, 29, 6/7/53/83a, and 6, were recovered initially from 2 subjects, only one subject had transmitted a staphylococcus to other subjects and the environment. The subjects remained healthy without any decrease in resistance to infection throughout all the test conditions. Author

N68-15710# Naval Radiological Defense Lab., San Francisco, Calif.
INFLUENCE OF AGE AT EXPOSURE ON SOME PERSISTANT AND LATE EFFECTS OF IRRADIATION WITH FAST NEUTRONS
Dave C. Jones, Garold K. Osborn, and Donald J. Kimeldorf 6 Dec. 1967 32 p refs
(USNRDL-TR-67-121; AD-662222)

In a duration-of-life study, male Sprague-Dawley rats were exposed to 220 rads of fast neutrons as juveniles (1 month of age), young adults (3 months), middle-aged adults (10, 15 months), or as old adult (21 months) and compared with their sham-irradiated littermates at intervals using a variety of criteria of radiation injury. In all 5 age groups, there was a deficit in body weight that persisted throughout life. The magnitude of this deficit was inversely related to age at exposure. Decreased food and water consumption were seen throughout life in the group irradiated as juveniles, and were less affected after exposure at older ages. These consummatory changes appeared related to the changes in body size. An age-associated marked increase in water consumption per unit metabolic size occurred earlier (than in controls) in animals exposed as juveniles or as young adults, but not in the groups exposed at older ages. Proportions of exposed groups with one or more palpable growths were in excess of the proportion for the appropriate controls after exposure at all except the oldest age, in spite of significant life-shortening after exposure at all except the oldest age, in spite of significant life-shortening after exposure at the three younger ages. Proportions of irradiated groups with palpable growths of large size (2.5 cm or more) exceeded those for controls even for the group exposed at 21 months. Thus, for criteria of metabolic injury and of the chronologic advancement of degenerative and neoplastic changes, it appears that exposure at a juvenile age is most effective for most criteria, but that some late effects of irradiation are discernible even after exposure during old age. Author (TAB)

N68-15827# Atomic Energy Establishment, Winfrith (England). Radiological and Safety Div.
A PLASTIC SACHET DOSIMETER CONTAINING LITHIUM FLUORIDE POWDER FOR SURFACE AND FINGER-TIP DOSIMETRY
C. O. Peabody and H. E. Preston Oct. 1967 22 p refs
(AEEW-R-497) HMSO: 3s 6d

A dosimeter is described, consisting of 30 mg of thermoluminescent lithium fluoride powder contained in a plastic sachet. Measurements of its sensitivity for photons and beta rays are presented and discussed. It is shown to provide a convenient, accurate, and reliable method of measuring directly the finger-tip radiation dose of workers handling radioactive materials, surface doses from such materials, and doses in general operational and experimental work. Author

N68-15733*# Terra-Space Corp., Malibu, Calif.
ASSEMBLER—THE FUTURE PROFESSION OF AN ASTRONAUT
A. Nikolayev [1967] 5 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 2, 1967 p 45–47 Prepared for JPL
(Contract NAS7-100)
(NASA-CR-92593) CFSTI: HC $3.00/MF $0.65 CSCL 05I

The tasks required of future astronauts during space flights are considered in terms of rendezvous and docking, getting out of the spacecraft, and extravehicular activities. The faultless operation of ground-based stations is stressed, along with the need for intense training of astronauts. M.W.R.

N68-15768*# Philco-Ford Corp., Blue Bell, Pa.
SINGLE EQUIVALENT FORMANT EXTRACTOR SYSTEM
Louis R. Focht Nov. 1967 16 p refs
(Contract NAS12-582)
(NASA-CR-86024) CFSTI: HC $3.00/MF $0.65 CSCL 05J

The Single Equivalent Formant (SEF) is a transformation by which the information bearing parameters of speech are represented with only three parameters, the SEF, the amplitude and the state-of-voicing. The equipment built to extract these three parameters is an approximation of the theoretical transformation and as a result possesses certain performance limitations. However the equipment's simple implementation and small number of parameters

considerably reduces the size of the total recognition logic. The utilization of the SEF parameters for recognition purposes requires an apriori knowledge of the perceptually significant features found in the SEF parameters. A total of five such features have been found to date and techniques for their utilization are suggested. The comparison of the usefulness of the SEF parameters with other analyzer techniques is considered. It is pointed out that any such evaluation should ideally be carried out as a comparison of the ultimate potential of each analyzer system. However, in practice this is very difficult in as much as it requires the solution to the general recognition problem for each analyzer system. As an alternate, a simpler technique is suggested that is felt will provide a reasonable and fair performance comparison of different analyzer systems for specific recognition tasks. Specific areas of the recognition task are also pointed out in which superior performance might be expected by the use of SEF techniques as well as those areas in which difficulty might be encountered. Author

N68-15784*# Philco-Ford Corp., Newport Beach, Calif. Space and Re-Entry Systems Div.

STUDY, STERILIZATION AND STORAGE COMPATIBILITY OF GROWTH MEDIA FOR EXTRATERRESTRIAL USE Final Report

E. R. Walwick, D. E. Gelvin, T. A. Oda, and J. B. Opfell 29 Dec. 1967 67 p refs

(Contract NAS2-4310)

(NASA-CR-73173) CFSTI: HC $3.00/MF $0.65 CSCL 06M

Because of the requirement of dry-heat sterilization for interplanetary spacecraft, an investigation was initiated to assess the scope of the problem presented by the thermal instability of substances important to extraterrestrial life detection experiments. Ninety-four substances were exposed to drastic thermal conditioning. Following heating, thirty-seven of the substances were found to pass preliminary screening tests designed to detect degradation. The substances were individually packaged under vacuum in borosilicate glass ampoules. Before packaging most substances were dried in a vacuum. After drying the substances were placed in ampoules which were flushed with nitrogen, evacuated, and sealed. The thermal processing consisted of two separate 92-hour heating periods at 135°C. After the second thermal treatment, the specimens were examined by a preassigned sequence of physical and chemical tests designed to detect degradation. Candidate substances were selected on the basis of their importance in microbiological growth media, as spore germinating agents, as substrates for metabolic assays, and as substances characteristic of major biochemical classes. Author

N68-15785*# Texas Christian Univ., Fort Worth.

MAGNITUDE ESTIMATION OF PERCEIVED DISTANCE OVER VARIOUS DISTANCE RANGES

Robert J. Vincent, Bill R. Brown, and Malcolm D. Arnoult [1967] 17 p refs

(Contract NAS2-1481)

(NASA-CR-73172) CFSTI: HC $3.00/MF $0.65 CSCL 05J

Thee groups of Os made magnitude estimation judgments of the apparent distance of a stationary space vehicle under conditions simulating outer space. Psychophysical functions for three stimulus ranges were obtained. The exponents for the "near" and "far" stimulus ranges were nearly 1.0. The power function exponent for the "full" range group was 0.48. The psychophysical scales are compared to JND scales obtained in previous research. The results indicate that in all ranges investigated the power law is an appropriate description of the relationship between perceived and objective distance, but that distance range and the location of the range are important determinants of the psychophysical scale. Author

N68-15839*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.

THE POTENTIAL HAZARD OF STAPHYLOCOCCI AND MICROCOCCI TO HUMAN SUBJECTS IN A LIFE SUPPORT SYSTEMS EVALUATOR AND ON A DIET OF PRECOOKED FREEZE DEHYDRATED FOODS

Leonard P. Lotter, Bonnie S. Horstman, and Joseph V. Rack Wright-Patterson AFB, Ohio AMRL Sep. 1967 60 p refs

(NASA Order R-85; Contract AF 33(657-)11716)

(NASA-CR-92648; AMRL-TR-67-18) CFSTI: HC $3.00/MF $0.65 CSCL 06S

Two groups of four human male subjects were confined under controlled metabolic conditions during 28 consecutive days in a Life Support Systems Evaluator. The subjects were exposed to simulated aerospace stress of confinement wearing an unpressurized pressure suit, experimental diet, and minimal personal hygienic conditions. Body and environmental areas were sampled and the catalase-positive, gram-positive cocci isolated were tested for production of coagulase, deoxyribonuclease, hemolysin, gelatinase, and utilization of mannitol. The results showed no significant differences in frequency of occurrence of biochemical types among the subjects or among the environmental areas during the chamber period. There were significant differences in the frequency of occurrence of biochemical types in microbiological specimens from the eye, ear, nose, throat, mouth, axilla, umbilicus, groin, glans penis, and anus. The subjects remained healthy without any decrease in resistance to infection throughout all the test conditions. In concurrent metabolic studies, the physiological, biochemical, and nutritional parameters investigated were all in the normal range of clinical values. Author

N68-15865*# Technology, Inc., San Antonio, Tex. Life Sciences Div.

THE INVESTIGATION OF VERTEBRAL INJURY SUSTAINED DURING AIRCREW EJECTION. PHASE 2a. BASIC SCIENCE EXPERIMENTAL DESIGN AND INVESTIGATION OF DYNAMIC CHARACTERISTICS OF VERTEBRAL COLUMNS CONSIDERED AS AN ENGINEERING STRUCTURE Annual Report, 1 Nov. 1966–31 Oct. 1967

Lawrence S. Higgins, Robert A. Schmall, Harold E. Brown, Rex H. Howard and Judith A. Brockway 31 Oct. 1967 33 p refs

(Contract NASw-1313)

(NASA-CR-92541; TI-67-159-4) CFSTI: HC $3.00/MF $0.65 CSCL 06E

The dynamic strength was determined for 2 vertebrae–1 disc sets of various categories. Details of the basic science experimental design used in this continuing investigation of dynamic characteristics of the human vertebral column as an engineering structure are included. Recent studies include moisture and ash determinations of the segments tested. The results are presented as a series of figures, tables and discussions. Author

N68-15866*# AiResearch Mfg. Co., Los Angeles, Calif.

PHASE 2: PARAMETRIC STUDY OF FLIGHT-INDUCED PULMONARY PATHOLOGY Final Report

James N. Waggoner, Edward C. Wortz, Robert L. Wick, Jr., T. J. Harrington, L. E. Browne et al 28 Jan. 1966 185 p

(Contract NAS2-1597)

(NASA-CR-92540; LS-66-0013) CFSTI: HC $3.00/MF $0.65 CSCL 06E

Pulmonary pathological response of four selected subjects breathing a conditioned atmosphere and then being centrifuged was investigated. Pre- and post-test data consisting of chest X-rays and pulmonary function measurements were collected after conditioning to three test atmospheres with total pressures of 380, 380, and 194 mm Hg abs, and oxygen partial pressures of 180, 367, and 180 mm Hg, respectively. Nitrogen was the diluent in

the first 380 mm Hg pressure test; the rest of the atmosphere was water vapor and carbon dioxide. Two test durations, three hours and eight hours, were investigated, and at the end of the conditioning the subjects were exposed to a 6-g transverse acceleration ($+a_x$) for two minutes. Statistically significant results cannot be deduced because of the wide variation in measured parameters and the statistically inadequate number of subjects tested. Atelectasis did not occur, and the severity appears to be a cox function of all variables studied. Author

N68-15867*# Techtran Corp., Glen Burnie, Md.
KINETICS OF DECOMPOSITION OF AMINO ACIDS LABELED WITH C^{14} IN SOILS [KINETIKA RAZLOZHENIYA MECHENYKH C^{14} AMINOKISLOT V POCHVAKH]
V. Rachinskiy, Z. Drabent, T. Mazur, and A. Pel'ttser Washington NASA Jan. 1968 7 p ref Transl. into ENGLISH from Agrokhimiya (Moscow), no. 4, 1965 p 28–30
(Contract NASw-1695)
(NASA-TT-F-11485) CFSTI: HC $3.00/MF $0.65 CSCL 06B

The activity of the $C^{14}O_2$ gas phase liberated by decomposition of various amino acids in soil (C^{14} label on carboxyl group) was studied in a sealed chamber with counters at the ends. The reaction rate for the amino acids studied was: methionine > glycine > phenylalanine > valine > alanine. A sharp maximum was observed on each rate curve. The kinetics of decomposition varied inversely with the concentration of the amino acid in the soil; with high concentration (e.g. 100 mg phenylalanine in 90 g soil), a saturation effect occurred. Author

N68-15878# Institute for Perception RVO–TNO, Soesterberg (Netherlands).
ON THE MEASUREMENT OF PITCH PERCEPTION [OVER HET MECHANISME VAN DE TOONHOOGTE-WAARNEMING]
G. F. Smoorenburg 1967 56 p refs In DUTCH; ENGLISH summary
(IZF-1967-23; TDCK-49473)

This report is directed to the mechanism of pitch and particulary to the importance of the time information in the nerve impulses (or of the periodicity mechanism) for the perception of pitch. In the introduction the most important concepts used in this report are discussed against an historical background. The consequence of the frequency-selective filtering of the basilar membrane for these experiments is treated; it is concluded that, to avoid the effects of the filtering, signals with a narrow bandwidth according to the critical bandwidth or narrower have to be used. With this knowledge an investigation is set up into the precision of the periodicity mechanism. Therefore the just-noticeable difference in repetition frequency of filtered periodical impulses is determined by means of the forced-choice method discussed in appendix I. Then artificial fluctuations are introduced in the impulse intervals to be able to estimate on the basis of an increase of the just-noticeable difference in repetition frequency the magnitude of the internal fluctuations. The standard deviation of the internal fluctuations is found to be 50 μsec. An experiment is discussed which clearly illustrates the importance of the fine structure for the perception of pitch on the basis of the periodicity mechanism. Author

N68-15899*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Dec. 1967 133 p refs
(NASA-SP-7011(44)) CFSTI: HC $3.00/MF $0.65 CSCL 06S

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. Also included are such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors. Each entry consists of a standard citation accompanied by its abstract. Author

N68-15901*# National Aeronautics and Space Administration, Washington, D. C.
THIRD ANNUAL NASA UNIVERSITY CONFERENCE ON MANUAL CONTROL
1967 435 p refs Conf. held Univ. of Southern Calif., Los Angeles, 1–3 Mar. 1967
(NASA-SP-144) CFSTI: HC $3.00/MF $0.65 CSCL 05H

In the conference proceedings presented, emphasis is placed on display devices, function models, decision processes, computer processing of manual control records, controlled elements, physiological modeling, and advanced modeling techniques. For individual titles, see N68-15902 through N68-15935.

N68-15902*# Systems Technology, Inc., Inglewood, Calif.
A SYSTEMS ANALYSIS THEORY OF MANUAL CONTROL DISPLAYS
D. T. Mc Ruer and H. R. Jex *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 9–28 refs (See N68-15901 06-05)

This paper summarizes the basic elements of a unified theory for the development of displays for pilots of manually controlled vehicles. The theory combines several recent manual control developments in its structure: (1) The vehicle dynamics, environmental distrubances, command structure, and mission criteria are derived in terms of meaningful servo analysis parameters. (2) The "best" or "alternative best" feedbacks for the pilot are derived using the "multiloop feedback selection hypothesis," which includes the human operator's describing functions, remnant, and subjective preferences. (3) Quantitative evaluation of the system performance measures, information bandwidths, and stability margins are made by systems analysis techniques. (4) The required scanning pattern and rates and workload margins are then derived, based on still-tentative pilot monitoring and scanning models. (5) The progression and regression of the level of pilot behavior (e.g., during training, transfer, stress, or equipment failure) are treated by the successive organization of perception theory of manual control skill development, and display concepts to enhance the level of display utilization can be quantitatively evaluated. This theoretical framework provides a paradigm for display development, a rational basis for experimental programs, and a theoretical foundation for analyzing the comparative merits or problems of new operational display systems. Author

N68-15903*# Bolt, Beranek, and Newman, Inc., Cambridge.
TWO DIMENSIONAL MANUAL CONTROL SYSTEMS WITH SEPARATE DISPLAYS
William H. Levison and Jerome I. Elkind *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 29–42 refs (See N68-15901 06-05)

The results of a current study of multi-variable manual control systems are presented. The objectives of this study are to investigate the human controller's behavior in multivariable control situations and to develop models of the controller which take into account both the monitoring and the control functions that he typically performs in such systems. A series of two-variable manual tracking experiments was performed in which subjects were required to view two separated displays and operate two control devices to control the system. Performance was measured as a function of the display separation, the forcing function bandwidth, the task

difficulty, and the controlled-element dynamics. Human controller describing functions, eye-movement distributions, and normalized mean-squared tracking error were obtained. A model for the human controller in the two-axis control situation was developed. It was tested against the data and found to be a good predictor of performance. Extensions of this model to higher dimension systems are discussed. Author

N68-15904*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PILOTED SIMULATOR DISPLAY SYSTEM EVALUATION. EFFECTIVE RESOLUTION AND PILOT PERFORMANCE IN THE LANDING APPROACH

Wendell D. Chase *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 43–53 refs (See N68-15901 06-05)

A two-part study designed to determine the quality of a visual display in a fixed cockpit piloted simulator and ways of measuring pilot-vehicle performance is reported. Focused on were: (1) the effective resolution of a typical simulator display relative to that for the real world; and (2) pilots' estimates of range and altitude from the runway threshold and measures of his ability to control the vehicle in the approach and landing. A correlation analysis of the information item (2) was used to indicate the degree of association between those performance measures. The static display characteristics, as measured by the resolution of landolt C-rings, were found to be degraded by as much as a factor of 12 when compared with the real world. A further loss of resolution by approximately one-third of the static resolution occurred with the moving display and was influenced by the apparent motion of the airplane. Range estimates to the runway threshold were in error by about 10%; altitude estimates above the runway threshold were in error by about 20%. Error in range estimates decreased with experience while altitude estimates remained relatively constant. Performace in the landing approach was very similar to that in actual flight and even included a duck under maneuver by each pilot. The termination of the landing approach was at higher rates of descent, but touchdown distance from the runway threshold was about the same as that in actual flight. A correlation analysis between the various measures of altitude-range estimates, and pilot-vehicle landing performance showed the following: (1) that the touchdown error depends on the pilot's ability to judge altitude in the landing approach, and (2) the touchdown error is highly correlated with the integrated altitude error, and the correlation indicates difficulty in estimating the correct altitude to decrease the rate of descent and to initiate the flare. However, the absence of motion feedback, ground effect dynamic forces, and vestibular and kinesthetic cues may be partially responsible for these errors. Author

N68-15906*# Stanford Research Inst., Menlo Park, Calif.

HUMAN OPERATOR DESCRIBING FUNCTIONS WITH VISUAL AND TACTILE DISPLAYS

James C. Bliss *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 67–79 refs (See N68-15901 06-05)
(Contracts NAS2-2752; NAS2-3649)

In the attempt to develop models of manual tracking behavior that also incorporate characteristics of the physiological systems underlying the responses, techniques are needed to separate the contributions of the individual physiological systems, including sensory, central, or motor functions. Techniques that have been used in the past involve variations in the type of command signal (e.g., transient, periodic, and random), the type of output response (e.g., continuous or discrete), and the vehicle dynamics. The research described in this paper emphasizes varying the sense modality employed (i.e., visual, tactile, or both) with continuous command signals and pure-gain vehicle dynamics. Two experiments are reported. The first experiment compares the describing functions obtained with (1) a visual display, (2) a tactile display, and (3) both displays used simultaneously. The second experiment explores various tactile display conditions. Author

N68-15907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SYNTHETIC DISPLAY TECHNIQUE FOR COMPUTER CONTROLLED SIMULATOR AND AIRBORNE DISPLAYS

Jack J. Hatfield *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 81–95 refs (See N68-15901 06-05)

Interest in airborne, computer-driven, integrated displays has resulted from the problem of effectively displaying greater quantities of rapidly changing control information. A new concept for implementing computer-controlled simulator and airborne displays is described. This concept employs the synthetic generation of desired instrumentation at the cockpit interface of the man–machine loop utilizing a programmable electronic display system. The synthetic display concept utilized is based on an "electronic animation" technique which allows the cockpit display designer to proceed directly from static (cardboard) instrument mockups to dynamic displays which are simulated in the cockpit by high-resolution closed-circuit monochrome television. Experimental synthetic display hardware is described from the viewpoint of relating the operational capability and flexibility of the "electronic animation" technique. The performance achieved to date is illustrated through photographs of synthetically generated electro-mechanical instrumentation. The potential of the technique for synthesizing experimental displays at lower costs, at higher speed, and in new integrated formats is discussed. Author

N68-15908*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

INFLIGHT AND GROUND SIMULATION MEASUREMENTS OF PILOT TRANSFER CHARACTERISTICS IN THE COMPENSATORY ROLL TRACKING TASK

F. D. Newell *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 99–119 refs (See N68-15901 06-05)
(Contract AF 33(615)-3605)

This paper presents a review of a measurement experiment in which pilot transfer characteristics have been determined for a random-appearing forcing function in both ground based simulation and actual flight. Three experienced test pilots were the subjects. The task was compensatory tracking in roll to maintain zero bank angle in the presence of small bank angle disturbances, of which the largest were approximately $\pm 8°$. Two simple single-degree-of-freedom controlled elements were flown in the ground based simulator only, and two six-degree-of-freedom airplane-like configurations with excellent handling qualities were flown both in the simulator and in actual flight. Companion work, not reported herein, has been accomplished by the NASA Flight Research Center with a contract analog, ground-based simulator. Author

N68-15909*# Westinghouse Electric Corp., Pittsburgh, Pa. Defense and Space Center.

DESCRIBING FUNCTIONS FOR COMPENSATORY TRACKING OF SINE WAVES PLUS NOISE

A. C. Beare and A. Kahn *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 121–135 refs (See N68-15901 06-05)

A study of compensatory tracking was performed on an analog computer simulation to test the application of the superposition theorem to human tracking performance. Four subjects participated in a $4\times4\times4\times3\times3\times2$ analysis of variance design in which the input variables of frequency, amplitude, stick and scope sensitivity, and noise conditions were varied systematically. The performance data of error and stick movement and the ratio of these two measures, that is, the gain, were subjected to an analysis of

variance performed on a digital computer. The results showed that the linearity assumption is not a valid assumption. The variable underlying performance is the average rate of stick motion. Using the rate variable, a transfer function was derived which provides an adequate fit between the empirically derived and the theoretically calculated data. The conclusions show that error increases and gain decreases as a direct function of average rate of stick motion and that the presence of noise has an effect similar to that of increasing the rate. Author

N68-15910*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

A COMPARISON OF HUMAN RESPONSE MODELING IN THE TIME AND FREQUENCY DOMAINS

Lawrence W. Taylor, Jr. *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 137–153 refs (See N68-15901 06-05)

Frequency and time-domain methods of analyzing human control response while performing compensatory tracking tasks are reviewed. Sample linear model results using these methods are compared and discussed. The inherent requirement of constraining the freedom of the form of the pilot models is also discussed. The constraint in the frequency domain consists of smoothing with respect to frequency; whereas, the constraint for the time domain model is more natural and meaningful in that it consists simply of limiting the memory of the pilot model. The linear models determined by both methods were almost identical. The time domain of analysis enables the determination of a nonlinear pilot model. The inclusion of a cubic as well as a linear term accounted for only a small additional part of the pilot's remnant and indicated that only a small portion of the total power of the pilot's output is caused by nonlinearities. The power-spectral density of an ensemble average of the pilot's output is used to determine the upper limit of the amount of power associated with a deterministic response. The indication is that more than half the remnant is stochastic when a linear model is used. Author

N68-15911*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INFORMATION PROCESSING RATE AS INFLUENCED BY THE DEGREE OF RESPONSE DIFFICULTY: A DISCRETE TRACKING TASK

Daniel L. Baty *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 157–164 refs (see N68-15901 06-05)

This study was designed to investigate the dependence of the information-processing rate on the degree of response, or task, difficulty. The degree of task difficulty was quantified for a series of discrete, random-input tracking tasks. Performance on one-dimensional (1-D) and two-dimensional (2-D) tasks was compared at equal values of task difficulty. Fourteen tasks were used: 9 with 4 target alternatives and 5 with 16 target alternatives. Six subjects performed the self-paced tasks by rapidly touching with a stylus well-defined areas as they were successively illuminated in a random sequence. Performance in terms of the information-processing rate was primarily determined by the degree of response difficulty and the number of target alternatives. Performance in terms of the average time per response, however, was determined primarily by the degree of response difficulty. For this type of task, higher information-processing rates are possible for 2-D tasks than for 1-D tasks because, for a given number of stimulus alternatives and a constant target size, the 2-D grouping has the lower value of task difficulty. Author

N68-15912*# Dunlap and Associates, Inc., Darien, Conn.

A PSYCHOLOGICAL APPROACH TO OPERATOR MODELING IN MANUAL CONTROL

Charles R. Kelley *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 165–180 (See N68-15901 06-05)

The usual engineering models of the human operator employ techniques that were first developed in control engineering to describe and model control mechanisms. If there are ways in which the human operator differs from inanimate control mechanisms that are significant for representing the human operator, the usual form of engineering model would not be expected to include them. Human operators differ from control devices in that they can understand their task and its environment, can remember the past and predict and plan for the future, and can employ these abilities in control. All of these psychological aspects of the human operator are important in manual control, yet all are absent from the usual engineering models of the human operator. A more veridical engineering model of the operator would contain the following: (1) A direct internal representation of the controlled element and its environment (2) Freedom of the internal representation from present time (fast-time operation) so that it can be used to extrapolate and predict controlled element behavior (3) Control action based on such predictions Adapation in such a model would occur automatically as a consequence of changes in the internal representation, reflecting actual external changes. The internal changes would bring about changed predictions, and as a result of the changed predictions, the control action taken would be changed adaptively. An automatic control device containing these three features was patented in 1950 by Ziebolz. Sheridan, Johnson, and this author have employed versions of Ziebolz' controller as a human operator model. Adaptive and optimizing features of such models are examined. Author

N68-15913*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

RELATIONSHIPS BETWEEN FOURIER AND SPECTRAL ANALYSES

Lawrence W. Taylor *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 183–186 ref (See N68-15901 06-05)

The feasibility of using expressions of the cross- and power-spectral density functions involving Fourier transforms instead of the cross- and auto-correlation functions in spectral human response analyses; is discussed. It is shown that: (1) It is correct to express the cross spectral density as either the Fourier transform of the cross correlation function, or as the product of Fourier transforms. (2) In order to obtain precisely the same results from the two expressions of cross spectral density, it is necessary not to limit the number of lags of the cross correlation function, and to use identical smoothing operations in both cases. (3) When smoothing is not necessary, such as when a sum of sine waves is used as the input, the expressions of Y_p and ρ can be simplified; and when smoothing is necessary, such as when a random signal is used as the input, the expressions for Y_p and ρ cannot be simplified by can still be expressed in terms of Fourier transforms. (4) Care must be taken to assure that an adequate number of degrees of freedom are used in computing the linear correlation coefficient, especially at low frequencies. S.C.W.

N68-15914*# Bunker-Ramo Corp., Canoga Park, Calif.

MANUAL CONTROL SYSTEM PERFORMANCE WITH QUICKENED DISPLAY, STATE VARIABLE DISPLAY, AND DISPLAY GAINS

F. A. Muckler and R. W. Obermayer *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 189–202 refs (See N68-15901 06-05)

(Contract NAS2-3113)

Twelve college subjects performed compensatory tracking with acceleration control dynamics ($0.5s^2$) and a low-frequency forcing function composed of the sum of six sinusoidal components. One group of six subjects performed with a quickened display and the second group of six subjects performed with a state variable display. The state variable display presented system error and system rate error on separate display indices, while the quickened

display presented this information combined as the deviations of a single index. All subjects were presented all combinations of two levels of display error gain and three levels of display rate-error gain. Quadratic performance measures were collected to provide information for synthesis of optimal manual control systems under different performance indices. Further, results of a multiple regression analysis, amplitude ratio/phase data, and amplitude distributions are discussed to reflect on display-man-controller performance. Author

N68-15915*# California Univ., Los Angeles.
SENSORY MOTOR ASPECTS OF MANUAL CONTROL OF HIGH INERTIA TRACKING SYSTEMS
Russell L. Smith and John Lyman *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 203–212 refs (See N68-15901 06-05)

A series of experiments were conducted on a high-inertia manual-tracking device (converted 40-mm gun mount) that simulated closely the characteristics of field tracking systems. The principle goals of the studies were to determine the extent to which results derived from research using low- and negligble-inertia tracking simulators could be generalized to high inertia simulators, and to derive optimum display and control configurations for tracking realistic target trajectories. Important theoretical and practical implications were suggested by the experimental results. It was found that tracking performance was facilitated by increasing display magnification, optical magnification (reducing subject-to-display distance), and proprioceptive cues derived from azimuth and elevation movements of the simulator. Reduction in the display field of view and/or addition of displacement aiding velocity control dynamics also significantly improved performance. Contrary to previous research, no differences were observed in performance with pressure and with movable-type controllers for experienced trackers, although the former controller appeared superior during early learning trials. Author

N68-15916*# Michigan Univ., Ann Arbor.
FORCE FEEDBACK COMPENSATION: A NEW CONCEPT FOR IMPROVED MANUAL CONTROL SYSTEM PERFORMANCE
James H. Herzog and Richard W. Pew *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 213 ref (See N68-15901 06-05)

A new concept for improved manual control system performance which considers the use of a force feedback compensation system that restores correspondence between the mechanical feel of a control stick and actual plant dynamics. To accomplish this, a mechanical analog of the differential equation describing the plant is implemented on the control stick. Instead of using the control stick output position as the control variable applied to the plant, a signal proportional to the operator's output torque is employed which provides the appropriate mechanical feel characteristics without adding additional dynamic filtering in the foreward loop. This technique of force feedback compensation was evaluated for the case of control of a lightly dampened second order system. Performance of the compensated system as compared with that of an isometric stick with analog plant dynamics showed that the compensated system was better by a factor of two to three. It is concluded that this concept has applicability in several areas of manual control, and is especially suitable for complex plants where the benefit of supplementary sensory information can greatly improve performance. S.C.W.

N68-15917*# Systems Technology, Inc., Inglewood, Calif.
EFFECT OF SOME CONTROL SYSTEM NONLINEARITIES ON SINGLE LOOP COMPENSATORY TRACKING
Dunstan Graham *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 215–221 refs (See N68-15901 06-05)
(Contract AF 33(615)-1782)

Reported are results of experiments which demonstrate the effects of changes in task variables involved in single loop compensatory tracking of random appearing inputs on human operator performance. On the basis of data presented, it is concluded that the human operator in single loop compensatory tracking of random appearing inputs will tend to linearize the performance of the system when this is possible. Both an adjustment as a high gain positioning servo, and the use of dither, are effective against friction and the combination of friction and preload. With the control velocity limiting nonlinearity, no linearization is possible and performance is degraded. In the experiments described, there was no evidence of self-sustained oscillations because of the nonlinearities. The same was true of other experiments made with controlled elements thought to be likely to produce this pathological behavior. S.C.W.

N68-15918*# University of Southern Calif., Los Angeles.
AN ASYNCHRONOUS PULSE AMPLITUDE PULSE WIDTH MODEL OF THE HUMAN OPERATOR
M. J. Merritt and G. A. Bekey *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 225–239 refs (See N68-15901 06-05)

Described is an asynchronous pulse-amplitude, pulse-width human operator model which produces discrete outputs in response to continuously presented Gaussian random inputs. Computer procedures for the complete identification of all model parameters are also described. Parameters of the model were identified from experimental data taken from one subject in an advanced state of training. Computational results were as follows: (1) The delay time between the model's decision to pulse and the actual event was 200 milliseconds. (2) The pulse amplitude and pulse width models for negative pulses produce better correlations with experimental data than models for positive pulses. (3) The pulse amplitude models for positive and negative pulses are similar, despite considerable asymmetry in pulse amplitude distributions. (4) Human operators utilize some preprogrammed pulse sequences. (5) If the differences between model results and experimental tracking data are viewed as the result of short term human operator variations, then the statistics of the human operator variations are easily determined. S.C.W.

N68-15919*# Cambridge Univ. (England). Applied Psychology Research Unit.
A QUANTAL MODEL FOR HUMAN TRACKING
E. C. Poulton *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 241–246 refs (See N68-15901 06-05)

Studies focusing on the development of a computer program which mimics human tracking inputs whose frequencies extend up to at least 30 cycles per minute are reported. Described are two models, one for pursuit, the other for compensatory tracking, which are proposed for use in mimicing human operators under conditions of high frequency inputs. Primary differences between these two models and models based upon servo theory are: (1) The proposed models are designed to produce data with high frequency inputs which actually mimics man, so that human and programmed ata are indistinguishable. (2) The models are sequential in time rather than continuous. (3) The models use statistical information about the forcing function which man has learned, as well as displayed position and rate information. (4) Separate models are given for pursuit and for compensatory tracking, according to the different tasks which the man faces in the two quite distinct situations. S.C.W.

N68-15920*# University of Southern Calif., Los Angeles.
THE EFFECT OF A RANDOM SAMPLING INTERVAL ON A SAMPLED DATA MODEL OF THE HUMAN OPERATOR
G. A. Bekey, J. M. Biddle, and A. J. Jacobson (Hughes Aircraft Co., Culver City, Calif.) *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 247–258 ref (See N68-15901 06-05)
(Grant NGR-05-018-022)

Reported is an experiment based on a simple analog computer simulation of a sampled data model of the human operator in a one-dimensional compensatory tracking loop with a constant gain. Objectives of the experiment were to determine the effects of a random sampling interval on a sampled data model of the human operator. Two types of data hold, a zero order and a first order, were investigated; and different amounts of randomness were used for a parametric study. Results showed that: (1) It might be impossible to determine the presence of an internal sampler by examining the human operator's output sepctra if a random sampler is assumed. (2) Assuming a randomly varying sampler, results were compatible with previous studies of human pilot dynamics in compensatory systems, and earlier sampled data models. (3) The feasibility of using sampled data models for the human operator is valid, provided only that the sampling interval includes a reasonable amount of randomness. (4) Attempts to enhance the remnant portion of the human operator's output, and improvement of the signal processing and power spectral analysis, will be important in further determination of the validity of sampled data models for the human operator. S.C.W.

N68-15921*# Illinois Univ., Urbana.
PERIPHERAL VERSUS CENTRAL ADAPTION: SOME PRELIMINARY RESULTS
G. C. Agarwal, B. Berman, P. Loehnberg, and L. Stark *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 261–265 refs (See N68-15901 06-05)
(Contract N00014-67-H-0185)

This paper is devoted to exploring possible decomposition of adaptive mechanisms into those utilizing a variable state of gain or dynamic of the peripheral control system, and those relying upon prefiltering of the preprogrammed, ballistic, intermittent commands which dominate the signal pathways during voluntary rapid movements. The mechanical-impulse technique is put forward as an experimental means of testing the state of the peripheral control system during various types of adaptive changes. Adaptation that takes place via the peripheral system should be reflected in changes in the mechanical constraints of the hand. The experimental results indicate that in the normal mode the peripheral system remains unchaged for positive and negative mechanical impulses. Author

N68-15922*# National Research Council of Canada, Ottawa (Ontario).
STATE OF THE ART IN DEVELOPING MODELS OF SKILLED MOVEMENT
C. B. Gibbs *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 267–279 refs (See N68-15901 06-05)

Following the Bell and Magendie discovery of the proprioceptive pathways, opinion divided sharply on their functions and importance. Two main theories have emerged in physiological psychology. The outflow or motor theory of Helmholtz and his followers asserts that the only factors effective in control are learned patterns of motor valleys to muscles; a release pattern runs its course without proprioceptive influence at high level in the brain. The modern version of the alternative inflow or feedback theory attributes continuous central function to proprioception in controlling movement and maintaining perceptual constancy. Ten young men were tested for their accuracy in making horizontal eye movements toward a visible target and toward the recalled position of a masked target. The latter movements were accurate, and secondary adjustments, made without visual cues, usually reduced the residual errors in primary movements. The subjects were tested both before and after drinking alcohol. Eight different man moved their right forearm in the vertical plane, without visual cues, to effect alinement with their stationary left forearm. Primary movements and their residual errors were highly variable, but the latter were usually reduced by "blind" secondary adjustments. The subjects were tested for the effects of alcohol consumption and sleep deprivation for 36 hours. It is argued that the results cannot be reconciled with outflow theory. A model for the control of movement, based on proprioceptive feedback, is outlined. Author

N68-15923*# Systems Technology, Inc., Inglewood, Calif.
A NEUROMUSCULAR ACTUATION SYSTEM MODEL
D. T. McRuer, R. E. Magdaleno, and G. P. Moore *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 281–304 refs (See N68-15901 06-05)
(Contracts NAS2-2824; AF 33(657)-10835)

Recently both high quality physiological data and human operator describing function data of low variability and large dynamic range have become available. These data lead to control engineering descriptions for neuromuscular actuation systems which are compatible with the available data and which provide insight into the overall human control structure (e.g., the types of feedback systems used for various inputs). In this paper, some of these physiological and human-operator data are briefly reviewed, and a simple neuromuscular actuation system model is presented. The physiological data of interest include recent anatomical and physiological data for the muscle spindle and input-output studies of the muscle. These data indicate that simple linear models can describe the basic behavior of these two elements in tracking tasks. Developed further here is the variation in system parameters as a function of average muscle tension and the role of the muscle spindle both as an equalization element and in its effects on muscle tone. The pertinent human-operator describing function data include the covariation of high- and low-frequency phase data and the describing-function variation of high-frequency phase with tension. The simplest neuromuscular model suggested by and compatible with these data is one in which muscle spindles provide both a feedback function, an operating point or bias adjustment, and at least one command path. Author

N68-15924*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
PUPIL DILATION AS A MEASURE OF WORKLOAD
R. O. Anderson and P. E. Pietrzak *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 305–308 refs (See N68-15901 06-05)

Preliminary results from an experiment designed to determine the feasibility of pupillometrices as a measure of workload are reported. The experiment design consisted of implementing the STI critical task on the analog computer. The compensatory task error display was a horizontally moving dot on the CRT which the subject controlled with lateral movements of the control stick. The subject, a military pilot, was told to keep the dot centered on the scope with a minimum of error. Four specific experiments were performed: (1) time varying λ tracking; (2) fixed λ tracking (various λ values); (3) fixed λ tracking with side task; and (4) error observation only, no other tasks. In these experiments λ was the value of the controlled element pole in the right half plane, and increasing represented an increasingly more difficult task. Results lead to the following conclusions: (1) Pupil dilation is evident in certain manual tracking tasks of increasing difficulty. (2) This dilation is correlated with results of at least one, more or less conventional, workload measurement technique, and is also correlated with task difficulty. (3) The exact cause of this effect is unknown; however, it does not appear to be the sole result of error

observation, i.e., the phenomenon appears to be a result of stresses from the combined observation–control task. S.C.W.

N68-15925*# California Univ., Los Angeles.
INHIBITORY CONTROL: CONCEPT FOR A FIRST MODEL
John Lyman and Amos Freedy *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 311–314 refs (See N68-15901 06-05)
(Contract V/005P-9779)

Described is an inhibitory control concept of an adaptive system which makes use of the observed high autocorrelation of manipulator movement states during general task performance. Objectives of the proposed design approach focus on eliminating the human operator's decision load during control operations of multi-dimensional manipulative devices. It is concluded that: (1) by providing a means to externalize partially the detailed decisions required for skilled movements, the operator can achieved more refined control of the output system; and (2) through continued experience with his particular performance goals, the operator will, in effect, shape the plant function, combined with himself, into an integral unit. S.C.W.

N68-15926*# Massachusetts Inst. of Tech., Cambridge.
SUPERVISORY CONTROL OF MANIPULATION
T. B. Sheridan and W. R. Ferrell *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 315–323 refs (See N68-15901 06-05)
(Grant NsG-107-61)

Described are design concepts for a supervisor controlled remote (tool-object) manipulation system. Primary objectives of the proposed design focus on removing man from the immediate control loop so that he can serve as a supervisor by intermittently setting subgoals for an otherwise autonomous remote system of servos, hands, and a small computer. The proposed approach treats the human operator as a strategic planner and is in contrast to previously proposed inhibitory control approaches. Other differences and similarities between conventional tracking and vehicle control, and the proposed remote manipulation or tool-object control system are discussed. S.C.W.

N68-15927*# Massachusetts Inst. of Tech., Cambridge.
STOCHASTIC MODELING OF HUMAN LEARNING BEHAVIOR
Albert E. Preyss and Jacob L. Meiry *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 327–349 refs (See N68-15901 06-05)

A stochastic model of human learning behavior in a manual control task is described. Regulation of the state of a double integral plant to minimize the integrated absolute error is the operator's task. Subjects given this task were instructed to drive the process from an initial state to the null state using a two-position relay controller and a visual display. A subject is conceptualized in the model as a sequential data processing system. A sensor, a decision maker, and an effector are the three serially connected components making up the system. Each element requires a finite time either to process or transmit information, and thus a delay is incurred between the reception of the visual stimulus and the execution of a motor response. In agreement with known experimental evidence, this delay or reaction time is treated as a sum of random variables. A time delay or reaction time is treated as a sum of random variables. A time delay of random duration thus completely describes the sensor and effector dynamics. Decisions are made on the basis of an a priori estimate of the probability that the control polarity should be switched, given the current state of the plant. Patterns in the subsequent phase trajectory are used as evidence by the decision maker to revise prior estimate. Bayes' theorem is the algorithm employed for the determination of the posteriori probability. Behavior of this model is compared with subject behavior in the motor-skill experiment. The extent of the model's characterization of the time varying random nature of human learning is brought out by this comparison. Also discussed are the applications of the concept of this model to other manual control tasks. Author

N68-15928*# Massachusetts Inst. of Tech., Cambridge.
MANUAL TIME-OPTIMAL CONTROL FOR HIGH ORDER PLANTS
Syozo Yasui and Laurence R. Young *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 351–370 refs (See N68-15901 06-05)

The concept of a switching surface is applied to closed loop, manual, time optimal, bang bang control of high-order systems by visually displaying the instantaneous position velocity error spot and the switching locus simultaneously on the phase plane. Switching locus is a curve describing the intersection between the switching surface and the plane parallel to the phase plane, for example, representing the locus in the instantaneous acceleration plane for third-order plants. The operator's task is to achieve minimum time response by reversing control polarity when the moving state point intersects the moving switching locus. The general procedure is outlined for nth order plants with real poles, and a technique suitable for an analog computer to generate the exact or approximate switching locus is proposed. The second-order plants, $1/s^2$ and $1/s(s+\alpha)$, are presented as preliminary examples, for which the switching loci do not move. The third-order plant, $1/s^3$, is studied in detail as an example of higher order plants. Satisfactory experimental results have been obtained for all examples given. Author

N68-15929*# University of Southern Calif., Los Angeles.
ADAPTIVE FINITE STATE MODELS OF THE HUMAN OPERATOR
E. S. Angel *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 371–379 refs (See N68-15901 06-05)
(Grants NGR-05-018-022; AF-AFOSR-1018-67)

While most of the mathematical models of human operators are based on the operator acting in a continuous manner upon continuous data, this model is based upon the human operator seeing only quantized input data and possessing a small number of internal states. The basic model is shown here, and a scheme by which the threshold levels might be adjusted to make the basic model adaptive is presented. Some preliminary results and suggestions for further research are also presented. Author

N68-15930*# Systems Technology, Inc., Inglewood, Calif.
OBTAINING APPROPRIATE HUMAN PILOT DESCRIBING FUNCTIONS FROM CROSSOVER MODELS AND OPTIMAL CONTROL THEORY
Lee Gregor Hofmann *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 381–384 refs (See N68-15901 06-05)
(Contract AF 33(615)-3652)

Demonstrated is the applicability of optimal control theory in relieving inherent problems associated with the use of crossover models for the human pilot to analyze situations in which the controlled element is not clearly one of the basic types (i.e., K_c, K_c/s, or K_c/s^2). S.C.W.

N68-15931*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF HUMAN TRANSFER FUNCTIONS TO A DESIGN PROBLEM
James J. Adams *In its* 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 387–397 ref (See N68-15901 06-05)

An analytical design study was made of a proposed full-scale, manually controlled lunar landing simulator using analytical transfer functions for the pilot control response along with the analytical representation for the mechanisms. The simulator reproduced the lunar environment by supporting five-sixths of the weight of the test vehicle with an overhead cable. The cable was kept directly over the test vehicle by the automatic control of the longitudinal drive mechanism of the simulator. The results showed that the dynamic characteristics of the simulator that could be expected in the actual system were in a range that would influence the response of the manually controlled systems which were to be tested. When the simulator was put in operation, the results of the analytical study were checked. The simulator was operated with the gain of the longitudinal drive set as high as was feasible with the actual mechanism and with a low gain to determine if this change would affect the pilot's response. The pilots reported that the degraded system was more difficult to control, and the records clearly showed a decrease in system damping with the degraded system. Author

N68-15932*# Ohio State Univ., Columbus.
ASYMPTOTIC STABILITY STUDIES IN SIMULATED CAR FOLLOWING
Robert E. Fenton *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 399–414 refs (See N68-15901 06-05)

A control stick with a built-in tactile aiding device was tested in a simulated car-following situation. The tactile device, or finger, gave the driver of a following car information (i.e. headway and relative velocity) about the state of a lead car. The finger position sensitivity and the range of tactile aiding ratios under which a driver may minimize headway and relative velocity variations are obtained, together with a mathematical model of the display-driver-control stick combination. The corresponding driver vehicle system is shown to be locally, but not asymptotically, stable. Hence, optimum tracking and asymptotic stability do not occur under identical conditions. Asymptotic stability may probably be achieved by compensating the driver vehicle system. To this end, various compensation methods are examined, and models are obtained for the modified system. Insight into the form of the required compensation was gained; however, all of the systems examined were asymptotically unstable. Author

N68-15933*# United Aircraft Corp., East Hartford, Conn.
INTERPRETATION OF PILOT OPINION BY APPLICATION OF MULTILOOP MODELS TO A VTOL FLIGHT SIMULATOR TASK
E. W. Vinje and D. P. Miller *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 415–440 refs (See N68-15901 06-05)

Analytical and flight simulator studies were conducted to develop a mathematical model for interpreting pilot opinion rating and pilot selection of optimum control sensitivity for a VTOL aircraft hovering task. Pilot longitudinal control of a VTOL aircraft hovering in turbulent air was modeled as a coupled, multiloop control task. Control characteristics of the pilot were described by adaptable gain and lead terms and by fixed lags. Pilots performed a simulated hovering task for a variety of VTOL configurations while rms hovering performance data were measured. These data were used to compute the pilot model adaptable parameters for each configuration. Results indicate that variations in longitudinal dynamics and the intensity of pitch-attitude distrubances affected pilot opinion rating but not hovering accuracy. However, increasing the intensity of position disturbances increased hovering error while pilot opinion deteriorated. When pilot opinion deteriorated because of difficulty in controlling pitch attitude, computed pilot lead in the pitch loop increased. The pilot also disliked controlling large position disturbances, but he did not always adapt large lead terms in doing it. There was some indication that the pilot's criterion for selecting optimum control sensitivity when the longitudinal speed-stability and drag parameters were varied may have been to keep his internal pitch-loop gain constant. Author

N68-15934*# Naval Research Lab., Washington, D. C.
MAN–MACHINE SYSTEM EQUALIZATION DETERMINATION AND ITS IMPLEMENTATION
C. L. Tipton *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 441–456 refs (See N68-15901 06-05)

This paper presents a simplified and direct method of systems synthesis of higher order, man–machine control loops. A profile of system feedback is derived which produces a previously selected standard form of closed-loop step response. Details of this design procedure are outlined and, by way of example, the equalization for an eighth order aircraft vertical-rate control loop is determined. Further, through an implementation procedure, the synthesized equalization formulation is executed in terms of the given system structure. Finally, a man–machine experiment compares the conventional and equalized control loop configurations. The results show that the derived equalization effects a 90 percent reduction in both system error and the amount of control manipulation. Author

N68-15935*# Systems Technology, Inc. Inglewood, Calif.
APPLICATIONS OF THE PILOT TRANSITION RESPONSE MODEL TO FLIGHT CONTROL SYSTEM FAILURE ANALYSIS
David H. Weir *In* NASA 3d Ann. NASA Univ. Conf. on Manual Control 1967 p 457–459 refs (See N68-15901 06-05)
(Contract NAS2-3607)

The applicability of the pilot transition model to problems of manual control, where the effective dynamics of the task are time varying with a sudden or instantaneous change between stationary control conditions, is discussed. Emphasized is the possibility of making these transitions easier or more graceful; that is, minimizing the operator control difficulties, resultant vehicle motions, and time to reach a steady state adaptation to the new dynamics. Experimental efforts directed toward testing of the graceful degradation hypothesis in a fixed base simulator are reported. According to the hypothesis, the operator will have the least transition control difficulty and his performance will be best if the difference in the effective controlled elements is minimized before and after transition. A second set of experiments involving lateral directional control of roll angel with aileron and yaw rate with rudder are reported. Preliminary results from these experiments support the graceful degradation hypothesis. It is surmised that results of these studies, together with the previously derived transition response model, will ultimately allow rational design criteria to be specified which may place more load on the pilot in some flight conditions, thereby relieving some of the requirements for augmentation system reduncancy. S.C.W.

N68-15937*# Naval School of Aviation Medicine, Pensacola, Fla.
EFFECT OF BLOOD pH AND CO_2 TENSION ON THE PERFORMANCE OF THE HEART–LUNG PREPARATION
N. S. Nejad and Eric Ogden 13 Nov. 1967 26 p refs Sponsored in part by NASA
(NASA-CR-92516; NAMI-1025) CFSTI: HC $3.00/MF $0.65 CSCL 6P

When the performance of heart–lung preparations was evaluated by the relationship between stroke work and left atrial pressure, a change of the CO_2 content of the inspired air from zero to 10 per cent caused a progressive decrease in performance. The use of HCl or $NaHCO_3$ allowed for changing the pH and pCO_2 of the arterial blood separately. Arterial blood pH rather than blood pCO_2 appeared to be the decisive factor in mediating this change. Whenever a change of inspired air composition was made in either direction, the new performance level was preceded by a marked overshoot. A fall in arterial pH was accompanied by a slowing of the heart rate. Author

N68-15945*# Systems Technology, Inc., Hawthorne, Calif.
STUDY, DEFINITION AND ANALYSIS OF PILOT/SYSTEM PERFORMANCE MEASUREMENTS FOR PLANETARY ENTRY EXPERIMENTS
D. E. Johnston and R. F. Ringland Dec. 1967 182 p refs
(Contract NAS2-3635)
(NASA-CR-73171; TR-169-1) CFSTI: HC $3.00/MF $0.65 CSCL 05H

The analysis and synthesis leading to a definition of an experimental program whereby pilot performance during planetary entry can be predicted is presented. This includes an analysis of the mission to determine the piloting skills required, an examination of the literature to determine the current state of knowledge concerning skill degradation under g-forces, and the definition of an experimental program designed to provide a model predictive of human performance during planetary entry. This program relies on ground-based experimentation (human centrifuge), the results to be correlated with a limited number of in-flight entry experiments. Author

N68-15947# Aerospace Medical Lab. (Clinical), Lackland AFB, Tex. Hematology-Cancer Chemotherapy Section.
CHARACTERIZATION AND CLASSIFICATION OF THE LIGHT CHAIN COMPOSITION OF A MACROMOLECULAR CRYOPRECIPITATING FACTOR
Richard A. Gams, John J. Costanzi, and Charles A. Coltman, Jr. Aug. 1967 18 p refs
(AMLC-TR-67-9; AD-662873)

Several patients were reported to have a form of cryoglobulinemia in which the IgM protein precipitated in the complex with the IgG protein. In certain instances, the light chains of the IgM were of both kappa and lambda types. In one previous instance, the light chains were exclusively kappa type and in another, exclusively lambda type. The IgM-IgG complex from a patient with a mixed form of cryoglobulinemia was studied. The IgM portion was found to be necessary for the formation of the complex. Pooled human IgG could be substituted for the IgG of the patient. The IgM protein had exclusively kappa type light chains, whereas the IgG portion had light chains of mixed kappa and lambda types. It was concluded that thd IgM was an abnormal monoclonal paraprotein that formed a cryoglobulin with the available normal IgG. Author (TAB)

N68-16003# Czechoslovak Academy of Sciences, Prague.
ADAPTATION IN CELL AND TISSUE CULTURES
Emma Holeckova 1967 76 p refs *Its* Vol. 77, No. 8, 1967

Tissue culture methods and their adaptation for cultured cell populations are summarized; also discussed are adaptation studies with animal cells to temperature changes, especially to cold, and laboratory results with cultured animal and human cells are presented. In general it is found that the age of the donor organism is a very important factor in cell adaptability; their adaptation ability decreases with age. Also exposure to light, hypoxia, and to subnormal temperatures damages parts of the cell population during handling, and only cells able to adapt to all those factors survive the transplant. G.G.

N68-16047*# Stanford Univ., Calif. Instrumentation Research Lab.
CYTOCHEMICAL STUDIES OF PLANETARY MICROORGANISMS—EXPLORATIONS IN EXOBIOLOGY Status Report, 1 Apr.–1 Oct. 1967
Joshua Lederberg and Elliott C. Levinthal 1 Oct. 1967 45 p refs
(Grant NsG-81)
(NASA-CR-92556; IRL-1061) CFSTI: HC $3.00/MF $0.65 CSCL 06M

The following studies are reported: (1) *Gas Chromatography and Optical Resolution*—molecular analyses of open-chain amines and cyclic amines, conversion of amino acids to non-polar isothiocyanate derivatives, and effects of coupling agents and N-acyl protecting groups on peptide synthesis; (2) *Mass Spectrometry*—analyses on natural products, and microanalysis of organic solids; (3) *Computer Managed Instrumentation*—development of advanced computer to provide digital interface between experimental equipment and data processing for mass spectrometers, chemical hypotheses, particle cell separation and identification, cell detection in high speed flow system, and thermal chromatography runs; (4) *Prebiological Evolution*—concentration of organic precursors of biological molecules in primitive oceans; and (5) *Pasteur Probe*—proposal to study molecular asymmetry in extraterrestrial life detection. G.G.

N68-16061*# Schwarz Bioresearch, Inc., Orangeburg, N. Y.
DEVELOPMENT OF A LOW RESIDUE DIET FOR SMALL PRIMATES Annual Report, 4 Oct. 1966–3 Oct. 1967
Ralph Shapiro 3 Oct. 1967 82 p refs
(Contract NASw-517)
(NASA-CR-91904) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Experiments were conducted to determine whether a highly defined low residue, liquid diet can maintain squirrel monkeys in a state of good health and nutrition. Of the 20 male monkeys selected, 8 passed through the three-phase transition of switching from a standard stock diet, to several chemically defined powder diets, and then to a liquid diet. Diet acceptance was found to be a key factor in achieving success with the liquid regime. After periods of up to 28 weeks, the results show that squirrels maintained on a 50% (w/v) chemically defined liquid diet have either gained or maintained weight, and appear active and healthy. Diet consumption averaged 76 ml/day, which provided 136 calories, 6.9 g protein, 0.15 g fat as ethyl linoleate, 0.19 g calcium, and 0.15 phosporous. No signs of hair loss, dermatitis, emaciation, or malnutrition were noted. M.G.J.

N68-16066 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
MAGNITUDE SCALING OF SHORT DURATION WITH CLOSELY SPACED STIMULI
John A. Michon [1967] 9 p refs
(IZF-1967-19; TDCK-49238)

A fine graduated magnitude scale for temporal duration is derived; it consists of two parts, each of which confirms the power law $\psi = a\ \phi^b$. For intervals shorter than 500 msec the characteristic exponent b is approximately equal to 0.6, for longer intervals $b \approx 1.1$. The latter result is in accord with earlier studies. The relation of this transition to similar effects obtained in indirect scaling experiments is discussed. The present results rule out the possibility that these effects are artificial byproducts of the motor response elicted by the indirect methods. Author

N68-16080*# Pillsbury Mills, Inc., Minneapolis, Minn.
COMPRESSED FOOD COMPONENTS TO MINIMIZE STORAGE SPACE
Jack R. Durst Natick, Mass. Army Natick Labs. Oct. 1967 74 p
(Contract DA-19-129-AMC-860(N))
(NASA-CR-91879; FL-64; TR-68-22-FL; AD-662060) CFSTI: HC $3.00/MF $0.65 CSCL 06H

The study was originated to design, develop, and demonstrate an integrated feeding system based on a specified number of stable food components which can be stored in a limited space and from which can be prepared a variety of nutritious food items. Information is presented for the preparation of 10 food bars, 4 food sheets and 13 food adjunct cubes. Data are given on these components packed in flexible pouches, some under vacuum, after a thirteen week storage study. Evaluations were carried out on microbiological, physical and organoleptic considerations. Hedonic ratings are shown for 45 meals prepared from these components before and after thirteen weeks storage at 38C using both a nine point 5 neutral scale and a nine point 3 neutral scale. Nutritional values of ingredients used are listed. Author (TAB)

N68-16099 California Univ., Livermore. Lawrence Radiation Lab. Bio-Medical Div.
X-RAY FLUORESCENCE ANALYSIS APPLIED TO BIOLOGICAL PROBLEMS
Lynn R. Anspaugh, John W. Gofman, Ora A. Lowe, and Walter H. Martin 1 May 1967 13 p refs Submitted for publication Sponsored by AEC
(UCRL-70351; CONF-670321-1) CFSTI: $3.00

A methodology is presented for the X-ray fluorescent analysis of trace elements in human fluids and tissues. The samples are lyophilized, and the resulting powder is pressed into one inch disc shaped wafers which are individually mounted in plastic holders. Lyophilization provides for sample concentrations of from 4 to 10, and for a comparatively contamination and loss free procedure. To eliminate any apparent peaks arising from elements present as contaminants within the spectrograph itself, the artificial scatterer used must be free of the trace element being measured, and must approximate the matrix of the sample to be measured. Since most plastic materials have a matrix similar to that of lyophilized biological materials they are used as holders. The data acquisition and reduction techniques used were designed to minimize questions of erratic behavior of the X-ray generator, positioning devices, and electronic counting circuits. The usual procedure is to analyze several samples (20 to 100) at a time for one element since counting it only once builds up a bias if long term drifts are operative. These procedures have been extensively applied to the analysis of chemical elements in human serum, and levels of concurrence or upper limit estimates have been established for 66 elements. E.J.S.

IAA ENTRIES

A68-16032 *
FINE CONTROL IN THE HUMAN TEMPERATURE REGULATION SYSTEM.
Ronald W. Cornew (Massachusetts Institute of Technology, Dept. of Electrical Engineering and Research Laboratory of Electronics, Cambridge, Mass.), James C. Houk (Harvard University, Dept. of Physiology, Boston, Mass.), and Lawrence Stark (Chicago, University, Dept. of Bioengineering and Presbyterian-St. Luke's Hospital, Chicago, Ill.).
Journal of Theoretical Biology, vol. 16, 1967, p. 406-426. 22 refs.
NSF Grant No. GK-835; NIH Grants No. MH-04737-06; No. NB-3055; No. NB-3090; No. MH-06175; Contracts No. DA-28-043-AMC-02536(E); No. Nonr-609(39); No. Nonr-1841(70); No. AF 33(616)-7282; No. AF 33(616)-7588; No. AF 49(638)-1313; No. DA-18-108-405-Cml-942; Grants No. NsG-496; No. NsG-22-009-019.

A model is developed for the regulation of temperature in man. The thermal properties of the body are presented in circuit form and simplified to eliminate all features not essential to an understanding of control. In this modeling, perspiration is treated as a source which can pump heat against a temperature gradient, while lung heat loss appears as a high-frequency alteration in effective heat production. To this simplified thermal circuit are appended the principal mechanisms which are available to the nervous system for controlling body heat balance - increased metabolism as in shivering, increased heat loss by perspiration, and alteration of thermal conductance through changes in blood flow - and a block diagram of the resulting control system is given. To formulate the problem on a feedback control basis, an error signal representing deviations of hypothalamic temperature from a reference value or set point of 37°C is defined. Since man normally spends most of his time neither shivering nor perspiring, particular emphasis is placed upon an analysis of the vascular mechanism by which fine control is achieved. A nonlinear differential equation governing the system under this mode of control is presented and solved for transient disturbances in metabolic heat production and environmental temperature. The analysis indicates a quantity - dependent on level of metabolism and degree of control over peripheral blood flow - which is a measure of the strength or effectiveness of vascular control. Both response time and steady-state error are reduced by this factor, which is estimated to have a numerical value of about 10. From this analysis it is clear that regardless of how additional assumptions might complicate a description of the system, the data on vascular control reported by Benzinger (1959) lead to a model of human temperature regulation exhibiting powerful multiplicative control over heat flow out of the body. (Author)

A68-16062 *
THERMODYNAMIC ESTIMATE OF THE LIKELIHOOD OF LIFE IN THE SOLAR SYSTEM.
J. P. Wesley (Missouri, University, Rolla, Mo.).
Currents in Modern Biology, vol. 1, 1967, p. 214-221. 20 refs.
Grant No. NGR-26-004-014.

Discussion of life taken as a property of open thermodynamic systems which reduce the entropy of compounds taken from the environment. To support entropy-reducing processes, an environment must increase the entropy of the universe with time; the greater such entropy production, the greater the likelihood of life. The entropy production of the planets is determined by the difference in entropy between incident solar photons and reradiated thermal photons. Mass transport, which is necessary for life, is estimated in terms of atmospheric mixing for the various planets. A number of miscellaneous characteristics are also considered. Earth appears most favorable for life. Mars probably has primitive thermodynamic life in the form of crystal growth. Life on the other bodies in the solar system appears unlikely. M.G.

A68-16065 *
CHARACTERISTICS OF ALDOLASE VARIFORMITY.
Colin J. Masters (Brandeis University, Graduate Dept. of Biochemistry, Waltham, Mass.).
Biochemical and Biophysical Research Communications, vol. 28, no. 6, 1967, p. 978-984. 12 refs.
American Cancer Society Grant No. P-771; Grants No. AF AFOSR 732-67; No. NsG-375; No. NsG-22-005-001.

Study of variant characteristics of the heteromorphs in some vertibrate tissues. Anomalous behavior of the aldolase enzyme in the liver and intestine of the chicken is noted. The electrophoretic mobilities of the anodic forms in these tissues were greater than for heart or brain, and the ratios of fructose-1, 6-diphosphate to fructose-1-phosphate were lower than usually observed for the brain type. The effects of tissue modification, isozyme association and microheterogeneity on the structural interpretations for this enzyme are reported. M.G.

A68-16190
THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966.
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby (University of Aston, Applied Psychology Dept., Birmingham, England), and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967. 217 p.
$8.50.

CONTENTS:

A68-16191
THE IMP IN THE SYSTEM.
Hugh M. Bowen (Dunlap and Associates, Inc., Darien, Conn.).

IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 12-19.

Review of recent trends in system philosophies, especially with regard to the contribution of human factors. Types of work are described which lead to the conclusion that success cannot be achieved in utilizing the resources of man in a system until the fact is accepted that he contributes a qualitatively different form of operation in comparison to machine elements. F.R.L.

A68-16192
EVALUATION OF HUMAN OPERATOR COUPLED DYNAMIC SYSTEMS.
K. C. Garner (College of Aeronautics, Cranfield, Beds., England).
IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 25-38.

Account of human-operator dynamics and of some trends in parameter-evaluation techniques. Some common theoretical descriptions of dynamic systems are given. In human-operator situations, the man-machine complex is ultimately always closed-loop. Factors are discussed which have taken parameter-evaluation techniques along two slightly different paths, one being essentially theoretical, in that a mathematical model is derived as a starting point, while the other relies on the use of a physical model, or simulation. Various aspects of the theoretical and simulation techniques are considered. F.R.L.

A68-16194
MAN-MACHINE ALLOCATION IN MILITARY SYSTEMS.
K. G. Corkindale (Ministry of Technology, Royal Aircraft Establishment; Royal Air Force, Institute of Aviation Medicine, Farnborough, Hants., England).
IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 61-66.

Consideration of a man-machine system viewed as any organized group of activities, involving men and machines, directed toward the solution of a given problem or set of problems and operating within the constraints of a given environment. The first task is to break down the total system into a set of subsystems, each one of which contributes to the overall effectiveness of the system. It is in the design of these subsystems that the choice between man and machine is of primary importance. The man-machine allocation problem and earlier approaches to it are discussed. Current views on task allocation and present techniques are considered. F.R.L.

A68-16195
TASK TAXONOMY - SCIENCE OR TECHNOLOGY?
R. B. Miller.
IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 67-76.

Discussion of task taxonomy, a taxonomy being defined as a way of simplifying a complicated universe of individual events according to some useful way of identifying and labeling the way in which groups of individuals (or observations) have things in common and differ from other groups of individuals. Explanatory vs descriptive taxonomies, and rigorous vs nonrigorous taxonomies are considered. The classification of objects and phenomena is explained, together with the objectives of a task taxonomy. An example of task classification is presented, and the construction of a taxonomic grid is outlined. Nonsense tasks and correlations are briefly discussed, and recommendations for further progress are made. F.R.L.

A68-16196
FAULT DIAGNOSIS TRAINING FOR MAINTENANCE PERSONNEL.
K. W. Tilley (Royal Air Force, Technical Training Command, Brampton, Cumberland, England).
IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 106-113.

Discussion of fault-diagnosis training for maintenance personnel by outlining, in general terms, what a systems approach to training involves, and by giving a concrete example of an attempt to apply a systems approach to one particular problem - namely, that of training men to maintain complex equipments. The systems approach to training involves job analysis, job specification, definition of training requirements, development of appropriate training methods, evaluation of the training course, and ensuring the retention of the acquired knowledge and skill. Problems encountered in actual fault-diagnosis training are described. F.R.L.

A68-16198
TOUCH DISPLAYS - A PROGRAMMED MAN-MACHINE INTERFACE.
E. A. Johnson (Ministry of Technology, Royal Radar Establishment, Great Malvern, Worcs., England).
IN: THE HUMAN OPERATOR IN COMPLEX SYSTEMS; PROCEEDINGS OF THE CONFERENCE, UNIVERSITY OF ASTON, BIRMINGHAM, ENGLAND, JULY 1966. [A68-16190 05-05]
Conference sponsored by the University of Aston and the Industrial Section of the Ergonomics Research Society.
Edited by W. T. Singleton, R. S. Easterby, and D. C. Whitfield.
London, Taylor and Francis, Ltd., 1967, p. 171-177.

Discussion of touch displays, conceived in an attempt to overcome certain limitations in man-machine communications. The concept has applicability to the whole field of data-processing systems. General principles of operation are outlined, and technical details of the touch display are given. An example in an air traffic control system is presented. Use of the touch display provides both a faster and more accurate means of communicating between an operator and a data-processing system than is obtainable with conventional keyboards. F.R.L.

A68-16296
THE MONAURAL M.A.P. THRESHOLD OF HEARING AT FREQUENCIES FROM 1.5 TO 100 C/S.
N. S. Yeowart, M. E. Bryan, and W. Tempest (Salford, University, Dept. of Electrical Engineering, Salford, Lancs., England).
Journal of Sound and Vibration, vol. 6, Nov. 1967, p. 335-342.
9 refs.

The monaural minimum audible pressure threshold of hearing has been measured at frequencies from 100 to 1.5 cps, with particular emphasis on frequencies below 25 cps. The results show that the threshold rises smoothly with decreasing frequency over the whole range measured and the data obtained are in good agreement with Bekesy (1936). (Author)

A68-16301
THE RESPONSE OF BUILDINGS TO SONIC BOOM.
C. W. Newberry (Ministry of Public Building and Works, Building Research Station, Watford, Herts., England).

Journal of Sound and Vibration, vol. 6, Nov. 1967, p. 406-418.

Discussion of some experimental observations of the excitation of building structures by sonic booms. Investigations showed that there are a large number of cases of trivial damage, but no case of severe structural damage. The nature and propagation of the sonic boom is reviewed, and measurements of the effect of sonic booms on buildings and the strength of the shock are reported. Sonic boom pressures from oscillograph records and direct-reading meters are tabulated together with house vibration measurements. The question of coincidences between sonic boom periods (including reflections) and natural periods of building structure is discussed. M.F.

A68-16311 *

INFLUENCE OF CULTURE MEDIA ON THE RADIATION RESISTANCE OF MICROCOCCUS RADIODURANS.

K. L. Krabbenhoft, A. W. Anderson, and P. R. Elliker (Oregon State University, Dept. of Microbiology, Corvallis, Ore.).

Applied Microbiology, vol. 15, Jan. 1967, p. 178-185. 23 refs.

Grants No. NsG(T)-68; No. NsG(T)-38-002-001.

Experimental investigation of the influence of a culture medium on the radiation resistance of the microorganism Micrococcus radiodurans. The addition of NZ-case to a growth medium (PC) consisting of tryptone, glucose, and yeast extract caused a significant decrease in γ-radiation resistance of Micrococcus radiodurans. The level of radiation resistance was inversely related to the concentration of NZ-case. The LD_{50} (dose level) for this organism was approximately 700 krad when grown in tryptone, glucose, yeast extract, and DL-methionine (TGYM) broth, but it was approximately one-half as resistant when grown in a PC medium containing 0.5% NZ-case (PCNZ). The resistance to UV light was also reduced. Cultures transferred from PCNZ to TGYM media regained the high level of resistance. M.M.

A68-16328

THE EFFECT OF PRIOR EEG "COUPLING" UPON THE VISUAL EVOKED RESPONSE.

Gary C. Galbraith (Southern California, University, Dept. of Psychology, Los Angeles; Pacific State Hospital, Pomona, Calif.).

(Computers and Psychobiology Workshop, Monterey, Calif., May 16 17, 1966, Paper.)

IEEE Transactions on Bio-Medical Engineering, vol. BME-14, Oct. 1967, p. 223-229. 20 refs.

Description of a statistical technique which appears to measure important interaction processes within the central nervous system (CNS). This statistic, termed weighted-average coherence, or $\bar{C}$, is derived primarily from parameters generated in cross-spectral frequency analysis. $\bar{C}$ has the useful property, however, of summarizing a larger amount of cross-spectral information into a more manageable form. By applying $\bar{C}$ analysis to the ongoing EEG, it has been possible to define unique patterns of interaction, or coupling, between different brain areas. The total pattern of EEG coupling is taken to define a given state of functional brain organization. Moreover, since $\bar{C}$ is sensitive to changes in the EEG, it also reflects something of the dynamic properties of such brain organization. Results of tests performed on a rhesus monkey support the meaningfulness of $\bar{C}$ as a measure of functional brain organization and also provide a basis for understanding how such organization is effected in the CNS. M.M.

A68-16329

THE DESIGN AND USE OF AN FM/AM RADIOTELEMETRY SYSTEM FOR MULTICHANNEL RECORDING OF BIOLOGICAL DATA.

J. Rod Zweizig, Raymond T. Kado (California, University, Center for Health Sciences, Brain Research Institute, Space Biology Laboratory, Los Angeles, Calif.), John Hanley (California, University, Dept. of Psychiatry and Center for Health Sciences, Brain Research Institute, Space Biology Laboratory, Los Angeles, Calif.), and W. Ross Adey (California, University, School of Medicine and Center for Health Sciences, Brain Research Institute, Space Biology Laboratory, Los Angeles, Calif.).

IEEE Transactions on Bio-Medical Engineering, vol. BME-14, Oct. 1967, p. 230-238. 16 refs.

Grant No. AF AFOSR 61-81.

A multichannel telemetry system for EEG recording has been constructed for study of animal or human behavior correlates under natural, unrestrained conditions. To be useful in research of this kind, the transmitted radio signal must be independent of the environment, so that changes in antenna loading and in signal level cause no artifact. Standard IRIG proportional-bandwidth FM subcarrier channels are used. These subcarriers are generated by twin-T oscillators, modulated in turn by the amplified data signals. The FM subcarriers are then linearly summed and impressed upon a crystal-controlled AM transmitter. The system is also relatively insensitive to major shifts in supply voltage. Wherever possible, fabrication was by means of integrated circuits, thus reducing the bulk of the modules. When used in conjunction with appropriate sensing electrodes, this system yields accurate records, with subjects both at rest and in motion, and for recording periods as long as 24 hr. Electrical seizure data were obtained in situations where an observer, looking for the typical tonic or clonic contractions, would have missed the pathological brain activity, since there were no associated motor signs. Recordings of longer duration than usual are possible due to increased freedom of movement by the subject. (Author)

A68-16416 #

DYNAMICS OF THE RESPIRATORY WAVES OF INTRACRANIAL PRESSURE AT TRANSVERSE OVERLOADS OF UP TO 40 UNITS [DINAMIKA DYKHATEL'NYKH VOLN VNUTRICHEREPNOGO DAVLENIIA PRI POPERECHNYKH PEREGRUZKAKH DO 40 ED].

Iu. E. Moskalenko, G. B. Vainshtein, and I. I. Kas'ian.

Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia, vol. 32, Nov.-Dec. 1967, p. 843-850. 20 refs. In Russian.

Discussion of intracranial, pleural and tracheal pressure, and chest mechanograms obtained from 28 anesthetized dogs accelerated to 2 to 40 g on a centrifuge. Transverse acceleration was found to lead to an increase in the amplitude of the respiratory waves of intracranial pressure in proportion to the acceleration level. For accelerations up to 10 g, an explanation for this is seen in an increase in the pressure gradients of the pleural respiration cycle relative to the protective spasm of the vocal glottis, while for accelerations higher than 12 g, it is explained in terms of an additional compression of the bronchia, due to the deposition of blood in the lung vessels, and an additional compression of the lungs by the acceleration forces and pulmonary edema. Rapid recovery after acceleration is seen to indicate a high tolerance of brain circulation to transverse accelerations. V. P.

A68-16458 *

A CHRONIC CROSS-CIRCULATION TECHNIQUE FOR RATS.

Stephen A. Weinstein and Zoltan Annau (Johns Hopkins University, Dept. of Environmental Medicine and Dept. of Psychiatry and Laboratory of Behavioral Physiology, Baltimore, Md.).

Journal of Applied Physiology, vol. 23, Oct. 1967, p. 601-604. 5 refs.

Research supported by Wallace and Tiernan and Warner Lambert; NIH Grants No. HE-01929; No. HE-06945; Contracts No. DA-49-193-2726; No. NR-102-101; Grant No. NGR-21-001035.

The paper presents a technique for long-term cross circulation of unanesthetized, unrestrained rats. Improved techniques for chronic, simultaneous, implantation and anchoring of arterial and venous catheters are described and are the basis for successful cross perfusion. Daily 1-hr cross perfusions at exchange rates of 45 ml/hr have been carried out for periods of 2 weeks. No adverse reactions were observed except for a fall in hematocrit which rose when cross perfusion was discontinued for several days. The surgical and anchoring procedures described are compatible with the simultaneous implantation of chronic brain electrodes. (Author)

A68-16459 *

GLUCOSE OXIDATION AND REPLACEMENT DURING PROLONGED EXERCISE IN MAN.

D. R. Young, R. Pelligra, J. Shapira, R. R. Adachi, and K. Skrettingland (NASA, Ames Research Center, Biotechnology Div., Moffett Field, Calif.).

Journal of Applied Physiology, vol. 23, Nov. 1967, p. 734-741. 39 refs.

Investigation of the blood-glucose turnover rate and oxidation during prolonged physical exercise. Uniformly labeled glucose-^{14}C was administered as a single injection after 9 hr of treadmill walking, and observations were made during an additional 4 to 5-hr period of exercise. The glucose turnover rate was 206 mg/kg per hr, the glucose oxidation rate was 175 mg/kg per hr, and 17% of the total CO_2 production was derived from the oxidation of glucose. In resting subjects, the glucose turnover rate was 140 mg/kg per hr, the glucose oxidation rate was 79 mg/kg per hr, and 33% of the total CO_2 production was derived from glucose metabolism. The incorporation of various precursors into the blood glucose was examined. The incorporation of carbon from palmitate, alanine, and glycerol into glucose was similar during rest or exercise. The data suggest that relatively more lactate was recycled into glucose during exercise than at rest. M. M.

A68-16460 *

MODEL FOR EVALUATION OF FATTY ACID METABOLISM FOR MAN DURING PROLONGED EXERCISE.

D. R. Young, J. Shapira, R. Forrest, R. R. Adachi, R. Lim, and R. Pelligra (NASA, Ames Research Center, Biotechnology Div., Moffett Field, Calif.).

Journal of Applied Physiology, vol. 23, Nov. 1967, p. 716-725. 30 refs.

Examination of plasma FFA (free fatty acid) turnover in relationship to fat metabolism. After nine hours of exercise, uniformly labeled palmitate-^{14}C was administered to two subjects and periodic samples were taken of venous blood and expired air in order to obtain the necessary data required for a determination of the kinetics of palmitate metabolism. From these data, a model which describes the metabolism of the plasma FFA is formulated. The model places in juxtaposition various metabolic pools and defines certain flow rates which are consistent with results of past research and various underlying theories regarding fat metabolism. R.B.S.

A68-16491

EFFECT OF A 21-HOUR DAY ON THE HUMAN CIRCADIAN EXCRETORY RHYTHMS OF 17-HYDROXYCORTICOSTEROIDS AND ELECTROLYTES.

H. W. Simpson and Mary C. Lobban (Glasgow, University, Royal Infirmary, Dept. of Pathology, Glasgow, Scotland; Medical Research Council, National Institute for Medical Research, Div. of Human Physiology, London, England).

Aerospace Medicine, vol. 38, Dec. 1967, p. 1205-1213. 11 refs.

Experimental investigation in which seven fit adult subjects lived from one to seven weeks on a day/night routine lasting 21 hr instead of the usual 24 hr. On alternate weeks all urine was collected (generally every two hours) and the serial 17-hydroxycorticosteroids (17-OHCS), potassium, sodium, chloride and water excretion rates were estimated in order to study the effect of this shortened day/night routine on the circadian rhythm of excretion. The results show that adaptation of the 17-OHCS and potassium rhythms took at least five weeks, while for sodium, chloride and water, it tended to be more rapid but was not immediate. These differences in the response of the various rhythms resulted in a loss of their normal synchronization. An interesting finding was that when experimental days fell on periods corresponding to deep sleep periods at home, adaptation was very slow. The fundamental nature of the 24-hr period in the promotion of these excretory rhythms was demonstrated. M.M.

A68-16492 #

METABOLIC EFFECTS OF MONOMETHYLHYDRAZINE.

Harold L. Bitter, Dale A. Clark, and William W. Lackey (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Biosciences Branch, Physiological Chemistry Section, Brooks AFB, Tex.).

Aerospace Medicine, vol. 38, Dec. 1967, p. 1214-1219. 14 refs.

The metabolic effects of monomethylhydrazine (MMH) were studied in rats using whole body calorimetry and measurements of serum and liver levels of fat and carbohydrate. Biochemical measurements were made in rats sacrificed 3 hr after injection of nicotinic acid only, nicotinic acid plus MMH, MMH only, or saline. In other groups of rats similarly injected, calorimetric and RQ measurements were made from 2 to 2-1/3 hr after injection. MMH alone had little metabolic effect except to increase plasma free fatty acids (FFA) slightly. In rats pretreated with nicotinic acid and subsequently injected with MMH, however, the RQ for a time was very low, apparently reflecting catabolism based almost exclusively on fat. Presumably, the MMH counteracted the nicotinic acid-induced inhibition of FFA mobilization from peripheral tissues and inhibited protein catabolism. (Author)

A68-16493

ANALYSIS OF F4 AIRCRAFT DAY AND NIGHT CARRIER APPROACHES.

Clyde A. Brictson (Dunlap and Associates, Inc., Western Div., Santa Monica, Calif.).

(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 217, 218.)
Aerospace Medicine, vol. 38, Dec. 1967, p. 1219-1224.
Contract No. Nonr-4984(00).

A68-16494

AEROMEDICAL ASPECTS OF THE SUPERSONIC TRANSPORT - A REVIEW.

Siegfried J. Gerathewohl (Federal Aviation Administration, Office of Aviation Medicine, Oklahoma City, Okla.).

Aerospace Medicine, vol. 38, Dec. 1967, p. 1225-1229. 24 refs.

Review, as to their present state, of five medical areas of supersonic commercial transport. The problems of concern are ozone concentration and cosmic radiation at SST cruising altitudes, hazards of rapid decompression of cockpit and passenger compartment, sonic boom effects on the population, and physical standards of the occupants of the SST. While most of the environmental and operational parameters of high-altitude supersonic flight are well understood, their physiological, psychological, and medical consequences deserve further investigation. Progress in these areas and extrapolations from available results indicate that no insurmountable obstacles will prevent the safe transportation of passengers and crews at supersonic speeds. (Author)

A68-16495 #

METHEMOGLOBINEMIA AS AN INDICATOR OF EXPOSURE TO MONOMETHYLHYDRAZINE.

Dale A. Clark (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Biosciences Branch, Physiological Chemistry Section, Brooks AFB, Tex.) and Sidney R. Fortney (Duke University, School of Medicine, Dept. of Medicine, Durham, N.C.).

Aerospace Medicine, vol. 38, Dec. 1967, p. 1230-1234. 15 refs.

Investigation of the possibility that the blood methemoglobin level could provide an index of dose of the monomethylhydrazine (MMH) received in case of accidental exposure of man to MMH. Indirect evidence was provided by in-vitro incubations of MMH with blood of man, dog, rabbit, guinea pig, and rat. The rates of methemoglobin formation were highest with dog, intermediate with human, and lowest with rodent blood, but reactivity of rodent oxyhemoglobin toward MMH was not less than reactivity of human oxyhemoglobin. Oxidation of heme by MMH was compared with peroxidation effected by certain MMH derivatives used as drugs. Results support conclusions that species differences in methemoglobin response to MMH largely reflect differences in erythrocyte metabolism and that accidental exposure of man to MMH would produce methemoglobin levels that would vary markedly with time after exposure. M.M.

A68-16496
RESPONSES OF THE HUMAN BODY TO A KNOWN FORCE LOAD DURING PROLONGED ISOLATION IN THE ENCLOSED SPACE.
Vladimir Zhuravlev, Lev Iseev, and Iuri Nefedov.
Aerospace Medicine, vol. 38, Dec. 1967, p. 1234-1239.

Experimental investigation of human-body responses during a four-month manned enclosure, using two provocative tests involving a known force load. The data accumulated at the adaptation optimum of trained subjects served as baseline values for a comparison with the results obtained during and after the experiment. Energy costs that indicate the development of adaptation and level of respiration are tabulated. A study of heat exchange carried out during training provided data which demonstrated an increase in the efficiency of work performance. The results obtained demonstrated that a long-term enclosure of man impairs his capacity for physical work. This was confirmed by an inadequate increase of some indices of human-body functions, including external respiration. As the experiment continued, the indices showed further deterioration, the percentage being very similar for the two provocative tests applied. M.M.

A68-16497 *
HEMATOLOGICAL CRITERIA OF CHRONIC ACCELERATION STRESS AND ADAPTATION.
R. R. Burton, A. H. Smith (California, University, Dept. of Animal Physiology, Davis, Calif.), S. J. Sluka (Pennsylvania State University, Dept. of Agricultural Engineering, University Park, Pa.), and E. L. Besch (Kansas State University of Agriculture and Applied Science, Dept. of Physiology, Manhattan, Kan.).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 136, 137.)
Aerospace Medicine, vol. 38, Dec. 1967, p. 1240-1243. 20 refs.
Grant No. NGR-05-004-008.
[For abstract see issue 23, page 3953, Accession no. A67-41587]

A68-16498
RATIONALE OF MASK-MOUNTED HYPOXIA WARNING SYSTEMS.
K. N. Ackles (Defence Research Board, Defence Research Medical Laboratories, Toronto, Canada), J. Ernsting, and A. J. F. MacMillan (Royal Air Force, Institute of Aviation Medicine, Farnborough, Hants., England).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1244-1247.

Assessment of the rationale of hypoxia warning systems, based on the monitoring of PO_2 in aviators' breathing equipment. A Polarographic Hypoxia Warning System and a respiratory mass spectrometer were used simultaneously to measure the PO_2 within the mask cavity or beyond the expiratory valve. Expired PO_2 was observed at simulated altitudes up to 25,000 ft during respiratory maneuvers both at rest and during exercise. Expired PO_2 levels of 54 mm Hg were recorded while subjects breathed a gas mixture whose PO_2 was 160 mm Hg. A warning level less than 60 mm Hg could allow serious hypoxia to develop before actuating the alarm. Adequate hypoxia warning without false alarms is unattainable when expired gas is monitored. Limited information with freedom from false alarms can be obtained by monitoring PO_2 at the mask inlet. M.M.

A68-16499 *
MEASUREMENT OF STROKE VOLUME BY THE VIBROCARDIOGRAM.
Clarence M. Agress, Stanley Wegner, Robert P. Fremont, Izumi Mori, and Dixie J. Day (Cedars-Sinai Medical Research Institute, Los Angeles, Calif.).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1248-1252. 12 refs.
Grants No. NsG-289; No. NsG-05-12-001.

An examination has been made of the relationship between stroke volume (measured by dye dilution) and left ventricular isovolumetric contraction and ejection times (measured by the vibrocardiogram). These studies were performed in 10 normal subjects under postural alterations and in 11 patients recovering from acute myocardial infarction. Regression analyses of the data showed that ejection time was highly correlated with stroke volume ($r = 0.84$), while use of both ejection time and isovolumetric contraction time improved correlation to $r = 0.90$. Similar correlations were obtained comparing changes in stroke volume with changes in the intervals. It was concluded that the vibrocardiogram provides a simple, nontraumatic method for the estimation of stroke volume. (Author)

A68-16500 #
A LABORATORY METHOD FOR SIMULATION OF SOLAR HEAT LOADS.
G. D. Callin and W. C. Kaufman (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biomedical Laboratory, Wright-Patterson AFB, Ohio).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1253-1259. 10 refs.

A test chamber in which the temperatures of the upper surfaces, lower surfaces, and circulating air can be independently controlled is used to produce solar-equivalent radiant heat loads on sitting subjects. Radiant heating of subjects by the upper surfaces is determined theoretically by blackbody mathematics and experimentally by partitional calorimetry. Though the two methods differ slightly in resultant values, the both indicate that upper surface temperatures of 54 to 82°C reproduce nearly the entire range of actual solar heat loads on a clear midsummer day. These findings point to use of this facility as a readily controlled simulator of outdoor environments. (Author)

A68-16501 #
CARDIAC DISPLACEMENT AND THORACIC VASCULAR TRAUMA RESULTING FROM ABRUPT DECELERATION OF DOGS.
Peter G. Hanson (New Mexico, University, School of Medicine, Dept. of Pharmacology, Albuquerque, N. Mex.).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 35, 36.)
Aerospace Medicine, vol. 38, Dec. 1967, p. 1259-1263. 15 refs.
[For abstract see issue 23, page 3951, Accession no. A67-41552]

A68-16502 #
EFFECTS OF VIBRATION ON COMPLEX PSYCHOMOTOR PERFORMANCE.
Richard W. Shoenberger.
Aerospace Medicine, vol. 38, Dec. 1967, p. 1264-1269. 9 refs.

Measurement of human performance on a complex of three psychomotor tasks, during vertical sinusoidal vibration lasting 30 min. The tasks of target identification, probability monitoring, and warning-lights monitoring had relatively small motor components and were largely mental or intellectual in nature. The results provided very little evidence of decrement on these tasks as a result of vibration. The results suggest that direct mechanical interference with the motor aspects of the task may be the most significant factor contributing to performance decrements during short-duration vibration of relatively low intensity. M.M.

A68-16503
COMPARISON OF TWO FORMULAE FOR IN VIVO PREDICTION OF STRENGTH OF THE FEMUR.
B. Sherwood Mather (Queensland, University, Dept. of Surgery, Herston, Australia).
(Surgical Research Society of Australasia, Meeting, Melbourne, Australia, May 1967, Paper.)
Aerospace Medicine, vol. 38, Dec. 1967, p. 1270-1272. 8 refs.

The magnitude of the load required to fracture a bone cannot be measured except by methods which entail destruction of the specimen. The results of mechanical tests performed on 145 femora from different subjects were analyzed, and formulas were obtained by means of which the breaking strength of the femur could be predicted from data which could be obtained from a living subject. The accuracy with which the formulas could be employed to predict values of breaking load of the femur was compared, and it was concluded that reasonably accurate predictions of the static breaking load of the femur could be made from data which could be obtained from the living subject. (Author)

A68-16504
SOME ASPECTS OF SUDDEN INCAPACITATION IN AIRMEN DUE TO CARDIOVASCULAR DISEASE.
H. L. Reighard and S. R. Mohler (Federal Aviation Administration, Office of Aviation Medicine, Aeromedical Applications Div., Washington, D.C.).
(International Congress on Aviation and Space Medicine, 16th, Lisbon, Portugal, Sept. 11-15, 1967.)
Aerospace Medicine, vol. 38, Dec. 1967, p. 1273-1275. 5 refs.

Discussion of 37 general aviation accidents which resulted between 1959 and 1965 from the effects of cardiovascular disease, considering also various cardiovascular incapacitations of airline transport pilots which occurred from 1961 to 1966. The following aspects are examined: (1) medical history, (2) physical examination, (3) EKG and exercise tests, and (4) criteria for flight status. It is pointed out that, in the event of a fatal accident or fatal in-flight incident, the postmortem examination must include a thorough gross and microscopic study of the coronary artery system. In the absence of such study, the question of coronary artery disease cannot be definitively resolved. Attempts are being made to further refine - in line with present capabilities - the screening methods practical for the medical certification of pilots. M.M.

A68-16505
SPIKE-WAVE COMPLEXES IN "NORMAL" FLYING PERSONNEL.
Donald R. Bennett (Utah, University, College of Medicine, Dept. of Neurology, Salt Lake City, Utah).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1276-1282. 13 refs.

Investigation in which spike-wave discharges were found in the EEGs of 16 out of 1965 consecutive flying personnel evaluated between Jan. 1, 1962, and Dec. 31, 1964. Only three of these 16 aircrew members had suffered a previous convulsion. Because spike-wave complexes are accepted by neurologists and electroencephalographers as indicative of epileptic phenomena with but few exceptions, all aviators who, although asymptomatic, have a spike-wave EEG, are suspended. However, a limited follow-up study of seven asymptomatic subjects revealed that spike-wave abnormalities in normal people do not necessarily imply an altered convulsive threshold. Age and type of spike-wave pattern, particularly the relatively low incidence of seizures with the six-per-second spike waves may be of importance. Larger numbers need to be followed before any definite conclusions can be made. M.M.

A68-16506
IDIOPATHIC SPONTANEOUS PNEUMOTHORAX AND FLYING.
Heinz S. Fuchs (German Air Force, Institute of Aviation Medicine, Fuerstenfeldbruck, West Germany; USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1283-1285. 14 refs.

Discussion of the results of recent studies of spontaneous pneumothorax (SP) considering the etiological role of decreased atmospheric pressure, pressure breathing, increased g forces, and anti-g-suit action. SP is a relatively rare occurrence at altitude and it seems logical to conclude that changes of atmospheric pressure only do not appreciably precipitate the incidence of initial attacks of SP in individuals with no preexisting lung disease. The impression that normal aerial flight is likely to produce SP in a healthy individual, as suggested by several authors, must be considered erroneous. The occurrence of SP during aerial flight seems merely coincidental. Operational flight, however, may possibly induce occurrence of SP, both in individuals with preexisting pulmonary malformations and in individuals exposed periodically over a several-year period to unusual stresses such as high altitude, rapid decompression, pure oxygen pressure breathing with forced expiration, increased gravitational forces and chest restriction due to the wearing of anti-g suit, which all probably predispose to the development of subpleural blebs. M.M.

A68-16507
INCIDENCE OF SPONTANEOUS PNEUMOTHORAX IN APPARENTLY HEALTHY AIRCREWS.
Heinz S. Fuchs (German Air Force, Institute of Aviation Medicine, Fuerstenfeldbruck, West Germany; USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.).
Aerospace Medicine, vol. 38, Dec. 1967, p. 1286-1288. 17 refs.

Survey of the medical literature on spontaneous pneumothorax (SP) in apparently healthy aircrews of USAF, RCAF and German Air Force (GAF). The occurrence of SP during normal aerial flight in individuals without definitive, preexisting pulmonary disease is apparently not greater than that of SP occurring during other activities. At ground level SP is relatively innocuous; in aircrews and in flight, however, the problem is far more serious because of the additional hazards and risks of flying. Therefore, candidates with a previous history of SP are rejected by the aeronautical selection board. In the case that an active pilot or aircrew member suffered an SP, the decision to return either to flying status should be based on a thorough aeromedical examination excluding all predisposing conditions for the recurrence of SP. If the flyer is returned to flying duty with a waiver, precautions should be taken that he does not fly either single-seat high-performance aircraft, or other aircraft without a copilot, and maneuvers involving high g-loads must be avoided unless he has undergone surgical treatment to prevent recurrences of SP. M.M.

A68-16668
RADIATION NOISE ENERGY AND HUMAN PHYSIOLOGY IN DEEP SPACE.
E. R. Graf, G. D. Weathers, R. J. Sims, P. Johnson (Auburn University, Dept. of Electrical Engineering, Auburn, Ala.), and F. E. Cole (Louisiana State University, Medical Center, Dept. of Biochemistry, New Orleans, La.).
IN: SATURN V/APOLLO AND BEYOND; NATIONAL SYMPOSIUM, HUNTSVILLE, ALA., JUNE 11-14, 1967, TRANSACTIONS.
VOLUME 1. [A68-16658 05-30]
Symposium sponsored by the American Astronautical Society, the University of Alabama, NASA, and the U.S. Army.
Edited by S. S. Hu.
Tarzana, Calif., American Astronautical Society, 1967. 20 p.
40 refs.

Discussion of a fundamental relationship between the earth's radiation-noise energy and human physiology, on the basis of the planetary-resonator hypothesis developed by Graf. The planetary resonator theory, derived from basic electromagnetic phenomena, is a theoretical corollary to the modern theory of planetary formation. According to the hypothesis, any planet with a high axial rotation will foster an electromagnetic phenomenon whereby the planet, together with its magnetic field, atmosphere, and Van Allen Belts, actually constitutes a concentric, spherical resonator. The planetary resonator, it is argued, has profound and heretofore unrecognized implications for the origin of life and the evolution of the relationship between living organisms and the electromagnetic environment. A theoretical model of the pre-Cambrian earth is discussed, and experiments in progress by Cole and Graf to study the effects of planetary-resonance phenomena upon cell cytology, polymerization of amino acids, and tertiary structure of proteins are cited. The relationship between the electromagnetic environment and living organisms is discussed theoretically in terms of evolution, and radiation-noise energy in particular is held to be an important but heretofore unrecognized factor in human biology. M.M.

A68-16669
LIFE SUPPORT FOR LUNAR EXPLORATION.
Gilbert M. Freedman (Lockheed Aircraft Corp., Lockheed Missiles and Space Co., Sunnyvale, Calif.).
IN: SATURN V/APOLLO AND BEYOND; NATIONAL SYMPOSIUM, HUNTSVILLE, ALA., JUNE 11-14, 1967, TRANSACTIONS.
VOLUME 1. [A68-16658 05-30]
Symposium sponsored by the American Astronautical Society, the University of Alabama, NASA, and the U.S. Army.
Edited by S. S. Hu.
Tarzana, Calif., American Astronautical Society, 1967. 24 p.

Results of an analysis of life-support requirements and configurations for two lunar surface-exploration missions, MOLAB (the Mobile Laboratory) and LSSM (the Local Scientific Survey Module).

The concepts selected have emphasized the acquisition of the most information about the moon at the least expense or encumbrance for the astronaut. Both missions are feasible from a life-support standpoint, using currently developed equipment and (in some cases) even flight-qualified equipment such as the Apollo portable life-support system. The open cockpit LSSM presents a hazard to transitions from one life support system to another in that these exercises must be conducted unassisted in a vacuum. Much work remains to be done to perfect a technique and equipment for unassisted lunar-surface PLSS (portable life support system) changes. M.M.

A68-16814
MISSION RISK FACTORS - THE BIO-RADIOLOGICAL COMPONENT.
George M. Angleton (Colorado State University, Dept. of Radiology and Radiation Biology, Fort Collins, Colo.).
IN: SATURN V/APOLLO AND BEYOND; NATIONAL SYMPOSIUM, HUNTSVILLE, ALA., JUNE 11-14, 1967, TRANSACTIONS.
VOLUME 2. [A68-16783 05-30]
Symposium sponsored by the American Astronautical Society, the University of Alabama, NASA, and the U.S. Army.
Edited by S. S. Hu.
Tarzana, Calif., American Astronautical Society, 1967. 24 p.
8 refs.

Evaluation of problems associated with the bioradiological risks of flight missions. The contention is made that the problems are not well-defined and that if they were, reorientation of current research and utilization of new research would be required so it will be possible to evaluate the risks associated with irradiation incidents once they occur. In order to achieve the desired objectives, two aspects of research must be stressed: (1) biometrical research must be put into proper perspective and on par with laboratory research; (2) both biometrical and laboratory research must be oriented toward describing groups of responses per individual, not groups of individuals per response. P. v. T.

A68-16835 #
STIMULATION OF THE GROWTH OF ALLIUM CEPA ONION BULBS AFTER A SPACE FLIGHT IN THE COSMOS 110 SATELLITE [STIMULIATSIIA ROSTA U LUKA ALLIUM CEPA POSLE PREBYVANIIA LUKOVITS V KOSMICHESKOM POLETE NA KORABLE-SPUTNIKE "KOSMOS-110"].
N. L. Delone, E. M. Morozova, V. V. Antipov, G. P. Parfenov, and A. S. Trusova.
Kosmicheskie Issledovàniia, vol. 5, Nov.-Dec. 1967, p. 939-943.
11 refs. In Russian.

Observation of growth stimulation in fourteen onion bulbs which received a 12-rad radiation dose during a 22-day flight on the Cosmos 110 satellite. The experimental bulbs sprouted earlier than control bulbs, showed a greater growth power during a 10-day sprouting period, and developed greater numbers of root chromosome rearrangements. No changes were observed in cell sizes of the meristem and root parenchyma or in the mitotic index of experimental plants. V. Z.

A68-16895
AN ANALYSIS OF THE CHEST WALL MOTIONS AT HIGH VALUES OF VENTILATION.
E. Agostoni and G. Torri (Ferrara, Università, Istituto di Fisiologia Umana, Ferrara; Milano, Università, Istituto di Fisiologia Umana, Milan, Italy).
Respiration Physiology, vol. 3, Dec. 1967, p. 318-332. 13 refs.
Research sponsored by the Italian National Research Council; Contracts No. AF 61(052)-867; No. F 61052-67-C-0053.

The changes of (1) lung volume, (2) circumference and lateral and dorso-ventral diameter of the rib cage, (3) dorso-ventral diameter of the abdomen, and (4) gastric pressure have been measured at various values of ventilation in the standing and sitting postures, and on a bicycle ergometer. At high ventilation the lateral diameter for a given lung volume decreases. The tidal changes of the lateral diameter lead those of the dorso-ventral one by 15-30° during maximum exercise ventilation and by 70-120° during maximum voluntary ventilation. The ventilatory efficiency of the rib cage decreases as the load increases. The dorso-ventral diameter of the abdomen at high ventilation is smaller than during relaxation at the same lung volume. At the beginning of the inspiration it increases regardless of the decrease of the abdominal pressure - i.e., the gravitational and elastic energy stored in the abdomen during expiration drives it down and forward more quickly than the activity of the diaphragm does. (Author)

A68-16999 #
SOME CONSIDERATIONS ON PILOT INDUCED OSCILLATIONS.
Katsuyuki Miyajima (Kawasaki Aircraft Co., Ltd., Gifu, Japan).
Japan Society for Aeronautical and Space Sciences, Transactions, vol. 10, no. 16, 1967, p. 11-22. 15 refs.

Investigation of pilot-induced oscillation (PIO) of a stable second-order system. PIO is a type of instability involving the closed loop consisting of the pilot, the control system, and the controlled element. Transfer functions of the human pilot are assumed, and nondimensionalized closed-loop gains on the instability boundary are used as the index to the extent of the instability. Fixed-base simulator tests were conducted, and the results are compared with the results of a theoretical analysis. R. B. S.

A68-17162
A NEW CRITERION IN THE QUEST FOR LIFE IN OUR SOLAR SYSTEM.
E. R. Graf, R. W. Cole, R. J. Coleman, M. D. Fahey, R. A. Heaton, P. Johnson, F. R. McDevitt (Auburn University, Auburn, Ala.), and F. E. Cole (Louisiana State University, Baton Rouge, La.).
IN: SATURN V/APOLLO AND BEYOND; NATIONAL SYMPOSIUM, HUNTSVILLE, ALA., JUNE 11-14, 1967, TRANSACTIONS.
VOLUME 4. [A68-17126 05-33]
Symposium sponsored by the American Astronautical Society, the University of Alabama, NASA, and the U.S. Army.
Edited by S. S. Hu.
Tarzana, Calif., American Astronautical Society, 1967. 6 p. 45 refs.

Examination of the implications of the planetary resonator hypothesis developed by one of the authors (Graf) with reference to the generation of life and the possibility of life on other planets. The planetary resonator hypothesis, based upon fundamental electromagnetic phenomena, is a theoretical corollary to modern theories of planetary formation. Actually, the planetary resonator is conceived as a natural resonant cavity functioning within an e.l.f. oscillator of gigantic dimensions. The existence of an active planetary resonator at a period over two billion years ago presupposes an electromagnetic environment vastly different from that hereto imagined for the Precambrian earth, and hence may be seen to have profound implications for theories of the origin of life from the non-living milieu. The evidence suggests that it is to Jupiter and the outer giants, rather than to Venus and Mars, that the search should turn to find life within the solar system. The probability that the creation of a planetary resonator was a concomitant feature of planetary formation in a majority of cases indicates that the emergence of living organisms, far from being a unique phenomenon confined to earth, is a fundamental characteristic of the universe. The generation of life is as natural as the formation of planets themselves, and where there are planets, life should be expected to exist or to have existed, rather than the opposite. P.v.T.

A68-17539 #
RESISTOJET BIOWASTE UTILIZATION - EVALUATION AND SYSTEM SELECTION.
Robert V. Greco and R. M. Byke (McDonnell Douglas Corp., Douglas Aircraft Co., Missile and Space Systems Div., Huntington Beach, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 6th, New York, N.Y., Jan. 22-24, 1968, Paper 68-121. 13 p. 5 refs.
Members, $1.00; nonmembers, $1.50.

The NASA Manned Orbital Research Laboratory (MORL), with a 6-man crew, was used to define candidate biowaste resistojet systems and to provide criteria for system selection. Quantities

of biowaste H_2, CO_2, and fecal-water outputs were established, and chemical analyses were performed. The H_2 had sufficient oxidizing contaminants to require its operating-temperature limit to be set the same as that for the CO_2 and fecal-water propellants (3000^oR). Collection method and pressure were established for each biowaste output. For MORL impulse requirements (1870 lb-sec/day), biowaste resistojet-control systems were defined, and weight, power, and volume comparisons were performed. A biowaste CO_2 system was established as the most advantageous and showed significant gains when compared to similar H_2 and NH_3 resistojet systems. An evaluation to assess the effect of closed-loop environmental control/life support (EC/LS) system capability showed that the biowaste system (with open-loop EC/LS system) remained competitive with the H_2 and NH_3 systems (with closed-loop EC/LS systems). (Author)

A68-17600
PILOT PROFICIENCY AND ATC.
Michael V. Huck (Aircraft Owners and Pilots Association, Washington, D.C.).
(Radio Technical Commission for Aeronautics, Annual Assembly, 1967.)
Journal of Air Traffic Control, vol. 10, Jan. 1968, p. 9-11.

Discussion of existing procedures used by general-aviation pilots for controlling an aircraft. The need for simplifying and standardizing these procedures is emphasized, and the solution of the terminal-area problem in the future is considered. It is pointed out that the only way for instrument pilots to maintain a level of proficiency sufficient to allow improvement in the terminal area is to constantly strive for the utmost in precise flying all the time. This is just as important for the 10,000-hr pilot as it is for the pilot who is beginning his career. M.M.

A68-17615
SELECTION OF OPTIMUM RATIOS FOR THE EFFICIENCIES OF LIFE-SUPPORT SYSTEMS.
A. A. Kugaenko.
(Kosmicheskie Issledovaniia, vol. 5, May-June 1967, p. 462-466.)
Cosmic Research, vol. 5, May-June 1967, p. 397-400. Translation.
[For abstract see issue 17, page 2807, Accession no. A67-32254]

A68-17799 *
USE OF ULTRASONIC ENERGY IN ASSESSING MICROBIAL CONTAMINATION ON SURFACES.
John R. Puleo, Martin S. Favero, and Norman J. Petersen.
Applied Microbiology, vol. 15, Nov. 1967, p. 1345-1351. 15 refs.
NASA Contracts No. R-137; No. R-11-004-001.

Ultrasonic tanks were evaluated for the ease with which viable microorganisms could be removed from various surfaces for subsequent enumeration. Test surfaces were polished stainless steel, smooth glass, frosted glass, and electronic components. The position of contaminated surfaces in relation to the ultrasonic energy source, distance of the ultrasonic source from the test surfaces, and temperature of the rinse fluid were some of the factors which influenced recovery. Experimental systems included both naturally occurring microbial contamination and artificial contamination with spores of Bacillus subtilis var. niger. The results showed that ultrasonic energy was more reliable and efficient than mechanical agitation for recovering surface contaminants. Conditions which increased the number and percentage of microorganisms recovered by ultrasonic energy were: using a cold rinse fluid, placing the sample bottle on the bottom of the ultrasonic tank, and facing the contaminated surfaces toward the energy source. It was also demonstrated that ultrasonic energy could be effectively used for eluting microorganisms from cotton swabs. (Author)

A68-17801
PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.).
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967. 249 p.
$8.50.

CONTENTS:

A68-17802
PSYCHOPHYSIOLOGY OF AEROSPACE MEDICINE.
George W. Barnard (Florida, University, College of Medicine, J. Hillis Miller Health Center, Gainesville, Fla.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 3-22. 23 refs.

Analysis of the physiological data acquired during the American and Soviet space programs. It is pointed out that no single physiological parameter adequately reflects the homeostatic balance of an individual. Physiological data obtained during flight have broadened the concept of "normality;" previous ideas of set limits for normality are inadequate. Altered physiological functions during flight are responses to stressors or to the anticipation of stress and will

return to previous baseline range once adaptation is obtained. Particular attention is given to the anticipatory effect - a central concept in laboratory experiments and operational aerospace flights. It is noted that physiological responses differ in terms of time dependence. This is illustrated by the fact that weight loss is not much different between 24- and 119-hr flights, whereas cardiovascular deconditioning was greater after the longer flights. M.F.

A68-17803
CONTROL ELECTROENCEPHALOGRAPHIC STUDY OF FLYING PERSONNEL.
Donald R. Bennett (Utah, University, College of Medicine, Electroencephalographic Laboratory, Salt Lake City, Utah).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 23-35. 9 refs.

Discussion of the value of electroencephalography in aircrew and astronaut selection. In addition to the electroencephalogram, extensive physical and mental tests were performed to determine the incidence and types of EEG abnormality found in a "normal" group of military and civilian flying personnel. The incidence of abnormal EEGs in 1332 flying personnel was found to be approximately 8%. The majority of the abnormal records were of the diffuse mildly dysrhythmic type. Specific abnormalities such as spike-wave forms were encountered infrequently (0.6%). In addition to selection, an electroencephalogram obtained at the time of enlistment serves another useful purpose in that it can be used as a baseline record for future reference. M.F.

A68-17804
THE USE OF NORMATIVE DATA IN THE PSYCHOLOGICAL EVALUATION OF FLYING PERSONNEL.
Charles L. Jennings (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Psychiatry Branch, Clinical Psychology Section, San Antonio, Tex.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 37-51.

Discussion of the psychological evaluation of flying personnel as a way of determining underlying symptomatology, dynamics, and motivation. The norms used as a basis for the evaluation of referred psychiatric cases include the Wechsler Adult Intelligence Scale, the Minnesota Multiphasic Personality Inventory, the Edwards Personal Preference Schedule, the Bender Visual Motor Gestalt Test, the Rorschach Psychodiagnostic Test, and the Thematic Apperception Test. The application of testing results is performed by a comparison with control-group data. It is pointed out that the typical Air Force flying officer is well suited for his job and performs very well. The psychological evaluation not only can assess the intensity of the problems but also the recuperative powers of the individual. M.F.

A68-17805
EMOTIONAL SUITABILITY FOR A FLYING CAREER.
Alan L. Morgenstern (Oregon, University, Medical School, Portland, Ore.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 61-73. 10 refs.

Application of the standards of emotional health to the selection of flying personnel. These standards have proven indispensable when selecting men for long careers in the cockpit. The history and value of psychiatric evaluation are reviewed, and the technique of psychiatric examination is described. Factors investigated include motivation, past history, congeniality, and character disorders. The Air Force and Federal Aviation Agency standards of emotional health are examined. M.F.

A68-17806
PSYCHIATRIC CONSULTATIONS AND CIVIL AVIATION MEDICINE.
H. C. Haynes (Georgetown University, Medical School, Washington, D.C.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 81-99. 8 refs.

Discussion of factors involved in writing the psychiatric-consultation report in civil aviation. Governmental rules and administrative and procedural matters are reviewed, and the requirements for an airman's medical certificate are summarized. The Aviation Medical Examiner program is outlined, and the form used to record the medical examination is described. Major sources of psychiatric referrals are discussed, and a brief history of the development of present psychiatric standards is presented. The appeal procedures available to the airman denied medical certification are described step by step. The special clinical and ethical problems encountered by the psychiatrist who submits a consultation for use in aeromedical certification are considered. M.F.

A68-17807
DAEDALUS AND ICARUS REVISITED - INTERPERSONAL ASPECTS OF FLIGHT INSTRUCTION.
Gary J. Tucker (Yale University, School of Medicine, New Haven, Conn.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 101-120.

Analysis of the psychological aspects of the instructional process of flight training with particular attention to the unique aspects of flight training, the problems of the student, and the problems of the instructor. It is pointed out that, especially for the student, the unfamiliarity of the instruction and intense interpersonal relationship, combined with the newness of the aerospace, allow for intense and often out-of-proportion, as well as misdirected, emotional responses. Problems of the student including the problems of identification, transference of parataxis distortion, and oedipal conflicts are discussed. The problems of the instructor are usually of a less severe nature. M.F.

A68-17808
CLINICAL ASPECTS OF PSYCHIATRIC ILLNESS IN FLYERS.
John C. Sparks (USAF, Systems Command, Aerospace Medical Div., Wilford Hall Hospital, Dept. of Psychiatry, Psychiatry Service, Lackland AFB, Tex.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 133-139.

Discussion of various clinical aspects of psychiatric illness in flyers as seen in a hospital setting. It is pointed out that rapid evaluation and short-term therapy can be used much more frequently with flyers than with any other military group. Symptoms in flying personnel are most frequently of a neurotic nature. Their recovery from illness seems directly related to their previous ability to adapt to new situations. M.F.

A68-17809
PHOBIC REACTIONS TO FLYING.
Alan L. Morgenstern (Oregon, University, Medical School, Portland, Ore.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 141-154. 5 refs.

Study of the various aspects of flying phobia and its treatment. It is pointed out that a psychoneurosis with phobic elements is the usual illness in aviators who are afraid to fly. Anxiety, guilt, shame, and other affects and defenses complete the picture of a symptom neurosis. Somatic expressions of emotion usually accompany the phobia. The possible precipitants of the phobia

include recent stress, past history of instability, daily or common stresses, boredom, temptation and social pressure. The first step in treatment is temporary removal from flying status. Two case histories are reviewed, and the probability of success in treatment is evaluated. M.F.

A68-17810
PSYCHODYNAMIC RELATIONSHIPS - SUICIDE AND FLYING PHOBIA.
Paul F. Eggertsen (USAF, Hospital Travis, Dept. of Psychiatry, Travis AFB, Calif.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 155-175. 7 refs.

Discussion of psychoanalytic and existential dynamics in an attempt to establish a base for the study of flight phobia as a defensive presentation of a pervasive suicidal dynamic. It is hypothesized that flight phobias interweave with suicidal movement. This concept has application in the development, diagnosis, and treatment of flight phobia. A procedure is outlined for assessment of suicidal risk which is applicable in method and content to assessment of flight risk in phobia. M.F.

A68-17811
EMOTIONAL FACTORS IN AIRCRAFT ACCIDENTS.
Roger F. Reinhardt (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Div. of Psychiatry and Neurology, Pensacola, Fla.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 177-184.

Study of the psychodynamics of pilot-error aircraft accidents and accident proneness in military aviators. Nine presumptively accident-prone aviators were studied intensively for a year, and the results of the psychological tests are presented. It is noted that accident proneness in aviation is an illness form which shares some psychodynamic mechanisms with depression, suicide, aggressive behavior, psychosomatic illnesses, and personality disorders. M.F.

A68-17812
PSYCHOLOGICAL FACTORS IN FLYING FATIGUE.
Bryce O. Hartman (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Biodynamics Branch, Psychobiology Section, Brooks AFB, Tex.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 185-196.

Discussion of the various psychological factors involved in flying fatigue. Flying fatigue involves environmental, situational, and personal factors. Three types of flying fatigue are discussed - acute fatigue, cumulative fatigue, and chronic fatigue. Acute fatigue, which occurs in a single flight, has little effect on the flyer's efficiency or his interactions with others. Cumulative fatigue - an accumulation of physiological, physical, and psychological residuals over a period of time - has subjective aspects. Chronic fatigue is rarely seen in the military flyer; it is a psychoneurotic symptom. M.F.

A68-17813
PSYCHIATRIC SUPPORT FOR MAN IN SPACE.
Carlos J. G. Perry (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 197-221. 15 refs.

Discussion of the role of psychiatry in evaluating man's reactions to space flight. The results of aeromedical evaluations of candidates for Project Mercury are summarized with particular emphasis on stress testing. The application of aeromedical evaluation methods to the Gemini and Apollo projects is reviewed, and the criteria involved in the selection of scientist-astronauts are considered. Evaluations of candidates for manned orbiting laboratories are discussed, and operational concepts for expanding clinical usefulness are examined. M.F.

A68-17814
IMPONDERABLES OF ISOLATION.
Don T. Mosher (Georgetown University, School of Medicine; U.S. Veterans Administration, Hospital, Washington, D.C.).
IN: PSYCHIATRY IN AEROSPACE MEDICINE.
Edited by C. J. G. Perry.
Boston, Little, Brown and Co., Inc. (International Psychiatry Clinics. Volume 4, No. 1), 1967, p. 223-230. 24 refs.

Examination of the obstacles which impede the progress of isolation research. One problem is the difficulty of selecting and delimiting the processes to be studied. Another problem is that animal experimentation has limited application to the study of isolation phenomena in humans. The greatest problem is that the very condition the effects of which the researcher seeks to observe is eliminated by his own presence. M.F.

A68-17832 *
ANATOMY AND STEADY FLOW CHARACTERISTICS OF THE ARTERIAL SYSTEM WITH AN INTRODUCTION TO ITS PULSATILE CHARACTERISTICS.
A. S. Iberall (General Technical Services, Inc., Upper Darby, Pa.).
Mathematical Biosciences, vol. 1, Sept. 1967, p. 375-395. 30 refs.
Contract No. NASw-1066.

For the past thirty years Green's table in Glasser's Medical Physics has been used as the common quantitative source for data on the arterial tree in mammals. The present paper updates that table by coordinating additional anatomical data from man and dog into a unified model of branching levels. The model and data appear to be consistent as to geometry, topology, and fluid resistance, as well as in number, size, and volume, of tubes. Application of such quantitative modeling to two problems is sketchily presented. The first application concerns the way the quantitative modeling information is involved in the treatment of pulsatile flow in the arterial system. The second application adduces some evidence that the wide resistive range of real arterial systems (as opposed to the average model developed) should be interpreted as mean power regulation by the system, rather than mean pressure regulation. (Author)

A68-18077 *#
OBSERVATIONS ON MAN IN AN OXYGEN-HELIUM ENVIRONMENT AT 380 MM. Hg TOTAL PRESSURE. IV.
Charles W. Nixon (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biological Acoustics Branch, Wright-Patterson AFB, Ohio), William E. Mabson, B. E. Welch (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Environmental Systems Branch, Brooks AFB, Tex.), Frank Trimboli (Dayton, University, Research Institute, Dayton, Ohio), and James E. Endicott (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, ENT Branch, Brooks AFB, Tex.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 1-9. 14 refs.
NASA-supported research.

Intelligibility and physical characteristics of helium speech were investigated during a simulated space mission at Brooks AFB, Texas. Speech was produced under conditions of room air at ground level, 100% O_2 at 18,000 ft., 56% He-44% O_2 at 18,000 ft and 80% He-20% O_2 at ground level. Results of both objective and subjective analyses of the data show that (1) word intelligibility in the 80% He condition was less than in room air, (2) when in the presence of noise, intelligibility was less in both 56% and 80% He mixtures than in room air, (3) the high fundamental pitch observed immediately upon entering the He atmosphere gradually decreased, but did not return to the prehelium level of pitch, (4) measured rate of speaking was unaffected, and (5) mean second formants frequencies were 1.35 times higher in 56% He and 1.62 times higher in 80% He than in room air. Observed ratios were slightly less than ratios predicted on the basis of velocity of sound in the vocal tract. (Author)

A68-18078
BLOOD VOLUME STUDIES DURING AND AFTER IMMOBILIZATION IN HUMAN SUBJECTS AS MEASURED BY SODIUM RADIOCHROMATE (CHROMIUM 51) TECHNIQUE.
Richard A. Oberfield, Edward P. O'Hanlon, Melany Schoaf (Lahey Clinic Foundation, Dept. of Internal Medicine, Boston, Mass.), and Franklin G. Ebaugh, Jr. (Lahey Clinic Foundation, Dept. of Internal Medicine; Boston University, School of Medicine, Boston, Mass.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 10-13. 17 refs.
PHS Grants No. CA-04326; No. TI-AM-5174.

The blood volume of 11 subjects was measured by the use of sodium radiochromate to compare their conditions after long periods of immobilization with those following ambulation. The whole blood volume increased an average of 10.1% with a range of -5.3% to 30.9%. The red blood cell volume increased an average of 8.6% with a range of -6.3% to 22.4%. These are statistically significant increases at the 1% level. For the plasma volumes, there is a statistically significant increase at the 3.2% level if the weights of the subjects before and after immobilization are averaged. However, if the exact height and weight of each subject are used, the plasma volume is not significantly increased at the 5% level. This variation in blood volume is a homeostatic adaptation mechanism not fully elucidated, but it perhaps explains some of the postural changes noted in human subjects after space flights or in patients after prolonged bed rest. (Author)

A68-18079 #
RAPID DETECTION OF MICROORGANISMS IN AEROSPACE WATER SYSTEMS.
G. V. Levin, E. Usdin (Hazleton Laboratories, Inc., Life Systems Div., Falls Church, Va.), and A. R. Slonim (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 237-239.)
Aerospace Medicine, vol. 39, Jan. 1968, p. 14-16.
Contract No. AF 33(615)-3996.
[For abstract see issue 23, page 3968, Accession no. A67-41627]

A68-18080
STUDIES OF PILOT PERFORMANCE. I.
Charles E. Billings (Ohio State University, Dept. of Preventive Medicine, Aviation Medicine Research Laboratory, Columbus, Ohio).
Aerospace Medicine, vol. 39, Jan. 1968, p. 17-19. 11 refs.
Contract No. DA-49-193-MD-2615.

The report describes criteria established by the investigators for the evaluation of methods and techniques of performance assessment in the flight environment. On the basis of previous studies and our own research desirable criteria for such performance measures are determined. The ideal measure of performance is one which does not involve a human observer at any point and thus compromise objectivity. Acceptable performance measures must yield quantitative data, since it is clear that performance can vary quantitatively within the range of safe operation of an airplane. A useful measure of performance should be relevant - i.e., reflect accurately the real and important tasks the pilot must perform in the course of a mission. No acceptable performance assessment method should require unsafe actions of the pilot, nor should it require undue attention on the part of an observer or safety pilot. Additional criteria include broad applicability of the techniques across missions and specific aircraft types. It is also believed that acceptable measurement techniques should be passive with respect to the pilot being studied: ideally, they should require neither the pilot's cooperation nor even knowledge that he is under study. (Author)

A68-18081
STUDIES OF PILOT PERFORMANCE. II.
Charles E. Billings, Jack J. Eggspuehler, Ralph J. Gerke, and Robert C. Chase (Ohio State University, Dept. of Preventive Medicine and Dept. of Aviation, Columbus, Ohio).
Aerospace Medicine, vol. 39, Jan. 1968, p. 19-31.
Contract No. DA-49-193-MD-2615.

Studies of the effects of stress in the flight environment have been difficult because of the lack of objective, quantitative indicators of performance. This experiment was designed to test such measures of pilot performance in rotary wing aircraft. Four rated helicopter pilots flew four 4-hr power line surveillance missions at extremely low altitude in a Hiller 12-E helicopter. The vehicle was instrumented for the recording of rotor RPM, cyclic and collective pitch control position and throttle position. These variables were recorded during prearranged geographic segments of each flight. The data were converted to digital format and analyzed by an IBM 7094 computer. In the course of these missions, designed to produce fatigue, pilots tended to allow rotor RPM to vary within wider limits as flight time increased. Control movements of relatively large amplitude increased considerably during the later hours of flight. These changes were evident both during flight in immediate proximity to obstructions and during flight of a less stressful nature. Significant differences among pilots appeared positively correlated with previous helicopter flight experience. It is believed that techniques of performance assessment such as those studied in this experiment can be useful in providing further insight into biomedical changes observed under stress. (Author)

A68-18082
ON-LINE PERSONNEL TESTING FOR NAVAL AVIATION.
Lewis E. Waldeisen, Patrick M. Curran (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Pensacola, Fla.), and Robert J. Wherry, Jr. (U.S. Navy, Naval Missile Center, Point Mugu, Calif.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 31-33.

A personnel testing system under control of a high-speed computer is described. The system is designed to operate in a real-time mode, which permits true contingency testing. Utilization of the system would permit collection of psychomotor test data on student aviators which might add unique validity to the Pensacola secondary selection system. The operation of the on-line system which consists of three basic sections, the testing booth section, the monitor control section, and the computer and computer subsection, is presented in detail. A typical test situation is included to exemplify the functioning of the total system. (Author)

A68-18083 *
THOUSAND AVIATOR STUDY - NONVESTIBULAR CONTRIBUTIONS TO POSTURAL EQUILIBRIUM FUNCTIONS.
Alfredo R. Fregly, Albert Oberman, Ashton Graybiel, and Robert E. Mitchell (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Pensacola, Fla.; Michigan, University, Ann Arbor, Mich.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 33-37. 29 refs.
NASA-supported research.

In a preliminary study of nonvestibular sources of variance in the postural equilibrium functioning of a group of middle-aged males, 28 of 38 selected measures have been shown to be related to one or another of three postural criteria. Outstanding among these, in descending order of magnitude, are: abdominal circumference, age, endomorphy, heart rate immediately after exercise, and duration of cigarette smoking. These and other findings are discussed in terms of their implications for vestibular and gerontological research. (Author)

A68-18084 #
DEVELOPMENT AND EVALUATION OF A SIMPLIFIED FORMULA FOOD FOR AEROSPACE FEEDING SYSTEMS.
Norman D. Heidelbaugh, John F. Vanderveen, and Howard G. Iger (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Brooks AFB, Tex.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 38-43. 32 refs.

Account of the development of a powdered formula food which meets the criteria for aerospace feeding systems. The powder is suitable for making a liquid drink or for pelletizing. The nutritional adequacy of the formula, when supplemented with vitamin and trace

minerals, was demonstrated by feeding the liquid form to two men in a 28-day metabolic balance study. Additional evaluations of the formula were obtained from 46 USAF personnel during studies on decompression sickness, and from 9 aerospace research pilots during lunar landing simulations. The powder readily reconstitutes with water to make a liquid drink. A simple method to pelletize the formula for feeding in solid form was developed. The formula, when vitamin and trace minerals were supplemented, was found to be nutritionally adequate. The acceptability ratings of the liquid form were adequate on taste panel scoring. Acceptability for the liquid was generally poor in the pilot group, but some individuals participating in the decompression sickness studies rated the acceptability very high. Suggestion is offered that formula foods may find application in aerospace feeding systems as: (1) milkshake-like, ad libitum, substitutes for regular meals; (2) basic formula for bite-size solid foods offered as nutrient-balanced snacks; and (3) defined sources of nutrients for physiological studies. (Author)

A68-18085
EXPERIMENTAL DETERMINATION OF THE MECHANICAL PROPERTIES OF BONE.
Frederick Bird, Herbert Becker, Janet Healer, and Melanie Messer (Allied Research Associates, Inc., Concord, Mass.).
Aerospace Medicine, vol. 39, Jan. 1968, p. 44-48.

The mechanical properties of fresh bone have been investigated with the aim of gathering fundamental data on the quasi-static stress-strain relationships of bone under various rates of loading. Data were obtained on axial, circumferential, and the radial characteristics of bone. Impact loading tests also were performed to investigate physical properties under high rates of loading and to correlate the quasi-static stress-strain data with a simple impact theory. The impact test samples were examined for gross failure and the production of cracks in the microscopic bone structure. Impacter particle velocity was correlated with stress and test results to identify regions of failure as functions of impact velocity. Modes of failure were defined as survival, microcracking and gross failure. Reasonably good agreement was evident between the impact test data and the quasi-static test data. (Author)

A68-18086 #
PHYSICAL ANALYSIS OF SPEECH IN HELIUM ENVIRONMENTS.
Jerry D. Speakman (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biodynamics and Bionics Div., Biodynamic Environment Branch, Wright-Patterson AFB, Ohio).
Aerospace Medicine, vol: 39, Jan. 1968, p. 48-53. 9 refs.

For future manned space systems the use of a breathing environment containing helium is under consideration. Subjective experiments previously conducted under such conditions have reported, for increasing concentrations of helium, an increase in the pitch of speech sounds and an impairment in communication capability. In the present study the physical acoustic characteristics of speech were investigated for helium concentrations of 0 to 70% at pressures from sea level to 258 mm Hg. An electromechanical/acoustical model of the vocal tract for the sustained phonetic vowel sounds of [i] (eat), [o] (lost), and [u] (boot) was utilized to determine the shift in resonance frequency and the change in the power radiated relative to that for normal air. For comparison purposes the relative acoustic powers were computed for ideal acoustic generators, edgetones, aerodynamic noise, and a moving voice coil type loudspeaker; loudspeaker directivity characteristics and power output were experimentally measured as a function of helium concentration. The two main conclusions of this study are: for a constant volume velocity at the glottis the change in speech pitch is directly dependent upon the velocity of sound in the vocal tract; the loudness of a given sound is primarily dependent upon the characteristic radiation impedance of the gas as viewed from the lips - i.e., it decreases with increasing helium concentration. (Author)

A68-18087
TRANSIENT CHANGES IN ARTERIAL OXYGEN TENSION DURING POSITIVE (+Gz) ACCELERATION IN THE DOG.
David H. Glaister (Royal Air Force, Institute of Aviation Medicine, Farnborough, Hants., England).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 301, 302.)
Aerospace Medicine, vol. 39, Jan. 1968, p. 54-62. 16 refs.
[For abstract see issue 23, page 3958, Accession no. A67-41653]

A68-18088 *#
EVALUATION OF ANIMALS CONTINUOUSLY EXPOSED TO A 5 PSIA PURE OXYGEN SPACE CABIN ATMOSPHERE FOR EIGHT MONTHS.
Harold P. Kaplan, Anthony A. Thomas, Kenneth C. Back, and Farrel R. Robinson (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 100, 101.)
Aerospace Medicine, vol. 39, Jan. 1968, p. 63-67. 29 refs.
NASA-supported research; Contracts No. AF 61(052)-941; No. AF 33(615)-5096; No. AF 33(615)-3464; No. AF 33(615)-2941.
[For abstracts see issue 23, page 3952, Accession no. A67-41574]

A68-18089
HUMAN ACCELERATION EXPERIENCE AT THE AEROSPACE MEDICAL RESEARCH DEPARTMENT, U.S. NAVAL AIR DEVELOPMENT CENTER, JOHNSVILLE, 1 JANUARY 1961-30 DECEMBER 1965.
Elihu York, R. J. Oleynik, and R. M. Patton (U.S. Naval Material Command, Naval Air Development Center, Aerospace Medical Research Dept., Johnsville, Pa.).
(AEROSPACE MEDICAL ASSOCIATION, 1967 ANNUAL SCIENTIFIC MEETING, WASHINGTON, D.C., APRIL 10-13, 1967, PREPRINTS OF SCIENTIFIC PROGRAM, p. 143, 144.)
Aerospace Medicine, vol. 39, Jan. 1968, p. 68-71. 14 refs.
[For abstract see issue 23, page 3953, Accession no. A67-41590]

A68-18090 *
EFFECTS OF IN VIVO HYPEROXIA ON ERYTHROCYTES. VII.
Charles E. Mengel (Ohio State University, Div. of Hematology and Oncology, Columbus, Ohio) and Richard Timms.
Aerospace Medicine, vol. 39, Jan. 1968, p. 71-73. 13 refs.
PHS Grant No. CA-08702-01; Contracts No. Nonr-495(30); No. NAS 9-6910.

Normal chow fed mice exposed to 100% O_2 for 90 min at 60 psia showed increases of hematocrit, osmotic fragility, red cell ATP with decreases of red cell phosphofructokinase activity. Splenectomy or tocopherol supplementation did not influence these changes. The changes were presumed to reflect an effect of O_2 per se rather than lipid peroxidation; furthermore, they were transient. (Author)

A68-18091
AN INTEGRATED APPROACH TO THE AEROMEDICAL INVESTIGATION OF CIVIL AIRCRAFT ACCIDENTS.
Stanley R. Mohler (Federal Aviation Administration, Aeromedical Applications Div., Washington, D.C.), Bernard C. Doyle (Department of Transportation, National Transportation Safety Board, Bureau of Aviation Safety, Human Factors Branch, Washington, D.C.), Harry Gibbons (Federal Aviation Administration, Aeromedical Services, Civil Aeromedical Research Institute, Oklahoma City, Okla.), and William J. Reals.
Aerospace Medicine, vol. 39, Jan. 1968, p. 82-84. 12 refs.

On Apr. 22, 1966, an American Flyers Lockheed Electra carrying 92 revenue passengers, five crew members and one nonrevenue passenger, crashed at Ardmore, Oklahoma. Because of the cooperation of flight surgeons, accident investigators and pathologists, the probable cause of the accident which resulted in 77 fatalities was determined to be due to incapacitation of the pilot-in-command as a result of coronary insufficiency. Failure of the pilot's family physi-

cian (not an Aviation Medical Examiner) to disclose to the FAA a long-standing diabetic and coronary artery disease condition in the pilot, contributed to the continued flight activities by the captain. Recommended preventive means for such accidents are provided. (Author)

A68-18238 #
CHANGES IN DURATION OF THE QT INTERVAL OF THE EKG DURING MUSCULAR EXERCISE. II [MODIFICAZIONI DELLA DURATA DELL'INTERVALLO QT NELL'ELETTROCARDIOGRAMMA DURANTE LAVORO MUSCOLARE. II].
E. Busnengo and P. Rota.
(Società Latina di Medicina dello Sport, Congresso Internazionale, 6th, Rome, Italy, June 5-8, 1967.)
Rivista di Medicina Aeronautica e Spaziale, vol. 30, July-Sept. 1967, p. 425-436. 7 refs. In Italian.

Investigation of changes in the duration of the QT interval in 20 subjects (22 to 30 years old) during and after strenuous exercise performed by means of a cycloergometer. The average values of actual QT ranged from 0.322 sec, at rest, to 0.204 sec at the tenth minute of exercise, increasing to 0.297 sec at the ninth minute of recovery. The average values of actual QT/correct QT ratio ranged from 89.8% at rest to 93.1% at the tenth minute of exercise, to 99.7% at the ninth minute of recovery. The importance of the data obtained in evaluating cardiac response to muscular exercise testing is emphasized. M.M.

A68-18239 #
CONTRIBUTION TO THE STUDY OF TRAUMATIC LESIONS FROM EJECTION AT GROUND LEVEL [CONTRIBUTO SULLE LESIONI TRAUMATICHE DA EJEZIONE A QUOTA ZERO].
P. Italiano.
Rivista di Medicina Aeronautica e Spaziale, vol. 30, July-Sept. 1967, p. 437-454. 6 refs. In Italian.

Description of the traumatic lesions of three pilots ejected at ground level, and of the conditions under which they occurred. Two ejections had a favorable result, while the third one resulted in the pilot's death. It is hoped that a more reliable ejection system at ground level be implemented by designers and manufacturers. The usefulness of making available to flight personnel refresher courses, lectures, and practical demonstrations, particularly training with simulators and ejection towers, is emphasized. The courses should make pilots aware of occurrences under emergency conditions and should teach them techniques for minimizing personal injury. It is pointed out that the traumatic lesions found in the tree subjects were caused, from the pathogenetic standpoint, by both ejection and ground impact. M.M.

A68-18240 #
LUESCHER'S CHROMATIC TEST AND ITS PSYCHOLOGICAL AND PSYCHIATRIC APPLICATIONS IN CONNECTION WITH AIR FORCE PERSONNEL [IL TEST CROMATICO DI LUESCHER E LE SUE APPLICAZIONI PSICOLOGICO-PSICHIATRICHE NEL PERSONALE DELL'AERONAUTICA MILITARE].
L. Longo.
Rivista di Medicina Aeronautica e Spaziale, vol. 30, July-Sept. 1967, p. 455-467. 15 refs. In Italian.

Evaluation of Luescher's chromatic testing of 150 subjects already enrolled and candidates for enrollment in the Italian Air Force. The results obtained emphasized the typological and projective validity of the test, and hence its use as a complementary method in the selection, psychological, and physiological checking and in the medico-legal evaluation of personnel. M.M.

A68-18241 #
CURRENT KNOWLEDGE REGARDING THE EFFECTS OF RADAR WAVES ON LIVING ORGANISMS AND THE PROTECTIVE EQUIPMENT INVOLVED. I [NOZIONI ATTUALI CIRCA GLI EFFETTI DELLE ONDE RADAR SUGLI ORGANISMI VIVENTI ED I RELATIVI MEZZI DI PROTEZIONE. I].
R. Busco and L. Comignani.
Rivista di Medicina Aeronautica e Spaziale, vol. 30, July-Sept. 1967, p. 469-528. In Italian.

Discussion of the diagnostic, preventive, and therapeutic problems caused by the effects of radar waves on personnel exposed to them. The principal results obtained in laboratory tests and observations made on men exposed for years to radar equipment are reviewed. The future prospects regarding the tolerable power limits and the safety standards to be used to avoid irreversible damage to human beings are briefly surveyed. M.M.

A68-18281
MAN WITHOUT GRAVITY [L'HOMME SANS PESANTEUR].
L. Tabusse and P. Pesquies.
Revue Française d'Astronautique, Nov. 1967, p. 7-11. 9 refs. In French.

Examination of the effects of weightlessness on the main vegetative functions in man and animals. Observations of several experiments on men and animals under flight conditions are related, and the effects on the cardiovascular system, equilibrium, and neuromuscular coordination are discussed. The psychological effects of weightlessness are also described including disorientation, inhibition, and a changed state of sleep observed in rats. The relatively short duration of certain flights made a precise diagnosis of the observed effects of weightlessness very difficult. M.G.

A68-18342
BIOLOGIC EFFECTS OF SUPERNOVAE.
K. D. Terry (Kansas, University, Dept. of Comparative Biochemistry and Physiology, Lawrence, Kan.) and W. H. Tucker (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
Science, vol. 159, Jan. 26, 1968, p. 421-423. 22 refs.

Presentation of estimates of the probability that nearby explosions of supernovas have occurred during the earth's history and the biologic effects of the radiation therefrom. They suggest that cosmic radiation from supernovas could have caused the extinction of many exposed animals without the simultaneous extinction of plant life. This suggests that supernovas should be considered as one possible mechanism by which fauna become extinct. (Author)

A68-18427 *
EFFECTS OF ACUTE EXPOSURE TO HIGH-ENERGY PROTONS ON PRIMATES.
S. Tom Taketa, Bruce L. Castle, Wayne H. Howard, Charles C. Conley, Webb Haymaker (NASA, Ames Research Center, Moffett Field, Calif.), and Charles A. Sondhaus (California, University, Lawrence Radiation Laboratory, Berkeley, Calif.).
Radiation Research Supplement, vol. 7, 1967, p. 336-359. 41 refs.

Comparison of the biological effectiveness of high-energy graphite-attenuated protons with that of ^{60}Co γ radiation in monkeys given 4π whole-body irradiation. The end points were mortality, clinical observations, necropsy, and microscopic findings, and changes in body weight and peripheral-blood erythrocyte and leukocyte counts. Data based on midpoint air dose, midpoint tissue dose, and average body dose were used for the evaluation. Protons appeared to be as effective or slightly more effective than γ rays when the comparisons were based improperly on midpoint air dose, but less effective when based properly on absorbed tissue dose. The general appearance, symptoms of radiation syndrome, and pathological changes were essentially similar in the two irradiated groups. Silver impregnation of the brains of 15 of the animals revealed glial activation in most of the animals. This was considered a radiation effect. M.M.

A68-18514 *#
RADIATION DOSIMETRY ON THE GEMINI AND APOLLO MISSIONS.
Carlos S. Warren (NASA, Manned Spacecraft Center, Space Physics Div., Houston, Tex.), Joseph C. Lill (NASA, Manned Spacecraft Center, Radiation and Fields Branch, Houston, Tex.), Robert G. Richmond, and William G. Davis (NASA, Manned Spacecraft Center, Radiation Environment Section, Houston, Tex.).

A68-18514

Journal of Spacecraft and Rockets, vol. 5, Feb. 1968, p. 207-210. 5 refs.

U.S. astronauts are equipped with radiation-dose recording instrumentation. The paper describes the dosimetry used on Gemini and that designed for use on Apollo. Radiation doses received by Gemini crews varied between less than 10 mrad on the Gemini 8 mission (Armstrong and Scott) and 779 mrad on the Gemini 10 mission (Collins). Particle spectrometers were flown on the Gemini 4 and Gemini 7 missions in order to compare dose calculations to measurements. Radiation instrumentation for Apollo consists of a particle spectrometer, rate-meters, integrating dosimeters, and passive dosimeters. The rationale for each instrument is discussed. Calculated doses in the Apollo vehicle are presented for intense events in the last solar cycle. (Author)

LC ENTRIES

A68-80420
DEMODULATION OF ELECTRICAL ACTIVITY IN THE CAROTID SINUS BAROCEPTOR NERVE.
Esmail Koushanpour and John P. McGee (Northwestern U. Med. School, Dept. of Physiol., Chicago, Ill.)
Journal of Applied Physiology, vol. 24, Feb. 1968, p. 262–266. 7 refs.
Grants NIH 5-R01-HE 09735 and NIH 5-T5-GM 1671-04.

The gross baroceptor nerve action potentials in the isolated and perfused carotid sinus were demodulated into an envelope having a contour similar to that of the applied forcing pressure. The demodulation consisted of rectifying the action potentials and passing them through a 50 cycles/sec. low-pass analogue filter. The demodulated envelope as a quantitative measure of the total electrical activity in the action potentials due to amplitude and frequency variations was validated by testing the method with trains of pulses of different amplitudes and frequencies. Using this method the baroceptor transfer functions for steady and sinusoidal pressures were determined. The results showed a significant ($P<0.01$) increase in the baroceptor activity in response to pulsatile pressures, at the same mean, as compared with steady pressures.

A68-80421
RELATIONSHIP BETWEEN DIET AND BONE MINERAL ULTRASTRUCTURE.
Aaron S. Posner (Cornell U., Med. Coll., Hosp. for Spec. Surg., New York City, N. Y.)
(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 17, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1717–1721.
Grant NIDR DE-01945.

It has been shown that certain dietary changes result in ultrastructural changes in bone mineral. Ingestion of fluoride results in replacement of hydroxyl ion by fluoride in, and crystal growth of, the apatite phase in bone, producing more stable mineral phase. Dietary changes resulting in rachitic bone produce an apparent lack of maturity in the sense that the bone mineral contains a higher amorphous content than normal bone mineral of the same age. Dietary deficiencies affecting the organic fraction of bone result in changes in the mineral ultrastructure.

A68-80422
VERTIGO: ANATOMICAL, ETIOLOGICAL AND CLINICAL ASPECTS.
Othmar Solnitzky.
Georgetown Medical Bulletin, vol. 21, Nov. 1967, p. 89–107.

Vertigo may be caused by lesions involving the vestibular labyrinth of the inner ear, the vestibular nerve, or all of its central connections from the cerebral cortex to the spinal cord. Vertigo is a useful sign of carotid or vertebro-basilar insufficiency. Its appreciation can lead to timely corrective surgery and thus major strokes can be avoided. The differentiation of vertigo from peripheral and from central lesions is imperative since the latter type is associated with a grave prognosis. Due to its unpleasant and often fightening aspect, vertigo in many cases is associated with marked emotional and psychoneurotic sequelae. Individuals with disturbed psychic states, including hysteria, often report so-called pseudo-vertigo in the form of dizziness, lightheadedness, wooziness and giddiness. However, hysterical individuals may suffer from true vertigo. The only way to avoid diagnostic errors is through a careful history and thorough testing of the cochlear and vestibular systems. In addition, electroencephalography, arteriography, roentgenography and brain scanning should be employed.

A68-80423
PALMAR SKIN RESISTANCE AND SWEAT-GLAND COUNTS IN DRUG AND NON-DRUG STATES.
Kerrison Juniper, Jr., David E. Blanton, and Roscoe A. Dykman (Ark. U., Med. Center, Little Rock).
Psychophysiology, vol. 4, Oct. 1967, p. 231–243. 25 refs.
Grants NIH G-551, NIH AM-08194, NIH FR-208-1, NIMH MK-KS-2504, and NIMH MH-01091.

Propantheline bromide, an anticholinergic blocking agent, was found to nullify all sizable changes in skin resistance. Betazole hydrochloride, a histamine isomer causing flushing of the skin, had no detectable effect on changes in skin resistance. Betazole hydrochloride did decrease the level of skin resistance, and it is possible that increased vasodilatation "pumps" more conductive (saline-like) substances into the skin. These results suggest that relatively rapid changes in skin resistance depend more upon sweat-gland activity than upon changes in the fluid content of the skin, without denying the importance of the latter. It may be that the level of skin resistance at any one time depends upon a combination of sweat-gland and vasomotor activities. Hence, as basal levels of skin resistance decrease, the relative magnitude of changes in skin resistance to stimuli also decreases (law of initial values).

A68-80424
INFLUENCE OF NICOTINE ON CATECHOLAMINE METABOLISM IN THE RAT.
T. C. Westfall and G. P. Anderson (Va. U., School of Med., Dept. of Pharmacol., Charlottesville).
Archives internationales Pharmacodynamie et de Thérapie, vol. 169, Oct. 1967, p. 421–428. 20 refs.
Am. Med. Assn., Educ. and Res. Found., and Council for Tobacco Res.-USA supported research.

The effect of three different doses of nicotine on the 24-hr. urinary excretion of epinephrine, norepinephrine, metanephrine, normetanephrine and 3-methoxy-4-hydroxymandelic acid was investigated in rats. All three doses (0.1, 0.5, and 1.0 mg./kg.) produced a statistically significant increase in the excretion of epinephrine and its major o-methylated metabolite, metanephrine. There were no significant changes in the excretion of norepinephrine, normetanephrine, or 3-methoxy-4-hydroxymandelic acid. This leads us to the conclusion that the release of epinephrine, from the adrenal medulla by nicotine, is much more important in producing the various pharmacological responses, than is the corresponding release of norepinephrine.

A68-80425
CARBON TETRACHLORIDE POISONING.
R. Barnes and R. C. Jones (Dept. of Public Health, Div. of Occupational Health, Sydney, Australia).
American Industrial Hygiene Association Journal, vol. 28, Nov.–Dec. 1967, p. 557–560. 6 refs.

Three cases of poisoning by carbon tetrachloride in one industry are reported. Liver damage as evidenced by altered liver function tests was a feature of other workmen of this plant also exposed to carbon tetrachloride. Kidney damage, which is a feature of other reported cases of carbon tetrachloride poisoning, was only shown by one of the cases reported here. The dangers of carbon tetrachloride are noted, and care in its industrial and household use emphasized.

A68-80426
NORMALITY OF DISTRIBUTION OF RESTING PALMAR SKIN POTENTIAL.
Donald N. O'Connell, Bernard Tursky, and Frederick J. Evans (Mass. Mental Health Center, Boston and Inst. of Pa. Hosp., Philadelphia).
Psychophysiology, vol. 4, Oct. 1967, p. 151–155. 24 refs.
Grants AF-AFOSR-707-67 and PHS MH 04172(05).

Resting skin potential level scores from three samples, two of undergraduates and one of housewives, were analyzed for normality of distribution. The first two samples showed no significant departure from normality. The third showed some significant positive skewness. In general, it was concluded that resting level scores were sufficiently normal not to require transformation for statistical analyses.

A68-80427
RADIO TELEMETRY FOR THE MEASUREMENT OF INTRACRANIAL PRESSURE.
James R. Atkinson, David B. Shurtleff, and Eldon L. Foltz (Wash. U., School of Med., Dept. of Neurol. Surg. and Dept. of Pediat., Seattle).
Journal of Neurosurgery, vol. 27, Nov. 1967, p. 428–432. 17 refs.
Grants NIH FR 37-03, NFMD 39; Atlas Chem. Ind. supported research.

A short-range telemetry system for the measurement of intracranial pressure is described. The system uses previously existing methods of detection of an implanted transensor. The transensor is constructed entirely from plastics and stainless steel of low tissue reactivity. The system provides for measurement of some parameters of intracranial pressure in the intact patient without recourse to repeated puncture of the cerebrospinal fluid system. Some factors leading to transensor failure and error have been discussed. The state of the art of transensors and detecting systems has reached a level where application of these techniques to neurosurgical problems is worth consideration.

A68-80428
POTASSIUM PALLADO SULFITE DETECTION OF CARBON MONOXIDE IN EXHALED AIR AS AN ESTIMATE OF CARBOXYHEMOGLOBIN.
James M. Ramsey (Dayton U., Dept. of Biol., Ohio).
American Industrial Hygiene Association Journal, vol. 28, Nov.–Dec. 1967, p. 531–534. 10 refs.
NSF and Dayton U. supported research.

From 22 comparisons of carboxyhemoglobin (COHb) from blood with that calculated from exhaled CO after 20 sec. of breathholding using the potassium pallado sulfite method, the overall chi-square fit was exceptionally good ($P>0.99$). However, the higher segment of the range (8–17% COHb) showed twice the deviation (3.0% COHb) as the 1–8% portion (1.5% COHb). This is because the potassium pallado sulfite technique has less accuracy above 50 p.p.m. of CO, a fact evident from reproducibility data on exhaled CO samples. Though not advocated for critical research determinations, the technique has potential value for obtaining public health information.

A68-80429
THE EFFECT OF COGNITIVE TASKS AND VERBALIZATION INSTRUCTIONS ON HEART RATE AND SKIN CONDUCTANCE.
Harold J. Johnson and Joseph J. Campos (Bowling Green State U., Ohio and Albert Einstein Coll. of Med., New York, N. Y.)
Psychophysiology, vol. 4, Oct. 1967, p. 143–150. 6 refs.
Grant NIMH MH-10398.

This study investigated the effects of cognitive tasks and verbalization instructions on heart period (HP) and skin conductance (SC). Two tasks (imagining common scenes and solving mental arithmetic puzzles) were used to test the hypothesis that conditions requiring attention to internal processes (rejection of the environment) are accompanied by cardiac acceleration and SC increases. Each type of task was administrered under three instruction conditions: no verbalization, later verbalization and concurrent verbalization. It was found that the imagination task was associated with no significant changes in HP or SC unless the subject was preparing to talk or actually talking. Mental arithmetic resulted in cardiac acceleration and SC increase even when no verbalization was required; however, this result is perhaps due to the covert verbalization inherent in the process of solving mental arithmetic problems. Both later and concurrent verbalization also produced significant increases in physiological activation during the arithmetic task. The findings of this study do not support the notion that conditions requiring rejection of the environment are associated with specific physiological changes. Rather the changes are generally attributable to the verbalization requirement. The effects of instructions requiring the subject to verbalize later are interpreted as due to either a motor set phenomenon or fear of being evaluated while talking.

A68-80430
LASER INDUCED EAR DAMAGE.
George Kelemen (Southern Calif. U., School of Med., Los Angeles), Yona Laor, and Edmund Klein (Roswell Park Mem. Inst., Dept. of Dermatol., Buffalo, N. Y.)
Archives of Otolaryngology, vol. 86, Dec. 1967, p. 603–609. 28 refs.
Contracts DA-49-193-MD-2436 and DA-49-193-MD-2437, Grant PHS 1-R01-RH-00361 RAD; NIH, Central Bur. of Res., Am. Otol. Soc., and Deafness Res. Found. supported research.

A group of 53 mice were exposed to pulsed ruby and neodymium irradiation of the head, and observed until they either died or were killed. Gross results varied with the parameters of radiation. Severe intracranial injuries and neurological and behavioral aberrations were evident in 46% of the animals. Damage to the ear was present and was on an "all or none" basis. Since the skin and bones were relatively uninjured, it is evident that secondary effects can be more severe at a deeper level than those produced at the superficial site of interaction. These preliminary explorations indicate high potential hazards of laser radiation to the ear.

A68-80431
BONE FORMATION AND RESORPTION IN NORMAL HUMAN RIB: A STUDY OF PERSONS FROM 11 TO 88 YEARS OF AGE.
Malvin Barer (Mayo Graduate School of Med., (Minn. U.), Rochester, Minn.) and Jenifer Jowsey (Mayo Clin. and Mayo Found., Sect. of Surg. Res. (Orthopedics), Rochester, Minn.)
Clinical Orthopaedics and Related Research, no. 52, May–Jun. 1967, p. 241–247. 14 refs.
Grant NIH AM-8658.

Quantitative microradiography of 74 specimens of normal rib from persons 11 to 88 yr. old showed that bone turnover in the rib appears to be relatively constant during a lifetime, but that the level of bone resorption is consistently higher than that of bone formation after the age of 20. This consistent level of both formation and resorption is not a feature of turnover in other parts of the skeleton. The haversian systems and the haversian canals remain about the same size throughout life, while there is a decrease in the thickness of the cortex.

A68-80432
THE MEASUREMENT AND THE MEANING OF URINARY CALCIUM.
B. E. C. Nordin, A. Hodgkinson, and M. Peacock (Med. Res. Council, Mineral Metab. Unit, Gen. Infirmary, Leeds, Great Britain).
Clinical Orthopaedics and Related Research, no. 52, May–Jun. 1967, p. 293–322. 176 refs.

The role of the kidney in the calcium economy of the body, the physiologic mechanisms involved and the limits within which they operate were given with normal ranges of calcium excretion, diurnal variations, sex and weight differences and the role of the glomerular filtration rate. The physiology of calcium excretion and the controlling factors of calcium intake, phosphorous intake, magnesium intake, oxalate intake, interrelationships between calcium and other urinary constituents, age, exercise, acid/base status and hormones were explained. Hypercalciuria and hypocalciuria were also discussed. Increasingly precise techniques for the measurement of urinary and plasma calcium are expected to further the understanding of the subject.

A68-80433
REDUNDANCY EFFECTS IN SHORT-TERM MEMORY.
D. W. J. Corcoran and D. L. Weening (U.S. Navy Electron. Lab. and San Diego State Coll., San Diego, Calif.)
Quarterly Journal of Experimental Psychology, vol. 19, Nov. 1967, p. 309–318. 15 refs.

Five experiments are reported whose purpose was to demonstrate that short-term memory is improved by a redundancy within the material. In Experiment I "tunes" containing, two, three, four and five tones of differing frequencies had to be coded into digits one to five, to indicate the order of the pitches in a tune. Performance on stimuli containing correlated amplitude and duration were compared with the uni-dimensional conditions. Experiment II repeated I, but required intensity to be coded. Experiment III required pitch coding under three conditions including that when amplitude and frequency were uncorrelated, and compared the performance of musically trained subjects with non-musicians. Experiment IV repeated III, but subjects were informed of the relation between dimensions. Experiment V involved "shadowing" the tunes by whistling simultaneously with the stimulus. It was concluded (a) that intercorrelation improves, but zero correlation impairs short-term memory; (b) that knowledge of the relation between dimensions improves performance in the correlated condition, but does not prevent impairment under zero correlation; and (c) the performance of musically trained subjects exceeds that of controls and is unaffected by the presence of a correlated or uncorrelated dimension.

A68-80434
PERCEIVED DISTANCE IN IMAGINED SPACE.
William Epstein (Kan. U., Dept. of Psychol., Lawrence).
Quarterly Journal of Experimental Psychology, vol. 19, Nov. 1967, p. 341–343. 6 refs.
Grant NIMH MH 4153.

An experiment was designed to determine whether, in the absence of distance-cues, the perceived distance of an object is regulated by the imagined space in which the object is located. Judgments of distance and size were obtained in a completely reduced situation. Preceding these judgments, the subject engaged in five min. of visual exploration of the interior of an oblong box. The length of the box differed (three, six or nine ft.) for different groups of subjects. The different pre-exposure conditions were expected to produce differences in the dimensions of the imagined space that the subject introduced in the subsequent test session. These differences in imagined space should lead to differences in the perceived distance of a single object located at a constant distance. Significant differences were obtained in the expected direction. In addition, judgments of the size of the standard tended to co-vary positively with the distance-judgments, suggesting that the effect of imagined space on judged distance was not simply the product of experimental biasing of the response system. Some methodological and theoretical implications of the findings are considered.

A68-80435
TRAINING OF FAST TAPPING WITH REDUCTION OF KINAESTHETIC, TACTILE, VISUAL AND AUDITORY SENSATIONS.
Judith I. Laszlo (Western Australia U., Dept. of Psychol., Perth).
Quarterly Journal of Experimental Psychology, vol. 19, Nov. 1967, p. 344–349. 9 refs.

Five subjects were trained to tap on a light Morse-key during nerve compression block. The training sessions lasted for 40 sec., with a 5 sec. rest after the first 20 sec. work period. The group learning curve reached 89.5% level of normal performance by the eighth training session. In the ninth, the testing session, subjects tapped with visual and auditory sense reduction superimposed on the kinaesthetic and tactile impairment of the training condition. Performance in the testing session reached 40.9% of normal. The sixth subject was trained in the same task as the other five subjects, but the training condition included elimination of cues from all four sensory channels. He reached 79.09% of his normal tapping performance in the seventh session. These results show that the motor skill of tapping can be relearned in the absence of kinaesthetic cues. Furthermore when the subject has no conscious knowledge of any peripheral sensory cues connected with the ongoing motor activity, learning can nevertheless take place. These findings lead to the hypothesis, that skilled motor activity can be monitored by central processes alone. During the training session subjects showed a tendency of tapping in groups of gradually increasing length. It is hypothesized that increased number of taps forming a group gives an indication to the possible mode of action of these central processes.

A68-80436
MICROBIOLOGICAL ASPECTS OF SPACE FLIGHT.
M. D. Lechtman and Ronald Nachum (Garrett Corp., AiRes. Manuf. Co., Life Sci. Dept., Los Angeles, Calif.)
American Journal of Medical Technology, vol. 33, Nov.–Dec. 1967 p. 515–523. 14 refs.

A general view of selected microbiological aspects of space flight was presented. Maintaining a healthful closed system for astronauts is a major problem in manned space flight, and various methods proposed for the control of microorganisms in the space cabin were reported.

A68-80437
PROTEIN REQUIREMENTS IN TROPICAL COUNTRIES: NITROGEN LOSSES IN SWEAT AND THEIR RELATION TO NITROGEN BALANCE.
Ann Ashworth (West Indies U., Med. Res. Council, Trop. Metab. Res. Unit, Jamaica) and A. D. B. Harrower (Edinburgh U., Med. School, Great Britain).
British Journal of Nutrition, vol. 21, no. 4, 1967, p. 833–843. 13 refs.

An experiment was undertaken to determine whether high rates of sweating in a tropical climate affect protein requirements by increasing the total nitrogen losses from the body. Six fully acclimatized volunteers were given a diet supplying 50 g. protein (=8 g. N) daily. They performed strenuous physical work of a normal nature for an average of six and one-half hr. a day for two five-day periods. During control periods the subjects took minimal

exercise and lived in a cool environment. N balance was measured throughout. Rates of sweating were measured by weighing. Whole body sweat was collected and the concentrations of nitrogen, sodium and potassium were measured. During six and one-half hr. of work approximately three liters of sweat were lost, containing on average 0.49 g. N, 64 m-equiv. Na and 22 m-equiv. K. The N concentration in sweat was 0.20 mg./g., which is lower than that found by most other workers. It is suggested that acclimatization is an important factor in reducing N loss by sweating. There was a marked decrease in urinary Na excretion during sweating, which compensated fully for the loss of Na in sweat. Renal compensation for loss of K was less efficient. Because the total N loss in sweat was small, it was not possible to establish with certainty whether it was compensated for by a reduced renal excretion of N. However, after the initial period the subjects were in N balance in spite of the relatively low protein intake. It is concluded that there is no evidence to suggest that heavy sweating under natural conditions in a tropical climate causes a significant increase in protein requirements.

A68-80438
SOME EFFECTS OF OVERFEEDING FOR FOUR DAYS IN MAN.

J. A. Strong, D. Shirling, and R. Passmore (Edinburgh U., Dept. of Physiol., Great Britain).

British Journal of Nutrition, vol. 21, no. 4, 1967, p. 909–919. 13 refs. Secy. of State for Scotland supported research.

Food which provided from 2,960 to 7,880 kcal. in excess of requirements was eaten by sixteen subjects, ten hospital patients and six students, in each instance for a period of four days. The proportion of the nutrients lost in the feces was not increased during overfeeding. The metabolic rates were in no instance increased by an amount equivalent to more than 15% of the excess calories. The increase could be attributed to the specific dynamic action of the extra dietary protein. The gains in weight ranged from 370 to 5,460 g./four days and the calorie equivalent of the weight gained varied from 1.1 to 10.0 kcal./g. These variations can be attributed to variations in the amount of water retained. Analysis of their respiratory exchanges suggests that most subjects stored from 400 to 1,500 g. of carbohydrate in the tissues, possibly in the form of muscle glycogen.

A68-80439
OXYGEN CONSUMPTION AND CARBON DIOXIDE PRODUCTION DURING BREATH-HOLD DIVING.

Albert B. Craig, Jr. and William L. Medd (Rochester U., School of Med. and Dentistry, Dept. of Physiol., N. Y.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 190–202. 25 refs.
Grants NHI HE 09676 and NIH GM 1606; Rochester U., supported research.

Alveolar oxygen tension (V_{O_2}) and alveolar carbon dioxide tension (V_{CO_2}) were measured during single dives and during repetitive diving to five and ten m. Results from these experiments were compared to those from underwater swimming and others in which the subject exercised intermittently on land and at the same time, held his breath. The V_{O_2} used for a five-m. dive was 0.8 liter, and for a ten-m. dive, 1.2 liters. The excess V_{O_2} used during repetitive diving was the sum of the V_{O_2} used in each single dive. During the latter part of a repetitive diving pattern the V_{O_2} became quite steady, and the $P_{A_{O2}}$ at the end of each dive was linearly related to the V_{O_2}. The CO_2 retention observed during the dive was most marked in the deeper dives. The $P_{A_{CO_2}}$ after an underwater swim indicated that the increased ambient pressure and lung compression of a dive accounts for only part of the CO_2 retention. Water immersion itself was probably a factor, for the $P_{A_{CO_2}}$ at the end of the underwater swim was not as high as it was after the land exercise. An increase in blood lactic acid concentration was observed after the first dive in each of three different diving patterns. Lactic acid decreased during the remainder of the period in which the dives were easy but remained elevated in the more difficult diving pattern.

A68-80440
BACKPACK FOR FREE-RANGING PRIMATES.

Nolan W. Watson, Dean L. Franklin, and Robert L. Van Citters (Wash. U., Dept. of Physiol. and Biophysics, and Reg. Primate Res. Center, Seattle and Scripps Clin. Res. Found., La Jolla, Calif.).

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 252–253.
Grants PHS HE-08433, PHS HE-09217, and PHS FR-0166; Wash. State Heart Assn. supported research.

A backpack was designed to house and carry apparatus used in telemetry studies of cardiovascular responses in free-ranging primates. The device consists of a formfitting chassis on which electronic circuits are mounted, a Fiberglas cover box, and plastic harness with shoulder straps to secure the apparatus to the animal's back. These packs have been used to study cardiovascular responses of wild baboons ranging freely in Africa, and are also worn by baboons living together in a laboratory compound. Baboons readily tolerate such packs and have worn them continuously for periods of months.

A68-80441
MYOCARDIAL TOXICITY FROM CARBON MONOXIDE POISONING.

Robert F. Anderson, Daniel C. Allensworth, and William J. deGroot (Tex. U., Med. Branch, Dept. of Internal Med., Galveston).

Annals of Internal Medicine, vol. 67, Dec. 1967, p. 1172–1182. 16 refs.
Grant NIH 5T02 HE 5098-13.

Seven cases of carbon monoxide poisoning were described. Two patients died, one five days after poisoning of what appeared clinically to be an acute myocardial infarction. At postmortem examination a mural thrombus in the left ventricle with coronary empolization was found. Electrocardiographic abnormalities are frequent and may occur promptly or after the acute episode has subsided. Patients poisoned with carbon monoxide should be observed with serial electrocardiograms. Clinical or electrocardiographic evidence of myocardial damage indicates a period of bedrest.

A68-80442
THE ROLE OF BROWN ADIPOSE TISSUE IN THERMOREGULATORY HEAT PRODUCTION IN THE WARM- AND COLD-ADAPTED ADULT RAT.

Sz. Donhoffer and Z. Szelényi (U. Med. School, Inst. of Pathophysiol., Pécs, Hungary).

Acta Physiologica Academiae Scientiarum Hungaricae, vol. 32, no. 1–2, 1967, p. 53–60. 16 refs.

Deep colonic temperature, temperature of the interscapular brown adipose tissue and of the dorsal muscle beneath it were measured with thermocouples at ambient temperatures of 30, 20 and 10°C. in adult rats adapted to environmental temperatures of 5 and 30°C., respectively, oxygen consumption being recorded simultaneously. In the warm-adapted rat both colonic and brown fat temperature declined at an ambient temperature of 10°C., whereas in the cold-adapted rat colonic temperature was maintained, and brown fat temperature rose above that observed in a thermoneutral environment. At an environmental temperature of 20°C., brown fat temperature exceeded colonic temperature in the warm-adapted animal, whereas in the cold-adapted rat it was somewhat lower than colonic temperature. At an ambient temperature of 10°C., brown fat temperature exceeded colonic temperature in both the warm-

and the cold-adapted group, but the difference between colonic and brown fat temperature was significantly greater in the warm-adapted animals. Oxygen consumption was higher in cold-adapted rats at all three ambient temperatures than in the warm-adapted animals, but the difference failed to reach statistical significance. It is concluded that in the warm-adapted adult rat brown adipose tissue is thermogenetically active and brown fat thermogenesis is maximally activated at higher ambient temperatures than in the cold-adapted animal.

A68-80443

THE EFFECT OF CARBON DIOXIDE ON VENTILATION IN COALMINERS.

I. Andik, F. Sárdi, and P. Schmidt (U. Med. School, Inst. of Pathophysiol., Pécs, Hungary).

Acta Physiologica Academiae Scientiarum Hungaricae, vol. 32, no. 1–2, 1967, p. 131–138. 16 refs.

Prolonged dust exposition in coalminers without manifest silicosis and without an increased alveolar pCO_2 when breathing air was found to be associated in 23% with a reduction in the ventilatory response to CO_2. Possible mechanisms were discussed and it was concluded that increased respiratory work plays the most important role in the reduction of the ventilatory response to CO_2.

A68-80444

EFFECT OF ARTERIAL HYPOXIA ON THE SUSCEPTIBILITY TO ARRHYTHMIA OF THE HEART.

L. Szekeres and Gy. Papp (U. Med. School, Inst. of Pharmacol., Pécs, Hungary).

Acta Physiologica Academiae Scientiarum Hungaricae, vol. 32, no. 1–2, 1967, p. 143–161. 26 refs.

Anesthetized cats and dogs were used for this investigation. Arterial hypoxia evoked changes in the susceptibility to arrhythmia which changes depended on the severity and duration of hypoxia. During slight hypoxia, susceptibility to arrhythmia was enhanced. With the deepening of hypoxia, susceptibility decreased. These changes were readily revealed by the electrical fibrillation threshold method. The temporary enhancement of the susceptibility to arrhythmia offers a possibility for arrhythmia being released by some additional factor such as a manipulation of, or an increased strain to the heart. This enhanced susceptibility to arrhythmia was found to be mainly due to the hypoxic excitement of cardioregulatory autonomic nervous centers. The importance of central sympathetic tone was shown by the following findings: (a) transection of the sympathetic fibers running to the heart considerably diminished but was not capable of abolishing completely the enhancement of susceptibility to arrhythmia in the first stage of the hypoxia; and (b) results fully identical with those found after sympathectomy could be obtained by beta-receptor blocking sympatholytic drugs. The hypoxic enhancement of susceptibility to arrhythmia was mainly due to the augmented excitability of the myocardium. In contrast, the second phase of anoxia, which phase was accompanied by a decreased susceptibility, was characterized by a marked diminution in myocardial excitability, a phenomenon also found in heart-lung preparations, from the very beginning of hypoxia. Thus, the increased, excitatory state of the autonomic nervous centers at the beginning of the hypoxic period influenced the fundamental parameters of cardiac function in an arrhythmogenic direction and overshadowed the antiarrhythmic autoregulatory reactions of the heart. Later, the autonomic tone continuously decreased until the autonomic centers had become practically paralyzed, a feature resulting in the liberation of the heart from the regulatory influences of the autonomic nervous system on the one hand, and in cardiac reactions similar to those seen in isolated or denervated hearts on the other.

A68-80445

THE TOXIC EFFECT OF ALCOHOL ON THE HUMAN LIVER AND ITS FIRST ULTRASTRUCTURAL MANIFESTATIONS.

Guy Albot and Monique Parturier-Albot.

American Journal of Gastroenterology, vol. 48, Oct. 1967, p. 319–327. 29 refs. I.N.S.E.R.M. and Reg. Fund of the Soc. Security supported research.

The ultrastructural peculiarities of three varieties of subacute alcoholic hepatitis were studied. Electron microscopic studies of the three initial lesions of subacute alcoholic hepatitis were: (1) subacute ballooned cell hepatitis; (2) subacute steatotic hepatitis; and (3) subacute cirrhotic hepatitis. In subacute alcoholic hepatitis with balloon cells, the predominant lesion was a generalized cell ballooning with vacuolization of the giant mitochondria and partial destruction of the endothelial coat of the sinusoids. In subacute steatotic alcoholic hepatitis, in addition to the preceding lesions which were more pronounced, there was marked lipid deposition in the hyaloplasm bounded by membranes of the smooth endoplasmic reticulum. In subacute cirrhotic alcoholic hepatitis two additional characteristic features were noted. There was disappearance of the endothelial cells and of Disse's space with increased density of the blood pole of the hepatocyte and dilatation of some bile canaliculi, with rarefaction or ballooning of their microvilli. In the mild and early forms which constituted subacute alcoholic hepatitis, superimposed accessory factors (anoxia, regeneration and deficiency) may be eliminated and the lesions specifically due to the toxic action of alcohol considered.

A68-80446

EFFECTS OF PREVIOUS RADIATION EXPOSURE ON THE ACTIVITY RESPONSE TO D-AMPHETAMINE HYDROCHLORIDE.

A. A. McDowell, H. H. Ziller, and G. M. Krise (Tex. A and M U., Coll. of Eng., Radiation Biol. Lab., College Station).

Journal of Genetic Psychology, vol. 111, Dec. 1967, p. 241–243. Tex. A and M U. supported research.

The activity response of control and previously irradiated rats to D-amphetamine hydrochloride was studied with the use of the appropriate placebo controls. The irradiated rats had been given whole-body exposure to 500 R of gamma radiation 100 days earlier. The results showed that previous exposure to radiation lowers the level of response to the drug, but fails to alter the pattern of response.

A68-80447

INTERFACIAL PHENOMENA GOVERNING ADHESION OF CHLORELLA TO GLASS SURFACES.

John S. Nordin, H. M. Tsuchiya, and A. G. Fredrickson (Minn. U., Chem. Eng. Dept., Minneapolis).

Biotechnology and Bioengineering, vol. 9, Oct. 1967, p. 545–558. 8 refs.

NASA Grant NsG79 60 and NASA Grant NGR 24 005 056

Interfacial phenomena are directly involved in the adhesion of a strain of *Chlorella*, a unicellular alga, to glass surfaces in simple ionic solutions. The principal mechanisms governing the adhesion appear to be electrostatic interaction between electrical double layers and various specific surface interactions resulting from surface heterogeneity and ion adsorption. Under most conditions the algal cells and glass surfaces have negative zeta potentials, and adhesion to glass will not occur; but if, for example, $FeCl_3$ is added to an algal-glass system immersed in 0.05M NaCl, the algal and glass surfaces will possess very different zeta potentials, and adhesion will be strongest under those conditions which produce the greatest difference in zeta potentials. Prior pretreatment and usage of glass apparatus greatly affect the glass zeta potentials and the

adhesion of algal cells to glass. An apparatus for measuring a relative set of numbers representing the force of adhesion of algal cells is described.

A68-80448
WORKING DESIGN FOR A 5-LITER CONTROLLED CONTINUOUS CULTURE APPARATUS.
F. J. Moss and F. Bush (New South Wales U., School of Biol. Sci., Dept. of Biochem. Eng., Kensington, Australia).
Biotechnology and Bioengineering, vol. 9, Oct. 1967, p. 585–602. 11 refs.

A continuous culture apparatus of 5 l. capacity is described which is capable of control of dissolved oxygen. Combined turbidostat and constant feed operation permit control of cell population density and one or more nutrients. A system for the measurement of oxygen uptake and CO_2 output is described. Sufficient detail is supplied to enable construction and operation of the apparatus.

A68-80449
OSCILLATORY GROWTH RATE RESPONSES OF S. CEREVISIAE IN CONTINUOUS CULTURE.
J. W. Gilley and H. R. Bungay (Va. Polytech. Inst., Dept. of Civil Eng., Blacksburg).
(Am. Chem. Soc., 150th Meeting, Atlantic City, Sep. 1965).
Biotechnology and Bioengineering, vol. 9, Oct. 1967, p. 617–622. 10 refs.
Grant PHS RO1 ES 00025.

The yeast Saccharomyces *cerevisiae* were grown on dilute, chemically defined media in continuous culture with either glucose or ammonium sulfate as the growth-limiting ingredient. Changes in dilution rate or glucose concentration induced decaying oscillations in the numbers of yeast growing on ammonium sulfate-limited media. Spot checks indicated that cell dry weight and Kjeldahl nitrogen followed the cell numbers during these oscillations. With glucose-limited media, there was no response to step changes in ammonium sulfate concentration, and dilution rate step changes gave non-oscillatory transient responses.

A68-80450
INFLUENCE OF ELEVATION OF ORIGIN, RATE OF ASCENT AND A PHYSICAL CONDITIONING PROGRAM ON SYMPTOMS OF ACUTE MOUNTAIN SICKNESS.
James E. Hansen, Charles W. Harris, Wayne O. Evans (U.S. Army Res. Inst. of Environ. Med., Natick, Mass.)
Military Medicine, vol. 132, Aug. 1967, p. 585–592. 19 refs.

Acute mountain sickness was found in young normal subjects traveling rapidly from sea level to 11,400 ft. or 14,100 ft. It was not found in residents of 5–6,000 ft. traveling rapidly to 11,400 ft. It was significantly decreased in sea level residents sent of 14,100 ft. with one week delays at 5,200 ft. and 11,400 ft. Cardiovascular fitness alone did not protect against illness. Headaches were the most distressing symptom; in several individuals they were lessened at high elevation by strenuous exercise. The present study isolated and identified some of the variables that influence the symptoms of acute mountain sickness. The ultimate cause may be recognized with the finding of an effective drug therapy or serial measurement of cerebrospinal fluid pressure, cerebral blood flow, or blood and cerebrospinal fluid pH and composition.

A68-80451
ANTHROPOMETRIC EXAMINATION FOR INDICES OF THE NUTRITIONAL STATE [ANTHROPOMETRISCHE UNTERSUCHUNGEN ZUR KENNZEICHNUNG DES ERNAHRUNGSZUSTANDES]
M. Möhr (Deut. Akad. of Wiss., Inst. für Ernährung, Berlin).
Das Deutsche Gesundheitswesen, vol. 22, Sep. 28, 1967, p. 1853–1859. 45 refs. In German.

A quantitative procedure was proposed for estimating the nutritional state, considering the characteristics of body composition and body structure. The stipulation of weight was based on the "optimal weight". For judging the body composition, the fat share in the body as well as the quantity of "active mass" was determined. The assessment of the structural conditions of the body resulted from the "primary and secondary growth tendencies" which were recorded as Strömgren index and as leanbody-fullness index respectively. The 121 fields of a system of coordinates into which three kinds of massivity were entered, enabled a differentiated and quantitative designation for the type of body structure concerned.

A68-80452
PHANTOM DOSIMETRY COMPARING DIFFERENT SOURCES OF IONIZING RADIATION [VERGLEICHENDE PHANTOMDOSIMETRIE MIT VERSCHIEDENEN QUELLEN IONISIERENDER STRAHLUNG].
J. Meissner and D. Wendorff
Atomkernenergie, vol. 12, Sep.–Oct. 1967, p. 371–373. 7 refs. In German.

Different sources of ionizing radiations are compared dosimetrically with regard to radiobiological experiments. A tissue-equivalent phantom (plexiglass) is constructed for dose measurements up to 25 cm. depth in 5 cm. steps at variable distances from the sources. The results for X-rays and gamma-rays are obtained by measuring the "standard ion dose rate", using an ionization chamber. For a neutron source the absorbed dose is estimated from the impulse rates determined by a scintillation counter. Results are presented by graph and by values of the half thickness of the tissue-equivalent phantom material.

A68-80453
NEUROVEGETATIVE DAMAGES AND HISTOMORPHOLOGIC CHANGES IN THE RAT BRAIN UNDER THE EFFECT OF ACOUSTIC STIMULI [UBER NEUROVEGETATIVE SCHADEN UND HISTOMORPHOLOGISCHE VERANDERUNGEN IM GEHIRN DER RATTE BEI EINWIRKUNG AKUSTISCHER REIZE].
St. Nitschkoff, G. N. Kriwizkaja, and U. Gnuchtel (Deut. Acad. of Sci., Inst. for Cortico-visceral Pathol. and Therapy, Berlin, East Germany).
Acta Biologica et Medica Germanica, vol. 19, no. 1, 1967, p. 33–45. 42 refs. In German.

Noise stress experiments (95 db) on rats (short-time permanent exposures for 96 hr. and chronical intermittent exposures for five min. twice a day for 28 wk. evoked irregularities in different organic systems: hyper- and hypoelectrolytemias, increase of serum cholesterol, increase of biogenic amines, hypertrophy of the adrenals, rise of blood pressure, changes of the electrocardiogram and partly significant changes of the erythro- and leukopoiesis and blood coagulation systems. The investigated material may be divided into a hyperresponsive and a hyporesponsive group. The number of animals showing normal behavior was small. Intermittent noise stress for 28 wk. produced more pronounced changes than permanent exposure for 96 hr. Attention was drawn to the complicated reaction of the neuro-endocrinium under stress, to regulation, counterregulation, adaptation and exhaustion. Histomorphological investigations of the brain were elucidative and interesting. Cortical areas (sensomotoric zones, acoustic analyzer, limbic region) showed early morphologic changes which were partly reversible in the initial stage. Subcortical areas (hypothalamus thalamus) were injured later, but the degenerative changes were

stronger and irreversible, including vacuolization of nuclei and plasma, chromatolysis, deformation of myelinated nerve fibers and the dendrite processes as well as hypertrophy and hyperplasia of the microglia. A capillarization with thickening of the intima and thrombosing the injured areas could also be observed.

A68-80454

INFLUENCE OF VARIOUS PSYCHOTHERAPEUTICAL AGENTS ON THE PHENELZINE-INDUCED INCREASE OF THE GAMMA AMINO BUTYRIC ACID LEVEL ON THE RAT BRAIN [DER EINFLUSS VERSCHIEDENER PSYCHOPHARMAKA AUF DEN PHENELZIN-BEDINGTEN ANSTIEG VON GAMMA-AMINOBUTTERSAURE IM RATTENGEHIRN].

N. Popov, V. Rösler, and H. Matthies (Med. Acad., Inst. for Pharmacol. and Toxicol., Magdeburg, East Germany).

Acta Biologica et Medica Germanica, vol. 19, no. 1, 1967, p. 111–119. 7 refs. In German.

Phenylethylhydrazine evokes a dose-related increase in the γ-amino butyric acid (GABA) content in the rat brain. This effect can be inhibited by pretreatment with other monoamine oxidase inhibitors having hydrazine, hydrazide or amine structures. The strength of their inhibition of the increase in GABA after phenelzine is roughly the same as their strength as monoamine oxidase inhibitors. The inhibition appears to be not competitive and irreversible. It cannot be abolished either in its time course nor by increasing the phenelzine dose. Pretreatment with harmine, harmaline, phenylethylamine, methamphetamine, DOPA, 5-HTP, chloropromazine, butyrylperazine, and imipramine has no effect on the GABA increase after phenelzine.

A68-80455

ENERGY ABSORPTION OF THE INTERFACE BETWEEN TIMES OF DIFFERENT STOPPING POWER [ENERGIEABSORPTION AN GRENZFLACHEN ZWISCHEN GEWEBEN VERSCHIEDENEN BREMSVERMOGENS].

A. D. Kappos (Max-Planck-Inst. for Biophysics, Frankfurt am Main, West Germany).

Giophysik, no. 4, 1967, p. 137–145. 19 refs. In German.

A method for calculating the absorbed dose at points near a plane interface between bone and soft tissue from α-emitting nuclides homogenously distributed in bone is presented. The method is more generalized in relation to other work done in this field by the fact that any experimental or theoretical dependence of soft tissue or bone stopping power upon the energy of the α-particle may be used for dose calculation. Results of a calculation with an α-particle stopping power fitted to the best experimental data known at present are presented. They diverge only slightly from results of previous investigators using a simple power function. The meaning in radiation biology of a mean absorbed dose in microscopic dimensions with a highly inhomogenous radiation field is discussed.

A68-80456

DEPENDENCE OF CALCIUM METABOLISM ON AGE IN RATS [UNTERSUCHUNGEN MIT ^{47}CA UND ^{45}CA ZUR FRAGE DER ALTERSABHANGIGKEIT DES CALCIUMSTOFFWECHSELS BEI RATTEN].

D. Glaubitt (I. Med. U.-Klin., Hamburg-Eppendorf, West Germany).

Biophysik, no. 4, 1967, p. 168–174. 16 refs. In German.

The kinetics of radioactive calcium is age dependent in rats. In 7 to 12 wk. old animals within a determined period after interperitoneal injection of ^{47}Ca, the biological half-life period of the whole body radioactivity and partial organ radioactivity (bones and rib cartilage) is shorter than in rats a minimum of eight mo. in age. The use of ^{45}Ca shows similar findings.

A68-80457

HEMATOLOGY, BLOOD VOLUME, AND OXYGEN TRANSPORT OF DOGS EXPOSED TO HIGH ALTITUDE.

James A. Vogel, George W. Bishop, Ronald L. Genovese, and Thomas L. Powell (Fitzsimons Gen. Hosp., U.S. Army Med. Res. and Nutr. Lab., Divs. of Physiol. and Pathol., Denver, Colo.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 203–210. 38 refs.

Purebred beagle dogs of uniform size, age, and genetic background were utilized to study the hematologic response at sea level and during 16 wk. exposure to 5,300 and 14,100 ft. altitude. Hematocrit, hemoglobin, and erythrocyte counts rose sharply at 14,100 ft. and plateaued before or by 30 days of exposure. Hematocrit at the end of the exposure period was 50% at 5,300 ft. and 59% at 14,100 ft. Reticulocyte counts peaked to 1.0% at about day 10 at 5,300 ft. and 3.5% at 14,100 ft. and returned to sea-level values (0.5%) by day 30 at both altitudes. The myeloid:erythroid ratio of bone marrow cells fell to 0.4 from a control of 0.9 within five to ten days of exposure. A marked reduction in plasma volume resulted in a lowered total blood volume which remained throughout the exposure period despite an increasing cell volume. Acclimatization was demonstrated by a significant increase in oxygen tension and saturation by the end of 16 wk. Dogs exhibit a hemopoietic response to high altitude qualitatively similar to man and lie between man and rat in the quantitative degree of this response.

A68-80458

DERIVATION OF CARDIAC MECHANICAL PARAMETERS FROM SERIAL BIPLANE ANGIOCARDIOGRAMS.

Charles E. Rackley, William P. Hood, Jr., Linda Cleveland, and Ralph W. Stacy (N.C. U., School of Med., Depts. of Med. and Surg., Chapel Hill).

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 254–258. 6 refs.

Grants NIH G M-13625, PHS FR 46, and N.C.HA 324 NOR 39.

Data-handling methods and algorithms have been developed for removing the tedious task of hand calculation of left ventricular volumes and weight, stress-tension relations, circumference, and work from biplane angiocardiographic data. These methods have been so planned and arranged that they can be carried out on a small, laboratory-oriented digital computer. In effect, they have reduced the information availability time to less than three hr. so that the procedure becomes feasible for clinical evaluation of patient status.

A68-80459

A SPRAY-ON ELECTRODE FOR RECORDING THE ELECTROCARDIOGRAM DURING EXERCISE.

J. Trank, R. Fetter, and R. M. Lauer (Kan. U., Med. Center, Dept. of Physiol. and Dept. of Pediat., Kansas City and Midwest Res. Inst., Kansas City, Mo.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 267–268. 6 refs.

NASA Contract NASr-63(11) and Grant PHS HD00997.

A convenient electrode for monitoring heart rate and the electrocardiogram during exercise is described. A study of the electrical characteristics of these electrodes shows that their impedance falls during exercise allowing improved recording with time.

A68-80460

CONCEPTS OF SET AND AVAILABILITY AND THEIR RELATION TO THE REORGANIZATION OF AMBIGUOUS PICTORIAL STIMULI.

A68-80461

George J. Steinfeld (Fairfield Hills Hosp., Newtown, Conn.)
Psychological Review, vol. 74, Nov. 1967, p. 505–522. 54 refs.

Experiments on the effects of set on perception are criticized for not having adequately differentiated perception from recognition, identifiability, interpretation and response processes. After making these distinctions within the context of a cognitive theory, this paper discusses the role of past experience in relation to these processes and to the process of recognition-perception (R-P). Two hypotheses are offered as explanations of the R-P. The paper then reviews what is meant by the concept of availability and argues that sets, no matter how conceived, refer to dynamic-motivational factors which increase the availability of memory traces. It is postulated that highly available memory traces can affect the reorganization of ambiguous pictorial stimuli (R-P), and experiments are reported which support this formulation. The availability concept is viewed as being broad enough to encompass the two basic hypotheses, perceptual and nonperceptual, used to interpret set effects.

A68-80461
INFLUENCE OF LEAD POISONING ON SYNTHESIS OF RIBONUCLEIC ACIDS IN SOME ORGANS IN THE RAT [WPLYW ZATRUCIA OLOWIEM NA SYNTEZE KWASOW RYBONUKLEINOWYCH NIEKTORYCH NARZADOW SZCZURA].

Sroczynski Jan, Jonderko Gerard, and Wegiel Antoni.
Patologia Polska, vol. 18, no. 3, 1967, p. 405–411. 25 refs.
In Polish.

The influence of experimental lead poisoning on synthesis of ribonucleic acids (RNA) as studied in ten rats poisoned with lead acetate and in ten control animals in which physiologic saline solution was injected intraperitoneally. When symptoms of lead poisoning appeared, radioactive phosphorus ^{32}P was injected intraperitoneally in both groups of animals. The animals were decapitated, and RNA was assayed by the method of phenol extraction in homogenates of the liver, spleen, and brain. On the basis of measurements of radioactivity in isolated RNA, synthesis of RNA in the different organs was assessed. Significantly lowered radioactivity was observed in the liver, and increased activity in the spleen; radioactivity was only slightly increased in the brain tissue. The results indicate that lead poisoning inhibits synthesis of RNA in the liver. The increased radioactivity in the spleen can be explained as a result of stimulation of marrow foci in the spleen of rats by the hemolytic process.

A68-80462
SKIN RESISTANCE, SWEAT-GLAND COUNTS, SALIVARY FLOW, AND GASTRIC SECRETION: AGE, RACE, AND SEX DIFFERENCES, AND INTERCORRELATIONS.

Kerrison Juniper, Jr. and Roscoe A. Dykman (Ark. U., Med. Center, Little Rock).
Psychophysiology, vol. 4, Oct. 1967, p. 216–222. 11 refs.
Grants NIH AM-08194, NIH T1-AM-05314, NIH FR-208-1, NIH FR-05050-1, NIMH MH KS-2504, and NIMH MH-01091.

Skin resistance, sweat-gland counts, salivary flow, gastric secretion and pH were measured in volunteers and patients of both sexes, Negroes and Caucasians. Correlational analysis suggested two negatively related clusters: (A) salivary flow, sweat-gland counts, and gastric secretion; and (B) age, skin resistance, and pH. Skin resistance was higher in Negroes than Caucasians, and in females than males, increasing irregularly with age.

A68-80463
THE INFLUENCE OF SOME PSYCHOLOGICAL FACTORS ON LATENCY OF THE GALVANIC SKIN REFLEX.

Walter W. Surwillo (Louisville U., School of Med., Dept. of Psychiat., Ky.)
Psychophysiology, vol. 4, Oct. 1967, p. 223–228. 12 refs.
Grant PHS FR-05375.

This study was made to examine the effect of differences in motivation and in attention on latency of the endosomatic galvanic skin reflex (GSR). Using verbal instructions, two different levels of motivation were induced in a group of 37 subjects who performed a simple reaction task in which they pressed a button whenever a 250 cycle tone was presented. The same tone also served as a stimulus for eliciting the GSR. In a second experiment, 42 different subjects performed a similar reaction task, but in this case the stimulus was the 250 cycle tone or a 1,000 cycle tone of equal subjective intensity. Subjects were asked to give a voluntary response to all tones irrespective of frequency and then, later on, to respond only when the 1,000 cycle tone was presented. Although voluntary reaction times were significantly shorter under conditions of high as compared with low motivation, latency of the GSR did not differ for the two conditions. In the second experiment, significantly shorter GSR latencies were recorded under the condition where subjects were required to pay closer attention to the stimulus.

A68-80464
STRESS–STRAIN RELATIONSHIPS OF MAN IN THE HEAT.

Arthur C. Custance (Human Eng. Group, Defence Chem., Biol. and Radiation Labs., Ottawa, Canada).
(DRB/Mobile Command Collaboration Conf., Toronto, Apr. 24–25, 1967).
Medical Services Journal, Canada, vol. 23, May 1967, p. 721–726. 26 refs.

The human body is able to tolerate a far smaller shift in core temperature upwards than downwards and is accordingly provided with a highly effective mechanism for the removal of heat by evaporative cooling to prevent such a rise. Interference with this mechanism becomes serious in a remarkably short interval of time. Currently designed chemical warfare protective systems of impermeable single-layer or semi-permeable multi-layer construction interfere with thermoregulation in two ways: by preventing the evaporation of sweat or by insulating the body against possible radiation losses. Either effect imposes severe physiological strain: the first very rapidly with fairly rapid recovery upon removal of the stress factor, and the second somewhat more slowly but with a longer recovery time when the resulting strain is caused by excessive sweat water loss and accompanying dehydration. Some of the parameters of these two forms of physiological strain are discussed.

A68-80465
A REVIEW OF THE TOXICITY AND METABOLISM OF MERCURY AND ITS COMPOUNDS.

J. R. Brown and M. V. Kulkarni (Toronto U., School of Hyg., Dept. of Physiol. Hyg., Canada).
Medical Services Journal, Canada, vol. 23, May 1967, p. 786–808. 113 refs.

A review of the toxicity and metabolism of mercury was presented. It was found that the frequency of positive cases of mercurialism tends to increase with increase in duration and in intensity of exposure, especially when exposure is to high concentrations of mercury in air. Since there is a marked variation in urinary excretion of mercury among individuals who were similarly exposed, and among those with and without clinical evidence of mercurialism, it appears that excretion of mercury in the urine is directly related to the concentration of mercury in the air to which the workers are exposed, and the degree of exposure. This conclusion is valid only on a group basis and does not consistently apply to individual cases. Also, there is a lack of correlation between urinary

mercury and clinical manifestations of poisoning. Observations made to date seem to justify the conclusions on mercury concentration in blood; that on a group basis high concentration and high degree of exposure give rise to high blood mercury levels, but the correlation does not always exist in individual cases. There is strong evidence that when mercury is absorbed as an inorganic or phenyl compound it leaves the blood in a matter of hours, and much of it is promptly excreted in the urine. This is not true of the alkylmercurials. Furthermore, extensive studies strongly suggest that the phenylmercurials are no more toxic than the inorganic compounds and are much less toxic than the alkylmercurials. D-penicillamine and 2,3-dimercaptopropanol (BAL) have both been used in mercury poisoning. However, BAL is the effective drug of choice.

A68-80466
CAN THE DISTRIBUTION OF INSPIRED GAS BE ALTERED?

A. C. Young, C. J. Martin, and T. Hashimoto (Wash. U., School of Med., Dept. of Physiol. and Biophysics and Firland Sanat., Inst. of Respirat. Physiol., Seattle).

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 129–134. 16 refs.
Grant NIH HE 01892.

Normal subjects and patients with an obstructive pulmonary syndrome were studied by means of a nitrogen-washout technique. The nitrogen washout was simulated on an analogue computer which described the washout in terms of six equally ventilated compartments. The effects of body position, of increasing the tidal volume, of increasing the inspiratory flow rate both actively and passively, of positive airway pressure, and of intermittent occlusion of expiratory flow were tested. The distribution of inspired gas could be altered by voluntarily increasing inspiratory flow or tidal volume. At higher flow rates of the volume-to-ventilation ratios and compartmental volumes are more widely dispersed. At greater tidal volumes the dispersion of volume-to-ventilation ratios is increased.

A68-80467
ABSORPTION AND METABOLISM OF DIETARY TRIGLYCERIDES IN GERMFREE AND CONVENTIONAL RATS.

Norbert L. Wiech, James G. Hamilton, and O. Neal Miller (Tulane U., School of Med., Dept. of Med., Nutr.-Metab. Unit, and Dept. of Biochem., New Orleans, La.)

Journal of Nutrition, vol. 93, Nov. 1967, p. 324–330. 13 refs.
Grants NIGMS TIGM-0648 and NHI HE-04150.

Although it is well-known that the physiology, morphology and biochemistry of the germfree animal differs in many respects from its conventionally reared counterpart, these studies were initiated to investigate the effect of the absence of the intestinal microflora on the absorption and metabolism of triglycerides derived from dietary corn oil. Germfree and conventional male rats were trained to consume a semipurified diet within a 1.5-hr. period daily. Fasting plasma triglycerides were elevated significantly in the germfree animals. Analysis of the fatty acid composition of the fasting plasma triglycerides showed a higher percentage of linoleic acid in the germfree group. Postprandial plasma triglyceride analysis indicated a faster rate of clearance of the absorbed triglyceride by the germfree rat but did not indicate any apparent difference in the rate of absorption of the dietary triglyceride. Fasting plasma glucose levels were found to be elevated in the germfree animals. Glucose tolerance tests showed that the germfree rats clear glucose from the plasma more slowly than conventional rats. Immunoassay of plasma insulin obtained during the glucose tolerance testing indicated a delayed and decreased insulin secretion by the germfree rats.

A68-80468
RELATIVE CONTRIBUTION OF RIB CAGE AND ABDOMEN TO VENTILATION DURING EXERCISE.

Gunnar Grimby, Jack Bunn, and Jere Mead (Harvard U., School of Public Health, Dept. of Physiol., Boston, Mass.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 159–166. 7 refs.
Grants PHS 5-R01-GM-12564 and PHS 2-R01-AP-00229-05.

Estimates were made of the relative volume changes of the rib cage and the abdomen during spontaneous breathing in subjects seated on a bicycle ergometer, at rest and during exercise, from measurements of changes in their anteroposterior diameters. These were compared with relative volume changes during voluntary relaxation. At rest, the chest wall deviated relatively little from its passive configuration, and the abdomen accounted for about one-fourth of the tidal volume. During exercise, with a tidal volume of about 30% of the vital capacity, the relative contribution of the abdomen increased to about one-third. Concomitant with the increases in the volume displacement of the abdomen, the volume of the abdominal compartment at end expiration decreased relative to that of the rib cage, and substantial deviations from the passive configuration of the chest wall were observed. Implications of our observations with respect to the work of breathing are discussed.

A68-80469
EFFECT OF PHYSICAL TRAINING ON THE PULMONARY DIFFUSING CAPACITY DURING SUBMAXIMAL WORK.

Philip S. Reuschlein, William G. Reddan, J. Burpee, J. B. L. Gee, and John Rankin (Wis. U., Depts. of Med. and Phys. Educ., Madison).

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 152–158. 22 refs.
Grants NIH HE-07474 and NIH T1 HE 5626.

There is evidence suggesting superior athletes may possess "supernormal" pulmonary diffusing capacities (D_L). In order to define the role of physical training in producing this supernormal D_L, a comparison was made of the effects of five mo. of vigorous physical training on D_L and other cardiopulmonary characteristics, both at rest and during submaximal work in eight freshmen candidates for the University boat crew with similar observations of eight control subjects leading normal campus lives. An analysis of covariance on the difference in responses of the training and control groups indicated training causes: (1) bradycardia at rest and relative bradycardia during exercise, (2) loss of adipose tissue, (3) no effects on D_L or pulmonary capillary blood volume at rest or during exercise, and (4) no changes in total blood volume. These data indicate that short-term training does not modify D_L, and imply that supernormal D_L values in athletes are not the result of training. A comparison of the response of D_L and heart rate to four equal work increments up to 85% of maximal aerobic work indicates: (a) a nonlinear response of heart rate, with a smaller increase per work increment at approximately 70% of maximal aerobic work, and (b) D_L continues to rise linearly with both increasing external work and V_{O_2}, and specifically does not depart from linearity at near maximal aerobic work.

A68-80470
PHYSIOLOGICAL RESPONSES OF MEN DURING SLEEP DEPRIVATION.

Vincent Fiorica, E. A. Higgins, P. F. Iampietro, M. T. Lategola, and A. W. Davis (FAA, Civil Aeromed. Inst., Physiol. Lab., Oklahoma City, Okla.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 167–176. 40 refs.

The effects of 84–86 hr. of sleep deprivation were examined in a group of six young men and compared with a group of six

controls. Subjects were studied in pairs, one sleep deprived and one control. Primary attention was given to the responses to acute whole-body cold exposure in terms of internal body and skin temperature changes, oxygen consumption changes, and plasma catecholamine levels. Psychomotor performance was evaluated at four-hr. intervals over the course of the sleepless period, and the patterns of urinary excretion of catecholamines, magnesium, and creatinine were followed. After the first sleepless night, psychomotor performance of sleep-deprived subjects were significantly lower than that of control subjects. The ability to regulate body temperature during standardized cold exposures, however, was not impaired by the loss of sleep. Urinary excretion patterns for the two groups were similar, except for differences related to activity level. It is suggested that, despite the gross psychomotor changes observed during sleep deprivation, physiological regulating systems are relatively unaffected by sleep loss.

A68-80471
EXCRETION OF CATECHOLAMINES AND CATECHOLAMINE METABOLITES IN PROJECT MERCURY PILOTS.

H. Weil-Malherbe, Elizabeth R. B. Smith, and Grace R. Bowles (Natl. Inst. of Mental Health, St. Elizabeths Hosp., Washington, D. C.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 146–151. 16 refs.
NASA Contract T22025.

The excretion of the three catecholamines, dopamine, norepinephrine, and epinephrine, and of some of their metabolites, viz., metanephrine, normetanephrine, 3-methoxy-4-hydroxymandelic acid (VMA) and, in some cases, 3,4-dihydroxyphenylacetic acid (dopac), was determined in pilots engaged in Project Mercury space missions. The excretion rates of each subject were studied during periods free from imposed stress, during stressful training procedures, and finally during and after space flights. Increased excretion rates of one or more of the substances measured, indicating an activation of the sympathoadrenal system, were observed after training procedures on some occasions, but on others the same procedures were tolerated without a significant sympathoadrenal response. In the same way, space flights induced increased excretion rates in some pilots but not in others. In the cases studied, the substance which was most frequently excreted at a significantly increased rate was epinephrine. VMA also appeared to be a sensitive indicator of stress. Attention is drawn to the fact that the associated occurrence of increased excretion rates in the same urine specimen provides an additional criterion of stress.

A68-80472
ACCLIMATIZATION TO COLD IN MAN INDUCED BY FREQUENT SCUBA DIVING IN COLD WATER.

S. Skreslet and F. Aarefjord (Tromso Museum, Marine Biol. Sta., Tromso, Norway).

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 177–181. 10 refs. Norsk Polarinst. supported research.

Three scuba divers, members of an archaeological/biological under water team working in the Svalbard area, 70°N, were shown to have established a short-time adaptation to cold as a result of extensive diving in the cold sea. At intervals during a period of 45 days they were tested physiologically under standardized conditions in a cold bath. The results obtained from the tests seem to indicate the following pattern of successive acclimatization: (1) unacclimatized stage: cold stress is met with by an elevated metabolic rate compensating heat loss; (2) intermediate stage: there is a fall in the rectal (core) temperature as heat loss is not fully compensated for by metabolism, believed to be caused by habituation of the CNS; and (3) acclimatized stage: a constant rectal temperature is maintained, although minor metabolic heat is produced. Conservation of heat is attributed to lowered heat transfer with the blood of the body surface.

A68-80473
ALVEOLAR GAS EXCHANGES DURING BREATH-HOLD DIVES.

Albert B. Craig, Jr. and Alan D. Harley (Rochester U., School of Med. and Dentistry, Dept. of Physiol., N. Y.)

Journal of Applied Physiology, vol. 24, Feb. 1968, p. 182–189. 22 refs.
Grants NHI HE 09676 and NIH GM 1606; Rochester U., supported research.

Five experienced divers performed unassisted breath-hold dives to depths ranging from 2.5 to 10.0 m. During these 30-sec. dives the alveolar oxygen tension (V_{O_2}) leaving the alveoli varied with the depth of the dive, but the alveolar carbon dioxide tension (V_{CO_2}) entering the alveoli was constant and equaled that of a breath hold at the surface. Changes in $P_{A_{CO^2}}$ and $P_{A_{O_2}}$ were observed during the course of unassisted dives of 5 and 10 m. Similar studies were made during 10-m. dives in which the subjects made the descent holding 14-kg. lead weights and were pulled up. During breath holds on land and during the 5-m. dive, the $P_{A_{CO_2}}$ increased throughout the period of apnea. At the deeper depths the $P_{A_{CO_2}}$ increased during the descent, but there was no further change while the subject was on the bottom. The $P_{A_{CO_2}}$ ranged between 54 and 62 mm. Hg. In one subject making three dives to 15 m. (14 sec.) and three dives to 20 m. (18 sec.) $P_{A_{CO_2}}$'s were 79 and 84 mm. Hg, respectively, when he arrived on the bottom. $P_{A_{O_2}}$ decreased linearly during the bottom time in all the dives studied. These changes in gas composition suggest that CO_2 does not leave the tissues when the diver is at depth.

A68-80474
THE PATHOPHYSIOLOGY OF CHRONIC HYPOXIA IN CHICKENS.

H. J. Olander, R. R. Burton, and H. E. Adler (Calif.U., Depts. of Pathol., Animal Physiol., Epidemiol., and Prevent. Med., Davis).

Avian Diseases, vol. 11, Nov. 1967, p. 609–620. 10 refs.
Grant PHS HE-01920.

Single Comb White Leghorn chickens exposed to high altitude (12,500 ft.) for several mo. were killed, and post-mortem examinations were performed. Histological examinations were made on selected tissues. Myxoid degeneration of the endocardium and a degenerative emphysema of the lungs were the most prominent findings. The persistent mortality found in this colony of birds was attributed to polycythemia and progressive cardiovascular collapse.

A68-80475
NOREPINEPHRINE AND 5-HYDROXYTRYPTAMINE IN THE CNS OF RATS UNDER CONTINUOUS ILLUMINATION AND TOTAL DARKNESS.

E. Rüther, A. Halaris, and N. Matussek (Max-Planck-Inst. fur Psychiat., Dept. of Biochem., Munich, West Germany).

Medicina et Pharmacologia Experimentalis, vol. 17, no. 2, 1967, p. 139–143. 12 refs.

Rats were subjected to total darkness (DD) and continuous illumination (LL) for a period of 30 days. Thereafter the norepinephrine (NE) and 5-hydroxytryptamine (5HT) concentration in the brain without the pineal body was determined. Both amine concentrations were above those of animals living under a light–dark cycle. The motorically less active animals under LL showed a higher increase of the 5HT concentration, while the more active animals under DD showed a higher increase of the NE concentration compared to the control groups. The quotient NE/5HT seemed to be correlated with the level of motor activity of rats.

A68-80476
ROLE OF THE VENOUS SYSTEM IN BARORECEPTOR-MEDIATED REFLEXES IN MAN.
Stephen E. Epstein, G. David Beiser, Morris Stampfer, and Eugene Braunwald (Natl. Heart Inst., Cardiol. Branch, Bethesda, Md.)
Journal of Clinical Investigation, vol. 47, Jan. 1968, p. 139–152. 34 refs.

Although baroreceptor stimulation produced by marked alterations in arterial pressure has been shown to produce reflex changes in venous tone in animals, the effects on venous tone in man of altering arterial pressure within the physiologic range have not been clear. In six subjects, venous tone did not change when mean arterial pressure was raised by 25 to 40 mm. Hg, although heart rate fell reflexly by 40%. Venous tone remained constant in ten subjects when arterial pressure was lowered. This contrasted to the sustained rise in forearm vascular resistance and the persistent tachycardia that occurred. However, 12 subjects continued to respond to these interventions by transient venoconstriction. To eliminate possible emotional influences on venous tone due to the experimental intervention, venous responses were studied before and during general anesthesia in five of these subjects. In contrast to the response before anesthesia, an equivalent fall in arterial pressure during anesthesia no longer evoked a venoconstrictor response. Venous reactivity and the baroreceptor reflex arc remained intact during anesthesia, since venous tone always rose after a deep inspiration, and tachycardia always accompanied the fall in arterial pressure. It is concluded that changes in arterial pressure in the physiologic range in man do not induce measureable reflex alterations in venous tone, and that the increases sometimes seen with decreases in arterial pressure appear to be due to extraneous psychic factors.

A68-80477
THE INFLUENCE OF THE PARATHYROID GLANDS ON THE HYPERCALCEMIA OF EXPERIMENTAL MAGNESIUM DEPLETION IN THE RAT.
H. J. Gitelman, S. Kukolj, and L. G. Welt (N. C. U., School of Med., Dept. of Med., Chapel Hill).
Journal of Clinical Investigation, vol. 47, Jan. 1968, p. 118–126. 28 refs.
Grants PHS T1-AM-5054, PHS 5-R01-HE-0131, PHS AM-08685, and PHS 5-K6-AM-934.

Magnesium-deficient rats develop significant hypercalcemia, hypophosphatemia and hyperphosphaturia. These changes suggest a state of hyperparathyroidism. This study examined the regulation of parathyroid gland activity in magnesium-deficient rats. Magnesium deficiency was induced in intact and chronically parathyroidectomized animals by feeding them a diet free of this cation. Control animals were pair fed and treated identically except for the inclusion of magnesium in their gavage solution. Magnesium-deficient rats with intact parathyroid glands developed significant hypercalcemia and hypophosphatemia. In addition, the concentration of ionic calcium in plasma was significantly elevated. In contrast, magnesium-deficient parathyroidectomized animals did not have a higher level of calcium in plasma than their nondeficient controls; they developed a decreased concentration of ionic calcium in the absence of a difference in the concentration of phosphate in plasma when compared with appropriate controls. The increased urinary excretion of phosphate was independent of the parathyroid status of the animals. It was concluded that the hypercalcemia and hypophosphatemia of magnesium deficiency demands parathyroid gland activity and that the regulation of this activity is modified in the magnesium-deficient state to permit the maintenance of an elevated concentration of ionic calcium in plasma. Additional explanations must be found for the hyperphosphaturia.

A68-80478
GENERALIZATION AND FREE RECALL OF SIMILAR AND OPPOSITE WORDS.
James H. Koplin, Danny R. Moates, and Judith Burroughs (Vanderbilt U., Nashville, Tenn.)
(Midwestern Psychol. Assn., Conv., Chicago, May 1966).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 166–170. 7 refs.
Grant OER OE-5-10-015.

Twenty-four pairs of words which varied in association strength (high vs. low) and in semantic relationship (similar vs. opposite) were studied in two experiments employing different dependent measures. In Experiment I (N=60) the amount of generalization of a motor response was obtained for each pair. Opposite pairs produced significant generalization at both levels of association strength, while similar pairs did not. Experiment II (N=80) used the same stimulus materials in a free-recall task. An index of clustering in recall was computed for each type of pair. At the high level of association strength, opposite pairs showed more clustering than similar pairs, while the reverse was true with low association strength pairs. The effects of an implicit meaning response were demonstrated in both tasks, but these effects were not consistent across tasks. One explanation involves the complex nature of the relationship between the members of a pair of words.

A68-80479
EFFECTS OF INCONSISTENT REINFORCEMENT ON REVERSAL AND NONREVERSAL SHIFTS.
N. J. Mackintosh and V. Holgate (Oxford U., Great Britain).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 154–159. 9 refs.
Contract ONR N62558-4286 and MRC supported research.

Three experiments were performed to investigate why inconsistent reinforcement during discrimination learning hinders reversal. In each of two experiments, rats trained on a 75:25 brightness discrimination reached a choice criterion of extinction marginally more rapidly than those trained on a 100:0 problem, but subsequently reversed more slowly because they formed stronger position habits. This implies that inconsistently reinforced subjects reverse slowly not because they extinguish slowly, but because they fail to learn adequately to attend to the cue relevant both during original training and reversal. Experiment III supported this idea by showing that inconsistent reinforcement results in more rapid learning of a nonreversal shift problem in which the originally relevant cue becomes irrelevant.

A68-80480
ANAGRAM SOLVING AS A FUNCTION OF LETTER-SEQUENCE INFORMATION.
Roger L. Dominowski (Ill. U., Chicago Circle).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 78–83. 15 refs.
Sigma Xi, Soc. supported research.

The solution of five-letter anagrams was studied under conditions of providing, in addition to the anagram, information about the solution. Four types of information were used: the position of a single letter; a bigram (but not its position); the position of a bigram; a trigram (but not its position). A control condition involved the presentation of the anagram alone. Analysis of number of solutions for 36 problems indicated three levels of performance, from lowest to highest: control and single letter; bigram; bigram position and trigram. In the bigram and bigram-position conditions, strong serial-position effects were obtained. Presenting either the first or last bigram produced significantly better performance than presentation of either of the middle bigrams. The results were related to a process of recalling words as possible solutions.

A68-80481
MINERAL INTAKE AND BONE LOSS.
D. M. Hegsted (Harvard School of Public Health, Dept. of Nutr., Boston, Mass.)
(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 17, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1747–1754. 44 refs.
NASA Grant NsG-679, Grant NIAMD 5-K6-AM-28,455; Nutr. Found., Inc. and Harvard School of Public Health supported research.

Observations concerning the relationship between nutrition and bone loss from a review of both animal and human studies were presented. Most studies were directed toward calcium intake and calcium balance in relation to bone disease. Evidence was also presented which indicated that fluoride consumption is an important factor affecting the development of osteoporosis.

A68-80482
PERSPECTIVE DETERMINANTS OF THE ROTATING TRAPEZOID ILLUSION.
Robert B. Freeman, Jr. and Robert Pasnak (Pa. State U., University Park).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 94–101. 12 refs.
Grants NIH MH 08856, NIH MH 10,691, and NIMH MH-32,272.

The plane of apparent reversal (PAR) of the rotating trapezoid illusion was obtained for male subjects, who monocularly observed white, unpatterned rotating trapezoids of various shapes and at several distances. The PAR was affected by both the amount of linear perspective and the horizontal visual angle subtense of the rotating trapezoid. Which of these cues to PAR was dominant depended upon the nature of the required judgmental task.

A68-80483
RETROACTIVE INHIBITION WITH DIFFERENT PATTERNS OF INTERPOLATED LISTS.
Judith Goggin (Mich. U., Ann Arbor).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 102–108. 7 refs.
Contract AF 49(638)-1235.

Retroactive inhibition (RI) has previously been found to depend on the number of new responses associated with the original stimuli when number of interpolated learning (IL) trials is constant. In the present study, the number of interpolated responses was held constant and variations in IL dominance were achieved by alternating IL lists at different frequencies. RI decreased as number of IL alternations increased. These data indicate that there are situations in which RI does not increase when number of opportunities for the unreinforced elicitation of List-1 responses increases and that, independent of its effect on the dominance of interpolated associations, number of IL lists may influence RI.

A68-80484
INFLUENCE OF POSTURAL DISTORTION ON THE PERCEPTION OF VISUAL VERTICAL IN PIGEONS.
Joseph Lyons and David R. Thomas (Kent State U., Ohio).
(Midwestern Psychol. Assn., Meetings, Chicago, May 1966).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 120–124. 10 refs.
Grants NIH-HD-00903-05 and NSF-GE-5159.

Five groups of ten pigeons each were given ten days of variable interval training to peck a key illuminated by a white vertical line on a black surround. In four of the groups, the Skinner box was otherwise dark in both training and in subsequent generalization testing; for the fifth group, the "house lights" were on during both of these conditions. Immediately following the tenth VI training session, a generalization test was performed in extinction, involving lines of five different angular orientations, 30°, 60°, 90° (CS), 120° and 150°. For the dark-tested groups, the floor was tilted 0°, 12°, 24° or 36° counterclockwise during test. The "lights-on" group was also tested with a counterclockwise floor tilt of 24°. The results for the dark-tested groups indicated that, with progressively increasing counterclockwise floor tilts, pigeons showed an increasing tendency to respond to a line tilted 30° counterclockwise from vertical, with a shift in modal responding to this value occurring with floor tilts of 24° and 36°. The "lights-on" group demonstrated that, when pigeons are given veridical visual information, no such shift in responding takes place.

A68-80485
TEMPORAL COURSE OF PERCEPTION IN AN IMMEDIATE RECALL TASK.
Doris Aaronson (Harvard U., Center for Cognitive Studies, Cambridge, Mass.)
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 129–140. 29 refs.
Grants PHS MH-14,589 and NSF GB-1172.

Analyses of errors from a sequential auditory recall experiment indicated that perceptual factors influence the shape of the serial position curve of recall errors. The signal to noise (S/N) ratio and presentation rate of the stimuli, as well as presentation rate during a prior training session, affected item and order errors. For an experiment in which subjects simply monitored the auditory sequences for a preassigned critical item, and an experiment in which subjects recalled the items in addition to monitoring, analyses of monitoring response times provided evidence that the requirement to recall induces perceptual difficulties.

A68-80486
LETTER-SEQUENCE AND UNIT-SEQUENCE EFFECTS DURING LEARNING AND RETENTION.
Thomas W. Turnage and Thomas A. McCullough (Md. U., College Park).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 141–146. 12 refs.
NASA Grant NsG-398 and Md. U. supported research.

A serial task involving backward recall was used to investigate letter-sequence and unit-sequence interference during learning and over a seven-day retention interval. The experimental results showed (a) that the frequency of items in the language and serial ordering were related by a significant quadratic trend ($p < .01$) and (b) that meaningfulness did not favor retention. These facts were found to be in agreement with a number of previous experimental findings as well as the basic theoretical predictions of Underwood and Postman.

A68-80487
AN EXPERIMENTAL ANALYSIS OF SINGLE STIMULUS TESTS AND MULTIPLE-CHOICE TESTS OF RECOGNITION MEMORY.
Walter Kintsch (Calif. U., Riverside).
(Psychonomic Soc., Meeting, St. Louis, 1966).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 1–6. 16 refs.
Grant NIH MH 11455.

Subjects were shown five four-letter combinations and tested for recognition on one of them after a 20-sec. delay. Either single-item tests or two, four, or eight alternative forced-choice tests were given. The single-item tests revealed strong response biases.

Performance on the multiple-choice tests decreased as a function of the number of response alternatives. From subject's confidence ratings on the single-item tests memory operating characteristics were constructed and the theory of signal detection was used to predict performance on multiple-choice tests. Two other theories which make predictions for the multiple-choice tests were also examined.

A68-80488
SPEED-ACCURACY TRADEOFF IN REACTION TIME: EFFECT OF DISCRETE CRITERION TIMES.
Robert G. Pachella and Richard W. Pew (Mich. U., Ann Arbor).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 19–24. 7 refs.
Contract AF 49(638)-1235.

In a choice reaction time (CRT) experiment that simultaneously varied the relative payoffs for fast and accurate responding and the criterion time defining fast vs. slow responses, it was shown that both the relative payoffs and the choice of criterion time have effects on CRT and errors. Of the two, the criterion-time effect appears to be more stable with practice. A modification of the statistical decision theory model of CRT is suggested to fit these data and a methodological problem concerning the use of such discrete-criterion payoff schemes is discussed.

A68-80489
IMAGERY AND ASSOCIATION VALUE IN PAIRED-ASSOCIATE LEARNING.
Allan Paivio and Stephen A. Madigan (Western Ontario U., London, Canada).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 35–39. 23 refs.
Grant NRC, Canada APA-97 and Western Ontario U. Res. Fund supported research.

In a paired-associate learning experiment, nouns either high or low in their rated capacity to evoke sensory imagery (I) but equated for m were paired with either high or low association value (AV) trigrams, and the S–R order of paris was varied. From a mediational theory originally proposed for PA learning of noun–noun pairs, it was predicted that a differential positive effect of noun I on the stimulus side of pairs would be greater with high AV than with low AV associates. Analyses of complex interactions revealed the expected effect for the first and second of four PA trials. Other significant interactions and strong main effects of I and AV were obtained as well.

A68-80490
RELATIONSHIP BETWEEN STATIC AND DYNAMIC STEREO ACUITY.
S. M. Luria and Seymour Weissman (Naval Submarine Med. Center, Naval Submarine Base, New London, Groton, Conn.)
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 51–56. 9 refs.

Equidistance settings were obtained from 50 subjects with a Howard–Dolman type apparatus which was either stationary or rotating about the subject at angular speeds of 60 to 180 deg./sec. The correlation between the settings decreased as the disparity of the speeds being compared increased, and there was a sharp drop in correlation between the stationary condition and any speed. At any speed of rotation, there was an increase in the variability of the settings as viewing time decreased and a sharp increase below 0.3 sec. A positive localization error was made by 24 subjects and a negative error was made by 26 subjects. There appears to be a relationship between positive errors and exophoria and between negative errors and esophoria.

A68-80491
DIETARY AND HORMONAL FACTORS IN BONE LOSS.
Richmond W. Smith, Jr. (Henry Ford Hosp., Dept. of Med., Detroit, Mich.)
(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 17, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1737–1746. 19 refs.
Contract PHS SAph 77270.

Data were obtained from women who were distributed by age groups and gradation of visually assessed relative vertebral density and patients with symptomatic osteoporosis in order to assess skeletal loss in terms of calcium consumption and endocrine characteristics. Histories of reproduction and gonadal function were evaluated in respect to menarche, menopause, pregnancies, offspring, lactation, pelvic surgery or irradiation and hormonal therapy. Neither age at menarche nor age at menopause were found related to residual bone mass in later life. Although some of these findings failed to support the hormonal concept of osteoporosis, subtle departures in pituitary and gonadal function and in adrenal steroidogenesis suggested that deficiency of the anabolic hormones, particularly androgen and possibly growth hormone, may be operative. The classic endocrine concept of osteoporosis cannot be discarded on the basis of recent evidence whereas certain clinical observations are supportive.

A68-80492
BONE LOSS AS A GENERAL PHENOMENON IN MAN.
Stanley M. Garn, Christabel G. Rohmann, and Betty Wagner (Fels Res. Inst., Yellow Springs, Ohio).
(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 17, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1729–1736. 30 refs.
Contract APA PH-43-65-1006; Grants PHS AM-08255 and FCF FR-00222.

A general discussion is given of the phenomenon bone loss in humans. The factors of geographic distribution, sex and nutrition are discussed. No significant geographic variation is found, but bone loss in females progresses twice as fast as in males. Individual variation is noted and correlated with various physical factors (statue, menopause, etc). Calcium intake within broad limits, does not appear to relate to bone loss either on an individual or population basis. High intakes of calcium do not offer protection against loss. The theory of calcium balance is questioned in light of these findings. It is concluded that the best natural protection against the sequalae of calcium loss is to begin an original large skeleton.

A68-80493
SIGNIFICANCE OF HORMONAL CORRELATION BETWEEN PITUITARY GLAND AND ADRENAL CORTEX FOR ADAPTATION TO PHYSICAL EFFORT IN SPORT [ZNACZENIE KORELACJI HORMONALNEJ POMIEDZY PRZYSADKA I KORA NADNERCZY DLA ADAPTACJI DO WYSILKU FIZYCZNEGO W SPORCIE].
J. Ottowicz.
Wychowanie Fizyczne i Sport, vol. 11, no. 3, 1967, p. 3–17. 65 refs.
In Polish.

The aim of this paper was to emphasize the role of the hypothalamo-pituitary-adrenal system in adaptation to physical effort. The adrenocorticotrophic function of the pituitary, the mechanism of action of ACTH and the endocrine function of adrenal cortex were described. The hormonal correlation between these endocrine glands was considered as the reflectory neuro-hormonal function.

This concerned especially the stimulatory effects of an intensive physical effort upon the adrenocorticotrophic function of the pituitary. The inhibitory effect of glycocorticoids on ACTH secretion was presented as a closed-loop feedback system in which the hypothalamus seemed to be a modifier of information. Using some cybernetic models the possibility of mathematical analysis for evaluation of hormonal correlation was indicated. The function of the pituitary-adrenal system is very important for the regulation of energy sources and keeping the nervous cells in high performance capacity. Therefore, the adequate behavior of this system is necessary to reach the highest degree of adaptation to physical effort connected with sports.

A68-80494

MEASUREMENT AND CALCULATION OF THE RECOVERY PROCESS BY THE NEURAL MEMBRANE AFTER X-RAY IRRADIATION [MESSUNG UND BERECHNUNG DER ERHOLVORGANGE AND DER NERVENMEMBRAN NACH RONTGENBESTRAHLUNG].

Kurt Vanselow (U. Kiel, Inst. für Angew., West Germany).

Atompraxis, vol. 13, Apr.–May 1967, p. 195–199. 7 refs. In German.

In order to investigate the effect of X-ray irradiation on the electrical properties of the peripheral nerve fibers, the behavior of the summation action potential of the nerve fiber bundles in the sciatic nerve of frogs was followed. During irradiation with X-rays, the level of the stimulation threshold decreased. The summation action potential increased. Equations were given describing the exponential decline after irradiation, as well as for the threshold potential for various time periods.

A68-80495

INVESTIGATIONS ON THE EFFECT OF LOWERED OXYGEN PRESSURE IN THE INSPIRED AIR ON THE EFFECTIVENESS OF GASEOUS EXCHANGE DURING WORK [BADANIA NAD WPLYWEM OBNIZONEJ ZAWARTOSCI TLENU W POWIETRZU WDECHOWYM NA EFEKTYWNOSC WYMIANY GAZOWEJ PODCZAS PRACY].

I. Malarecki and I. Wojcieszak.

Wychowanie Fizyczne i Sport, vol. 11, no. 3, 1967, p. 19–24. 19 refs. In Polish.

The effect of breathing air at a lowered oxygen pressure on the effectiveness of gaseous exchange during work was investigated. It was found that oxygen consumption in all experiments was reduced in proportion to the reduction of oxygen in the inspired air. With the oxygen pressure constant at 15%, oxygen consumption was reduced in proportion to the increased intensity of effort. These changes were accompanied by a deterioration in the utilization of oxygen from the inspired air, a reduction of pCO_2 and pO_2 in the alveolar air, a decrease in the oxygen rate and an increase in the lactic acid and dehydrogenase of lactic acid. Under these conditions the ventilation of the lungs (BTPS) was usually increased. Only under conditions of maximum effort while breathing 15% O_2 was a marked decrease registered. It was calculated that in spite of the increase in BTPS in the other cases, the ventilation measured in terms of the quantity of oxygen supplied to the lungs was reduced. This fact was considered to be one of the causes of the limited oxygen consumption, particularly during maximum efforts.

A68-80496

CHANGES IN THE CONCENTRATION OF COMPLETE FATS, ESTRIFIED FATTY ACIDS, CHOLESTEROL AND GLYCOSE IN BLOOD AS THE RESULT OF STAMINA AND SPEED EFFORTS [ZMIANY STEZENIA THUSZCZOW CALKOWITYCH, ZESTRYFIKOWANYCH KWASOW THUSZCZOWYCH, CHOLESTEROLU I GLUKOZY WE KRWI POD WPLYWEM WYSILKOW WYTRZYMALOSCIOWYCH I SZYBKOSCIOWYCH].

E. Preisler, D. Kruk, and U. Pankowska-Miciak.

Wychowanie Fizyczne i Sport, vol. 11, no. 3, 1967, p. 25–37. 19 refs. In Polish.

Changes in the concentration of complete fats, estrified fatty acids and cholesterol in the venous blood serum were investigated under the influence of stamina efforts, speed efforts and speed-stamina efforts. The concentrations of glucose, pyruvic acid, lactic acid and alkaline reserve in the venous blood were also determined. The investigations were performed on 159 persons aged between 17 and 45 yr. The results showed a reduction in the concentration of complete fats following stamina efforts of a high intensity and after professional work performed at night (driving a truck). Changes in the concentration of estrified fatty acids were similar. Reductions in the concentration of complete cholesterol in blood serum were also distinct after high intensity stamina efforts. Changes in the concentration of glucose were not uniform. The lactic acid content increased after all efforts investigated, particularly following loads of a speed type. The alkaline reserve showed insignificant reductions.

A68-80497

EFFECT OF STAMINA EFFORTS ON THE CONTENT OF SOME ALBUMEN FRACTIONS AND ALPHA-AMINO NITROGEN IN BLOOD SERUM [WPLYW WYSILKOW WYTRZYMALOSCIOWYCH NA ZAWARTOSC NIEKTORYCH FRAKCJI BIALKOWYCH I AZOTU ALFA-AMINOWEGO W SUROWICY KRWI].

R. Kabza and J. Rachlewicz.

Wychowanie Fizyczne i Sport, vol. 11, no. 3, 1967, p. 39–47 7 refs. In Polish.

In 90 persons the venous blood serum content of complete albumen and its electrophoretic fractions was determined, and in 72 persons the level of alpha-amino nitrogen before and after the execution of three kinds of stamina efforts (80-min. exercises, a 1,500 m. swim, professional work of a driver behind the wheel of a bus) was determined. Following high intensity efforts (the 1,500 m. swim), an insignificant increase in complete albumen and beta and gamma-globulin and a drop in the albumine level in blood serum was found. The content of alpha-amino content in blood serum decreased after medium intensity efforts and increased after the highest intensity efforts.

A68-80498

DIET AND ATHLETIC PERFORMANCE.

Per-Olof Åstrand (Gymnastik-och Idrottshögskolan, Stockholm, Sweden).

(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 19, 1967).

Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1772–1777 12 refs.

Nitrogen excretion does not differ significantly on days of inactivity from days including vigorous activity. The heavier the exercise in relation to the work capacity of the muscle groups involved, the higher is the relative energy yield from carbohydrate, the metabolic RQ approaching or reaching 1.00 during maximal exercise. The diet can markedly influence the interrelation between fat and carbohydrate metabolism. After days of an extreme fat diet, an energy yield from fat will dominate combustion even during exercise. The maximal work capacity is, however, reduced. A high-carbohydrate diet shifts the metabolism toward relatively high energy release from carbohydrate, and improves the capacity for prolonged heavy exercise. The diet on the days before a competition

in endurance events may be of the utmost importance for success. The proper preparation for the competition or performance, with a work time exceeding 30–60 min., would be to exercise the same muscles to exhaustion about one week in advance. Then the diet should be almost exclusively fat and protein for some three days which procedure keeps the glycogen content of the exercising muscles low. Thereafter a carbohydrate-rich diet should be taken for the remaining days before the performance. The longer the work time, the more important is this preparation (e.g., marathon running, cross-country skiing, bicycling, hiking, mountaineering, or military operations).

A68-80499
NUTRITION, ENVIRONMENT AND WORK PERFORMANCE WITH SPECIAL REFERENCE TO ALTITUDE.

E. R. Buskirk and J. Mendez (Pa. State U., Inst. for Sci. and Eng., Lab. for Human Performance Res., University Park).

(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 19, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1760–1767. 41 refs.
Contract DA 49-193-MD-2709.

A brief graphic review was prepared of both old and more recent efforts to relate food and water requirements to variables associated with climate and physical work. Attention was paid only to the young man of average body build and stature who works in various environments. Special attention was given to recent work at altitude. In the absence of abnormal climate situations and gross disturbances in thermal balance, the most important factor for determining caloric requirement is physical activity, and for water requirements the important factors are environmental conditons including vapor pressure plus physical activity.

A68-80500
LIPID METABOLISM AND MUSCULAR WORK.

Lars A. Carlson (Karolinska Sjukhuset, Dept. of Internal Med. and King Gustaf Vth Res. Inst., Stockholm, Sweden).

(Federation of Am. Soc. for Exptl. Biol., 51st Ann. Meeting, Chicago, Apr. 19, 1967).
Federation Proceedings, vol. 26, Nov.–Dec. 1967, p. 1755–1759. 48 refs.
Grant MRC, Sweden 19X-204-03.

Lipids are oxidized by muscle tissue during exercise. Two major routes of supply of fatty acids for this oxidation were discussed—transport via blood plasma and local pools. The effect of exercise on the three main components of the plasma lipid transport system—chylomicrons, lipoproteins, and free fatty acids—was reviewed; exercise affects all three. Data were presented indicating that exercise reduces the content of esterified fatty acids, mainly triglycerides, of muscle tissue. Physical training lowers the content of triglycerides in plasma and liver.

A68-80501
ABILITY OF ^{47}CA KINETIC ANALYSIS TO DISCRIMINATE METABOLIC STATES AFFECTING BONE FORMATION IN DOGS.

B. Lawrence Riggs, Jenifer Jowsey, Eugene Ackerman, and Jane B. Hazelrig (Mayo Clinic and Mayo Foundation, Rochester, Minn.)
Metabolism, vol. 16, Nov. 1967, p. 1064–1073. 26 refs.
Grant NIH AM-8658.

This study was designed to investigate rates of bone remodeling by simultaneous determinations of two parameters that are somewhat independent reflections of the remodeling process. One of the parameters, the F ratio, is defined as the ratio of the length of internal surface at which bone formation is active (assessed by microradiography and confirmed by tetracycline labeling) to the total length of internal surface in bone sections from biopsy sites. The second is an empiric parameter, A, and calculations are based on measurements of radioactivity in plasma at various times after intravenous injection of ^{47}Ca and on the amount of radiocalcium excreted during the same period. Three groups of dogs differing in their hormonal balance and, hence, in their overall rates of bone remodeling were studied. The results showed that among the three groups there was comparatively little overlap in the ranges of A values, of local F ratios measured in the rib (F rib), or of local F ratios measured in the femur (F femur). It was also noted that, within any one of the groups, A values, F rib ratios, and F femur ratios were not correlated. It was further shown that knowledge of both A and F values can provide better discrimination among these three groups than could be achieved with either parameter alone.

A68-80502
CURE AND PREVENTION OF NEUROSES AFFLICTING FLYING PERSONNEL [LECHENIE I PREDUPREZHDENIE NEVROZOV U LETNOGO SOSTAVA].

A. I. Severskii.

Moscow, Dosaaf, 1965, [132] p. In Russian.

A number of suggestions is given concerning fatigue and over-fatigue of the human organism. The prophylactic measures and treatment of different nervous afflictions of flying personnel such as neurasthenia, psychosthenia, hysteria, reactive or "emotional" syndrome, neurotic reactions and somatogenic neuroses are also given. The nature of these illnesses is discussed and interpreted according to the physiological teaching of I. P. Pavlov along with the medicine used in each case. Each particular brand of medicine is briefly described, and its effects and side-effects are discussed. Proper nourishment, rest and exercise are recommended to strengthen the resistance against such diseases. Fatigue is classified as physical, mental and emotional. These types of fatigue practically never occur separately, but their causes are different: (1) physical fatigue is associated with static muscular work, mostly due to non-relaxing during flight. Often it afflicts inexperienced pilots. An additional cause is long flying hours; (2) mental fatigue is caused by prolonged mental stress such as many hours of decoding, calculations and tension created by constant watching of control instruments; (3) emotional fatigue is the result of human reaction toward the environment, its meaning intensified by the vegetative and endocrine-humoral shifts during emotional experiences. Soviet scientists proved that fatigue occurs less in the nervous tissue and muscles than the nervous cells in the cerebral cortex. Fatigue itself is related to variations in the activity of cells of the cerebral cortex in the process of work. Tired cells cannot produce sufficiently strong stimulation of muscles, so the muscular work becomes weaker.

A68-80503
PREPARING AN EXPEDITION TO THE MOON [PODGOTOVKA EKSPEDITSII NA PUNU].

B. G. Pshenichner and V. I. Reznikova.

Moscow, Znanie, 1966, 70 p. In Russian.

This is a popular booklet the purpose of which is to arouse the interest of students toward physics, mathematics and astronomy. It presents a general discussion on the physical nature of the moon, the main purpose for landing on it, the ways in which science will be benefited if such landings are realized, what has already been achieved in this direction, the living conditions on the moon and the way in which astronauts must be dressed, fed and otherwise protected while staying on the moon.

A68-80504
RADIOTELEMETRY [RADIOTELEMETRIIA].
I. M. Tepliakov.
Moscow, Sovetskoe Radio, 1966. [311] p. In Russian.

The elements of radiotelemetry and the fundamentals of its design are discussed with particular stress on the code-impulse modulation, characteristics of cosmic systems and a detailed comparison of different radiotelemetric systems operating in the presence of fluctuation noises. The threshold signals and the transmission capacity of these systems are determined.

A68-80505
OCULAR SCATTERED LIGHT AND VISUAL PERFORMANCE AS A FUNCTION OF AGE.
Merrill J. Allen (Ind. U., Div. of Optometry, Bloomington) and Johannes J. Vos (Inst. for Perception RVO–TNO, Soesterberg, The Netherlands).
(Am. Acad. of Optometry, Meeting, Chicago, Dec. 9, 1961).
American Journal of Optometry and Archives of American Academy of Optometry, vol. 44, Nov. 1967, p. 717–727.

Visual performance of 62 healthy subjects, age 6–87 yr., on Landolt C variable contrast visual acuity targets was related to an index of ocular scatter obtained by slit lamp photometry. All subjects wore an optimum lens correction determined by retinoscopy. Visual performance decreased with age, and the ocular scatter index increased, but the relationship appears to be coincidental. It is concluded that the deterioration of visual performance with age cannot be predicted by measuring the back scatter in the cornea and lens.

A68-80506
CALCITONIN AND THYROCALCITONIN.
David Webster and Samuel C. Frazer (Aberdeen U., Dept. of Chem. Pathol., Great Britain).
Advances in Clinical Chemistry, vol. 10, 1967, p. 1–44. 100 refs.
Med. Res. Council supported research.

A review is presented on the action and nature of the hormones calcitonin and thyrocalcitonin. This includes discussions on the sites of production, the physical and chemical nature of thyrocalcitonin, the effect of thyrocalcitonin on bone and calcium metabolism, and detection and purification of the hormones. A survey is made of the clinical significance of thyrocalcitonin and its possible therapeutic use. A comprehensive bibliography is included.

A68-80507
BACTERIOLOGICAL COMPARISON OF HEXACHLOROPHENE AND POLYVINYLPYRROLIDONE-IODINE SURGICAL SCRUB SOAPS.
Virgil H. Crowder, Jr., John S. Welsh, George H. Bornside, and Isidore Cohn, Jr. (La. State U., School of Med., Dept. of Surg., New Orleans).
American Surgeon, vol. 33, Nov. 1967, p. 906–911. 16 refs.

Hexachlorophene and polyvinylpyrrolidone-iodine (PVP-iodine) surgical scrub soaps were compared for use in hand scrubs by surgeons and for use as the sole agent in preparing the patient's operative sites. The surgeon and his patient were monitored during 63 elective procedures. Sterile cotton swabs were used to transfer bacteria from the skin. Although both scrub soaps cleansed effectively, PVP-iodine surgical scrub soap was superior because fewer specimens yielded bacteria and the ranges of bacteria counts were lower after using it.

A68-80508
ERYTHROPOIESIS-STIMULATING ACTIVITY IN PLASMAS OF YOUNG MEN LIVING PERMANENTLY AT HIGH ALTITUDES.
A. O. Carmena, Nydia Garcia de Testa, A. Segade, and E. Luisa Frias (Inst. Munic. de Hematol., Buenos Aires, Argentina).
Acta Physiologica Latino Americana, vol. 17, no. 2, 1967, p. 145–148. 11 refs.
Consejo Nacl. de Invest. Cient. y Tec. and Inst. de Med. Aeron. y Espacial supported research.

Seven normal young men, living permanently at high altitudes, were brought down to sea level. After ten days in the new environment, three were injected with their own plasma, collected by plasmapheresis when they were at high altitudes, two with sea level plasma, and one with saline. One remained without treatment. Those injected with their own plasma increased plasma iron turnovers (PIT). No variation of PIT was seen either in those injected with sea level plasma or saline. The data would confirm the existence of an erythropoietic stimulating factor in plasmas of permanent dwellers of high altitudes.

A68-80509
EXPERIMENTAL HEMORRHAGIC SHOCK IN ANIMALS ADAPTED TO HIGH ALTITUDES.
V. Zapata-Ortiz, R. Castro de la Mata, E. Fernández, L. Batalla, and A. Geu (U. Peruana "Cayetano Heredia", Fac. de Med., Dept. of Physiol. Sci., Lima, Peru).
Acta Physiologica Latino Americana, vol. 17, no. 2, 1967, p. 194–199. 18 refs.
Grant NHI HE 08732-03.

Dogs and sheep native to high altitudes are more resistant to experimental hemorrhagic shock. This has been demonstrated by a decrease in the mortality rate amounting to about half in the dogs, and one sixth in the sheep, when compared to the mortality of the sea level animals.

A68-80510
A MODEL OF THE PERIPHERAL AUDITORY SYSTEM RESPONDING TO LOW-FREQUENCY TONES.
C. Daniel Geisler (Wis. U., Elec. Eng. Dept. and Lab. of Neurophysiol., Madison).
Biophysical Journal, vol. 8, Jan. 1968, p. 1–15. 16 refs.
Grants NIH NB-06225 and NIH FR00249; NSF and AEC supported research.

A model of the peripheral auditory system responding to low-frequency tone stimulation is given. The model is of the type previously introduced by another investigator. It includes three interconnected parts: a linear model of the ear's mechanical system, a model of the cochlear transducer, and a stochastic model of an auditory nerve fiber. The output of the model accurately mimics many characteristics of the output of some auditory nerve neurons responding to sinusoidal stimuli but is unable to successfully match all reported aspects of data obtained from other of these neurons. Characteristics of the model neurons are discussed.

A68-80511
THE EFFECTS OF CERTAIN CENTRAL NERVOUS SYSTEM STIMULANTS UPON THE SPONTANEOUS ACTIVITY OF MICE EXPOSED TO HIGH ALTITUDE AND LOW PARTIAL PRESSURE OF OXYGEN.
J. Huff, C. Olmstead, and J. E. Stone (Ark. U., Med. Center, Dept. of Pharmacol., Little Rock).
Journal of the Arkansas Medical Society, vol. 64, Nov. 1967, p. 208–210.

A method of recording the activity of groups of animals under low atmospheric pressure and low PO_2 is presented. It was found that mice were able to partially maintain their normal activity under these conditions when pretreated with Cocaine or Atropine. The administration of amphetamine produced much uncoordinated activity while procaine was without significant effect.

A68-80512
THE PERCEPTION OF CURVATURE.
John Ogilvie and Eva Daicar (Toronto U., Canada).
Canadian Journal of Psychology, vol. 21, Dec. 1967, p. 521–525. 6 refs.
Grant DRB, Canada 9420-50.

Thresholds of curvature were determined for two chord lengths at three orientations—vertical, horizontal, and oblique. The radius of curvature at threshold was smaller for the shorter lines. Performance was about the same for horizontal and vertical lines but not as good for oblique lines. The sagitta or "off-straightness" of the threshold curves varied between two and four sec. of arc at the eye. The problem of the appropriate measure of acuity is discussed.

A68-80513
THE USEFULNESS OF PERIODICAL MASS EXAMINATIONS OF WORKERS EXPOSED TO THE EFFECT OF "LOCAL" VIBRATION.
Jerzy Gwoździewicz, Czeslaw Bartnicki, and Jerzy Waśkiewicz (Inst. of Marine Med., Gdańsk, Poland).
Biuletyn Instytutu Medycyny Morskiej w Gdańsku, vol. 18, no. 1/2, 1967, p. 55–60. 10 refs.

Symptoms and diagnosis of vibration disease were studied through periodical mass investigations of workers using vibrating tools. Certain repeatedly appearing symptoms which form syndromes occurring in the vibration disease were observed. An attempt was made to determine the degree of vibration disease development in individual professional groups in general. Small groups of workers were selected in order to submit them to further detailed diagnostic examinations.

A68-80514
THE LEVEL OF ASCORBIC ACID IN ORGANIC FLUIDS AND IN LEUKOCYTES OF MEN EXPOSED TO HUMID HEAT.
Adam Went and Rajmund Dubrawski (Inst. of Marine Med., Gdańsk, Poland).
Biuletyn Instytutu Medycyny Morskiej w Gdańsku, vol. 18, no. 1/2, 1967, p. 61–65. 13 refs.

A total of 128 men were exposed to humid high temperature for 120 min., and measurements were made of the ascorbic acid (vitamin C) level in the blood serum, the leukocytes and in the urine. The vitamin C level in sweat was determined in men who had received synthetic vitamin C previous to exposure, and in those who had not. A significant decrease in the vitamin C level in leukocytes, an insignificant increase of vitamin C concentration in blood serum and an increase in vitamin C concentration in urine was observed. The results concerning the concentration of vitamin C in sweat were inconclusive as to the role of the sweat-excreting system in the excretion of ascorbic acid from the organism.

A68-80515
HYPOTHESIS BEHAVIOR IN A CONCEPT-LEARNING TASK WITH PROBABILISTIC FEEDBACK.
Steven P. Rogers and Robert C. Haygood (Kan. State U., Manhattan).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 160–165. 13 refs.
NASA Grant NsG (T)-54 and Grant NIMH MH 11283.

Predictions based on assumptions of recent mathematical models for concept learning were tested in a concept-learning task with probabilistic feedback. Subjects' verbalized hypotheses were examined at five-trial intervals. The results failed to support the model assumptions in that a large proportion of hypothesis changes occurred in the absence of errors and a large proportion of hypothesis retentions occurred following errors. A correlation of +.61 was found between total errors and total hypothesis changes under misinformation feedback conditions, but where the total number of errors was held constant by making feedback independent of subjects' responses, error rate had no significant effect on rate of hypothesis changes. The results suggest that subjects pass through distinct stages in solution of a concept-learning problem.

A68-80516
TRANSLATION PROCESSES AND AGING.
J. Richard Simon.
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 553–554.
Iowa U. supported research.

Two disparate age groups, a younger group between 18 and 29 and an older group between 64 and 81, performed a choice auditory reaction-time task which involved depressing a right- or left-hand key in response to a monaural pure tone (directional cue) or a binaural verbal command of "right" or "left" (symbolic cue). There were significant differences between age groups and between cue conditions. However, the prediction that older subjects would have greater difficulty than younger subjects in translating the symbolic content of the command was not supported.

A68-80517
DECREASED REACTION TIME PRODUCED BY DISCORDANT WARNING AND REACTION STIMULI.
Lawrence Karlin and Arnold M. Mordkoff (N. Y. U., New York City).
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 555–556. 6 refs.
Grants PHS MH 07253 and PHS MH 13758.

Decreased reaction time (RT) was obtained when the stimulus modality of the warning signal (WS) differed from that of the reaction stimulus (RS). This effect was obtained only when the interval between the WS and RS was relatively short (0.5 sec.) and not when it was lengthened to 2 sec.

A68-80518
TASK SPECIFIC DECREMENTS IN THE DURATION OF ATTENTION.
Bruce T. Leckart (Ohio U., Athens).
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 559–560. 10 refs.

Eighty undergraduates viewed a series of 80 color photographs under instructions asking them to view each stimulus for as long as they wished. The results indicated that a significant decrease in looking time occurred as a function of the number of previous stimuli viewed. These results were interpreted in terms of considering the looking situation as an information processing task.

A68-80519
RESPIRATORY ADJUSTMENT TO CHRONIC METABOLIC ALKALOSIS IN MAN.
Roberta M. Goldring, Paul J. Cannon, Henry O. Heinemann, and Alfred P. Fishman (Columbia U., Coll. of Physicians and Surgeons, Presbyterian and Francis Delafield Hosps., Depts. of Med., New York, N. Y.).
Journal of Clinical Investigation, vol. 47, Jan. 1968, p. 188–202. 31 refs.
Grants PHS CA-02332 and PHS HE-1082.

This study examined the ventilatory adjustment to chronic metabolic alkalosis induced under controlled conditions in normal human volunteers. Metabolic alkalosis induced by buffers (sodium bicarbonate, trishydroxymethylamine methane) or ethacrynic acid was associated with alveolar hypoventilation, as evidenced by a rise in arterial carbon dioxide tension, a fall in arterial oxygen tension, a reduced resting tidal volume, and a diminished ventilatory response to CO_2 inhalation. Alveolar hypoventilation did not occur when metabolic alkalosis was induced in the same subjects by thiazide diuretics or aldosterone despite comparable elevations of the arterial blood pH and bicarbonate concentration. The different ventilatory responses of the two groups could not be ascribed to differences among individuals comprising each group, pharmacological effects of the alkalinizing agents, differences in the composition of the lumbar spinal fluid, changes in extracellular fluid volume, or sodium and chloride balance. The differences in ventilatory adjustments were associated with differences in the patterns of hydrogen and potassium ion balance during the induction of alkalosis. Alveolar hypoventilation occurred when hydrogen ions were buffered (sodium bicarbonate, trishydroxymethylamine methane) or when renal hydrogen ion excretion was increased (ethacrynic acid). Alveolar hypoventilation did not occur when induction of similar degrees of extracellular alkalosis was accompanied by marked potassium loss and no demonstrable increase in external hydrogen loss (thiazides and aldosterone). These observations suggest that respiratory depression does not necessarily accompany extracellular alkalosis but depends on the effect of the mode of induction of the alkalosis on the tissues involved in the control of ventilation.

A68-80520
RECALL OF PAIRED-ASSOCIATES AS A FUNCTION OF THE ASSOCIABILITY.
Alexander J. Wearing, Clinton B. Walker, and William E. Montague (Ill. U., Urbana).
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 533–534. 9 refs.
Contracts DA 28 043 AMC 00073(E), ONR Nonr-3985(08), and OEC-3-6-058375-0612.

The recall of paired CVCs varied as a joint function of the association value (AV) of items constituting the pairs and the associability (AS) of the pairs, where the AS of a pair was defined as the probability of forming a natural language mediator (NLM) between its members. As value variation with AV levels produced reliable differences in recall. A significant AS by AV interaction indicates that the magnitude of the effect of AS on recall is considerably greater when pairs are composed of high AV items.

A68-80521
THE THERAPEUTIC EFFECT OF ALUPENT AFTER LETHAL WHOLE BODY GAMMA IRRADIATION [DIE THERAPEUTISCHE WIRKUNG VON ALUPENT NACH LETALER GAMMA-GANZKORPERBESTRAHLUNG].
E. Gabler, W. Stöckl, and J. Casta.
Atompraxis, vol. 13, Apr.–May 1967, p. 188–189. 7 refs. In German.

Albino rats and guinea pigs were exposed to whole body gamma irradiation in order to test the effects of Alupent. The death rate was significantly lower in animals treated with Alupent than in control animals. The results indicated that Alupent is effective as a therapeutic agent.

A68-80522
PVC SUITS FOR PERSONAL PROTECTION AGAINST RADIOACTIVE CONTAMINATION [ANZUGE AUS PVC ZUM SCHUTZ VON PERSONEN GEN GEGEN RADIOAKTIVE KONTAMINATION].
F. Suter (Inst. für Reaktorforsch., Wüenlingen, Switzerland).
Atompraxis, vol. 13, Apr.–May 1967, p. 180–185. In German.

Three types of PVC suits for protection against radiation were tested: unventilated protective suits; light-weight, ventilated protective suits; and heavy-weight, ventilated protective suits. Subjects wearing the suits underwent various tests including reaction time tests, attention tests and physiological measurements taken during work on a bicycle ergometer. During the work period measurements were made of the pulse rate, CO_2 concentration, body temperature and the temperature within the suit. After completion of the work, pulse rate, reaction time and attention were measured and the weight of the subject was determined. From the results of these tests, the light-weight, ventilated suit seemed favorable. The permissible time limits for use of the heavy-weight ventilated protective suit in a tritium atmosphere were investigated. There was an inverse relationship between exposure time and tritium concentration.

A68-80523
EFFECTS OF PATTERN COMPLEXITY IN SOLVING PATTERN RECOGNITION AND PATTERN PRODUCTION PROBLEMS.
Gary A. Davis and Alice J. Train.
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 549–550.
Contract OE 5-10-154.

Using a switch-light problem-solving apparatus, the task of 27 college subjects was either to identify each light pattern or to learn to produce each pattern. Increasing the number of lights in the pattern increased the difficulty of both tasks. Participation in the pattern recognition task appeared to facilitate performance in the production task. Performance in the production task was not facilitated by informing the subject of which pattern was to be produced.

A68-80524
WARNING SIGNAL AS A COMPONENT OF A COMPOUND STIMULUS IN HUMAN EYELID CONDITIONING.
Jonathan Berman, Carl D. Williams, and Neil Schneiderman (Miami U., Coral Gables, Fla.)
Psychonomic Science, vol. 9, Dec. 5, 1967, p. 541–542.
NASA Grant NGR 10-007-010.

One hundred human subjects conditioned and extinguished in a parallel fashion to both the warning signal of a masking probability learning task and the programmed CS. Acquisition and extinction curves were similar for early and nonearly responders though early responders had a higher response rate during acquisition.

A68-80525
THE LASER AS A LIGHT SOURCE FOR THE PHOTOSYNTHESIS AND GROWTH OF CHLORELLA VANNIELII.

Edward P. Karlander and Robert W. Krauss (Md. U., Dept. of Botany, College Park).
Biochimica et Biophysica Acta, vol. 153, Jan. 1968, p. 312–314. 8 refs.

A helium-neon continuous-wave gas laser, emitting light of 6,328±0.01 Å, a 500-mm. grating monochromator set at 633 mμ, half-band width 20.8 mμ and a tungsten source with an infrared filter were compared as light sources for the photosynthesis and growth of *Chlorella vanniellii*. Data showed that no detriment to the overall-performance of the organism resulted from the laser radiation. Results indicated a greater long-term photosynthetic efficiency in laser light than with either white light or light from a monochromator. An explanation for this greater efficiency was given.

A68-80526
FLASHING COLOR AND THE ELECTROENCEPHALOGRAM IN COLOR-DEFICIENT SUBJECTS.
E. Liske and Benjamin Kislin (USAF School of Aerospace Med., Brooks AFB, Tex.)
Neurology, vol. 18, Jan. 1968, p. 9–15. 9 refs.
USAF supported research.

Eleven Air Force males were selected on the basis of abnormal color vision and their color vision defects were identified. Photic flashes controlled by color filters were used to evoke responses at the occiput. Group and subgroup averaging techniques were used to minimize individual subject variability and to find the average waveform after each color in both the eyes open and eyes closed mode. The waveform previously seen in normals after red flash was not seen after red stimulus in these color-vision deficient groups. A double-peaked waveform was instead seen after blue flash in the protanomalous subgroup and after green flash in our single protanope. The four deutans failed to generate a double-peaked positive wave after any color or white.

A68-80527
MEANINGFULNESS AND ABSTRACTNESS IN SHORT-TERM MEMORY.
John G. Borkowski and Howard C. Eisner (Oberlin Coll., Ohio).
Journal of Experimental Psychology, vol. 76, Jan. 1968, p. 57–61. 11 refs.
Grant NSF GY-262.

Three experiments were conducted to investigate the effects of word meaningfulness (m) and abstractness (a) in short-term memory (STM). Recall for sets of words was tested after short (3 or 4 sec.) or long (18 or 20 sec.) retention intervals. The number of sets prior to any recall period defined the amount of proactive interference (PI). Results indicated that abstractness had a significant effect on the course of STM when varied independently of m and frequency. In contrast, m effects were significant only when a was not controlled. The differences in STM for high-m-low-a and low-m-high-a materials were not dependent upon the development of PI. Decay of the memory trace as well as PI were considered in attempting to explain the operations of m and a in STM.

A68-80528
RECENT DEVELOPMENTS IN OPTICAL AIDS IN THE UNITED STATES AIR FORCE.
Benjamin Kislin (USAF School of Aerospace Med., Brooks AFB, Tex.)
(Am. Acad. of Optometry, Ann. Meeting, Denver, Dec. 11, 1966). American Journal of Optometry and Archives of American Academy of Optometry, vol. 44, Dec. 1967, p. 810–817.

A discussion is presented of newly developed optical aids for use by flying personnel. These include a nosepad adjuster for eye glasses, a spectacle headband for use in pressure suits and a spectacle hood. The designs and uses of these in aiding pilot performance is explained.

A68-80529
RETINAL DAMAGE BY VISIBLE LIGHT: AN ELECTRON MICROSCOPIC STUDY.
Toichiro Kuwabara and Robert A. Gorn (Harvard U., Med. School, Mass. Eye and Ear Infirmary, Howe Lab. of Ophthalmol., Boston).
Archives of Ophthalmology, vol. 79, Jan. 1968, p. 69–78. 5 refs.
Grants PHS NB-03015 and PHS 2T01NB05142.

Albino rats were exposed to a fluorescent lamp at the brightness level of 750 ft. candles. The first morphological changes were seen in the outer tip of the photoreceptic organs as thinning and separation of the myelin membranes. Prolonged illumination caused more severe changes in the outer segments. The photoreceptic myelin membranes lost their regular lamellar arrangement completely and were transformed into tubular structures. Upon losing the connection with the damaged outer segments, the whole of the photoreceptic cells disappeared totally from the retina. However, if the exposure was stopped before this disconnection occurred, the damaged retina was found to have certain reversible capacities.

A68-80530
ASYNCHRONY: THE PERCEPTION OF TEMPORAL GAPS WITHIN PERIODIC AUDITORY PULSE PATTERNS.
Irwin Pollack (Mich. U., Mental Health Res. Inst., Ann Arbor).
Journal of the Acoustical Society of America, vol. 42, Dec. 1967, p. 1335–1340. 12 refs.
NSF supported research.

The perception of temporal gaps within periodic pulse patterns was examined in a forced-choice test. The task of the listener was to identify which one of four pulse patterns contained a temporal gap. Extremely acute gap detection (in the region of 1–10 μsec.) may be obtained with high pulse frequencies. Gap detection with high pulse frequencies is critically dependent upon the number of pulses; gap detection with low pulse frequencies is relatively independent of the pulse number. This result is consistent with the generalization, obtained in related studies, that extremely acute temporal discrimination is achieved at high pulse frequencies only with a large number of temporal samples, whereas the relatively poor temporal discrimination at low pulse frequencies is substantially less dependent upon the number of temporal samples. The temporal precision of the auditory system, in contrast with its precision of spectral analysis, appears to be insufficient to account for minimal gap thresholds.

A68-80531
VISUAL CODING USING FLASHING LIGHTS.
Donald A. Goldstein and Jerry C. Lamb (Gen. Dyn./Elec. Boat Div., Groton, Conn.)
Human Factors, vol. 9, Oct. 1967, p. 405–408. 5 refs.
Contract Navy NObs 4437(CSED).

An investigation of the feasibility of an alarm system employing visual signals was made. Using flash rate, values for four easily discriminable signals were established. In addition, minimum effective intensities for the four signals were obtained for the entire range of ambient illuminations associated with the operational situation. In a separate study, it was shown that little training was required to learn the signal code and once learned the code was maintained with little or no retention loss over the length of the

experiment. The alarm system in its final form was used under both simulated work and actual shipboard conditions and was found to be effective as an attention-getting device and as a message source.

A68-80532
A MODEL FOR AUDITORY DISCRIMINATION AND DETECTION.
G. Bruce Henning (Defence Res. Estab. Toronto, Ontario, Canada).
Journal of the Acoustical Society of America, vol. 42, Dec. 1967, p. 1325–1334. 21 refs.

A modified energy detector is proposed as a predictor of human frequency- and amplitude-discrimination performance. The model consists of an initial bandpass filter followed by a square-law device and an integrator. The center frequency of the initial filter is assumed to be a random variable distributed over time. The predictions of the model for performance in two-alternative forced-choice frequency- and amplitude-discrimination experiments are presented, together with data from human observers. While the model is able to predict the frequency and amplitude data very well, it is less successful with detection data.

A68-80533
RELATIONS AMONG AFTEREFFECTS OF ACOUSTIC STIMULATION.
J. Donald Harris (C. W. Shilling Auditory Res. Center, Groton, Conn.)
Journal of the Acoustical Society of America, vol. 42, Dec. 1967, p. 1306–1324. 18 refs.
PHS supported research.

In Experiment 1, six women were given 12 separate tests of short-duration auditory adaptation. Correlations among subjects showed that two subgroups existed, one pair differing from the others in exhibiting an interaction between stimulus strength/duration and slope of recovery. A battery of four tests is tentatively recommended that would sample the effects on different subjects of stimulus frequency, intensity, and duration, and of slope of recovery. In Experiment 2, 15 adults were given 47 tests of true auditory fatigue with pure tones. Previous data on temporary threshold shift (TTS) growth rates, equinoxious contours, recovery slopes, etc., were confirmed. An obverse factor analysis was performed, upon a correlation matrix not among tests but among subjects. A general-susceptibility grouping emerged; three individuals defined rather poorly a grouping with reduced high-frequency and increased low-frequency susceptibility; three other individuals showed recognizable specific patterns of susceptibility. Three specific tests can be shown to sample these groupings, and are recommended tentatively as an auditory fatigue battery for pure tones. Using a supplementary battery of 15 noise tests, a subgroup of three was sufficient to predict whole battery performance ($r = 0.81$), as against a prediction ($r = 0.65$) between any pure-tone combination versus the whole-battery noise data. Experiments 3, 4, and 5, used this information to study the prediction of susceptibility to noise-induced permanent threshold shift in man, rat, and monkey, respectively. A rather low level of success was achieved.

A68-80534
THE INFLUENCE OF A NEW CHLORDIAZEPOXIDE ANALOGUE ON HUMAN MENTAL AND MOTOR PERFORMANCE.
Martin E. Bernstein, Francis W. Hughes, and Robert B. Forney (Ind. U., School of Med., Dept. of Pharmacol. and Toxicol., Indianapolis).
Journal of Clinical Pharmacology, vol. 7, Nov.–Dec. 1967, p. 330–335. 6 refs.
Grant PHS (GM-1089); Hoffmann–LaRoche Inc. supported research.

Ro 5-4556, a chlordiazepoxide analogue, was tested on motor and mental performance, with and without ethanol, as part of a continuing investigation into the interactions of drugs and alcohol on man. Sixteen paid medical and graduate student volunteers were tested under four double-blind and randomized treatment conditions. Testing was biphasic, with mental performance being analyzed by means of a delayed audio feed-back system (DAF) and motor performance by a pursuit meter apparatus. Results indicated that, within the limits of our testing conditions, Ro 5-4556, in general did not affect human mental or motor performance either alone or in combination with alcohol. Alcohol, however, at concentrations below those usually associated with measurable impairment in any person, produced significant impairment of performance in a number of procedures testing mental and motor capabilities.

A68-80535
EFFECT OF REDUCED PRESSURE ON HUMAN PERFORMANCE.
Joseph L. Seminara, Richard J. Shavelson, and Stuart O. Parsons (Lockheed Missiles and Space Co., Sunnyvale, Calif.)
Human Factors, vol. 9, Oct. 1967, p. 409–418.

The purpose of this study was to determine whether reduced pressure (1.5 p.s.i.) versus ambient pressure (14.7 p.s.i.) had a differential effect on man's performance in a pressurized (3.7 p.s.i.) Apollo suit. Two subjects were tested on three different types of tasks: psychomotor, a lunar mission-specific task, and walking. The results of this study gave support to the hypothesis that it would require greater effort to complete the same tasks in the reduced pressure condition than in the ambient pressure condition. During the reduced pressure condition, an increase in total time, total errors, heart rate, and carbon dioxide production was consistently observed over the ambient condition. These findings are considered preliminary, and future research is required to substantiate the conclusion that reduced pressure associated with the space environment negatively affects human performance.

A68-80536
THE ASSOCIATION BETWEEN ALPHA RHYTHM PROPAGATION TIME AND LEVEL OF AROUSAL.
J. C. Shaw and K. R. McLachlan (Med. Res. Council, Clin. Psychiat. Res. Unit, Graylingwell Hosp., Chichester, Sussex and Southampton U., Dept. of Mech. Eng., Hampshire, Great Britain).
Psychophysiology, vol. 4, Jan. 1968, p. 307–310. 12 refs.

Alpha waves in the electroencephalogram occur with a time delay in the anteroposterior direction. The hypothesis that this time delay is associated with level of arousal was tested. Alpha time delay was determined from covariance functions and level of arousal from palmar skin conductance levels. The results support the hypothesis.

A68-80537
VISUAL RECALL ABILITY AND EYE MOVEMENTS.
Barbara B. Brown (Calif. U., Coll. of Med., Dept. of Psychiat. and Human Behavior, Los Angeles and VA Hosp., Exptl. Psychiat., Sepulveda, Calif.)
Psychophysiology, vol. 4, Jan. 1968, p. 300–306. 14 refs.
Contract DA 44-009 AMC 367 (T).

Pursuit eye movements, using a moving object of specific excursion and beat frequency, were compared between active watching of the moving object and recalling the motion with eyes closed. Ability for visual imagery and incidence of its use were evaluated by questionnaires and discussion following the test procedure. Eye movements during eyes-closed recall occurred significantly more frequently in visualizers than non-visualizers.

Exceptions to the relationship suggest that the occurrence of eye movements during recall do not necessarily indicate presence of visual imagery, but that oculomotor activity may be recalled independently. Eye movements during eyes-closed recall generally under- or over-estimate both excursion and timing of the original motion.

A68-80538
AUTONOMIC CORRELATES OF EYE MOVEMENT BURSTS DURING STAGE REM SLEEP.

Lawrence F. Spreng, Laverne C. Johnson, and Ardie Lubin (U.S. Navy Med. Neuropsychiat. Res. Unit, San Diego and San Diego State Coll., Calif.)

Psychophysiology, vol. 4, Jan. 1968, p. 311–323. 33 refs.
Grant NSF GB 3961.

During stage REM sleep, eye movements were found to be distributed in discrete bursts of rapid eye movement (REM-bursts). REM-burst time averaged approximately 10% of stage REM sleep and the rate within a subject was consistent from epoch-to-epoch and night-to-night. Consistent subject biases in eye movement direction were also found. Within subject correlations were obtained between REM-burst time and autonomic activity. Significant positive correlations were found for respiration rate and number of finger pulse responses. There were positive but insignificant correlations with electrodermal activity, heart rate and decreases in respiration amplitude. Autonomic variability was not significantly associated with REM-burst time.

A68-80539
EFFECTS OF EVENING ACTIVITY ON EARLY NIGHT SLEEP.

Peter Hauri (Chicago U., Ill.)

Psychophysiology, vol. 4, Jan. 1968, p. 267–277. 14 refs.
Grant PHS MH-04151.

This study was designed to determine the effects of presleep activity on a variety of physiological variables during 3.5 hr. of subsequent sleep. Three presleep conditions were investigated for each of 15 subjects: six hr. of strenuous physical exercise, six hr. of concentrated studying and six hr. of relaxation, i.e. watching TV, listening to records, and reading magazines. The following variables were recorded during a 3.5 hr. sleep period: EEG, EOG, body movements, heart rate, respiratory rate, peripheral pulse volume, phasic vasoconstrictions, rectal temperature, and rapid variations in skin potential. None of the experimental presleep activities influenced the EEG cycle during the 3.5 hr. of sleep. These findings indicate a surprising stability of the sleep stage cycle *vis a vis* the markedly different evening activities. Physiological arousal after exercise decreased rapidly until it was no longer distinguishable from the base levels following studying or relaxation. A tendency to approach these base levels was observed even in heart rate, a variable which remained elevated after exercise throughout the 3.5 hr. of sleep. For none of the physiological variables was the level of physiological arousal during sleep inversely related to the level of physiological arousal during wakefulness. It was observed that on nights when respiratory rate was high there was more delta sleep and less stage two sleep. Also, respiratory minima were most often found during stage two sleep immediately following a REMP, and respiratory maxima during NREM sleep were significantly associated with delta sleep.

A68-80540
THE CARDIAC COMPONENT OF THE ORIENTING RESPONSE.

Joseph Germana and Stephen B. Klein (Va. Polytech. Inst., Blacksburg).

Psychophysiology, vol. 4, Jan. 1968, p. 324–328. 5 refs.

A beat-by-beat analysis of the human heart rate (HR) response to repeated presentation of three intensities of auditory stimulation (50, 70, and 90 db) was undertaken to test the hypothesis that the HR component of the orienting response (OR) is deceleration. Over-all level of poststimulus acceleration and a late acceleratory component of a multi-phasic response pattern best met the criteria of an OR, suggesting an alternative hypothesis.

A68-80541
THE SUBJECTIVE RESPONSE TO THE THERMAL ENVIRONMENT.

Warren H. Teichner (Northeastern U., Boston, Mass.)

Human Factors, vol. 9, Oct. 1967, p. 497–510. 21 refs.
Grant AFOSR 60 and Contract ASOSR 958-65.

Techniques used to assess subjective reactions to the thermal environment are evaluated and found to have been developed without any conceptual basis. In addition, the scales used lack sensitivity and interexperimenter consistency. A novel approach to the problem has been developed which assumes that such measurements must account explicitly for the subject's motivation and which depends upon the correlation between physiological and behavioral measurements on the one hand, and voluntary exposure time on the other. Exploratory data are presented as a first step in the direction of developing methods for introducing the concepts into the laboratory.

A68-80542
TACTUAL CODING OF CYLINDRICAL KNOBS.

James V. Bradley (Antioch Coll., Aerospace Med. Res. Labs. and Behavior Res. Lab., Ohio).

Human Factors, vol. 9, Oct. 1967, p. 483–496. 18 refs.

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 one % of the time) identified the wrong picture as the felt knob in any of the following situations: diameters differ by one-half in. or more, thicknesses differ by three-eights in. or more, rim surfaces belong to different ones of the three families: smooth, fluted, knurled.

A68-80543
FLICKERING ENTOPTICAL HALO FOR VARIOUS COLOR MIXTURES.

Lucia Ronchi (Inst. Nazl. di Ottica, Florence, Italy) and Giuseppe Salvi (Florence U., Clin. Oculist., Italy).

Atti della Fondazione Giorgio Ronchi e Contributi dell'Istituto Nazionale di Ottica, vol. 22, Sep.–Oct. 1967, p. 690–700. 12 refs.
Contract AF F6 1052 67 C 0067.

The behavior of flickering halo for various color mixtures was investigated as one aspect of glare. The task consisted of determining the apparent size of the halo, of entoptical origin, as a function of the intensity of the central spot. Data were in line with the known fact that blue receptors lying in the near periphery are highly sensitive to flicker when the frequency of interruption is slightly greater than 15 c.p.s. The question of failure of additivity in the peripheral retina was discussed. A connection appeared to exist between the rate of increase of the flickering halo and the slope of the linear branch of the electroretinographic intensity function. It was stressed that the determination of both size of flickering halo and slope of the electroretinographic intensity function, for various colors, may be useful for diagnostic purposes, as in the case of patients suffering from glaucoma and retinitis.

A68-80544
INDIVIDUAL DIFFERENCES IN BEHAVIOR DURING EXPOSURE TO AN EMPTY FIELD.
Mario Conticelli (Florence U., Inst. di Psicol., Italy) and Ercole M. Gloria (Pisa U., Clin. Oculist., Italy).
Atti della Fondazione Georgio Ronchi e Contributi dell'Istituto Nazionale di Ottica, vol. 22, Sep.–Oct. 1967, p. 681–689. 11 refs.
Contract AF F6 1052 67 C 0067.

A number of subjects were presented with an empty field. They had at their disposal a switch which allowed projection of a luminous spot at a point of the visual field. The presence of such a structure minimizes the weariness induced by the prolonged exposure to the extended uniform stimulus. The instruction was to present the spot when wanted or needed. The frequency of spot presentation is found to differ strongly between individuals. The effect is discussed in terms of a tentative model.

A68-80545
PSYCHOPHYSIOLOGICAL RESPONSES TO MEANINGFUL SOUNDS.
John W. Chotlos and Gerald Goldstein (Veterans Admin. Hosp., Topeka, Kan.)
Journal of Nervous and Mental Disease, vol. 145, Oct. 1967, p. 314–325. 8 refs.

Emotional reactions are reported of three hospitalized patient groups and one normal comparison group to a series of sounds and periods of silence, as determined by electrophysiological measurements. Recently hospitalized chronic schizophrenics, chronic alcoholics, medical patients whose primary problem was hypertension, and hospital employees comprised the groups. Measurements were taken for skin resistance, heart rate, and digital temperature. Skin resistance was found to be the only measure that discriminated among the groups at a statistically significant level. Response to sound differed from response to silence. Heart rate declined during sound, while skin resistance increased.

A68-80546
THE INFLUENCE OF SOME PYRETOGENIC AGENTS ON THE BIOELECTRIC ACTIVITY OF THE HYPOTHALAMUS IN THE RABBIT [WPLYW NIEKTORYCH SRODKOW GORACZKOTWORCZYCH NA CZYNNOSC BIOELEKTRYCYNA PODWZGORZA U KROLIKA].
Zbigniew Korolkiewicz.
Acta Physiologica Polonica, vol. 18, no. 6, 1967, p. 957–962. 16 refs. In Polish.

The influence of pyretogenic drugs on the electroencephalogram from the hypothalamus was studied. It is believed that the centers in this part of the brain take part in the regulation of body temperature. Functional currents were detected with electrodes implanted into the anterior hypothalamus in rabbits after injection of physiologic saline solution (0.9% NaCl) as control, pyrogens, 2,4-dinitrophenol, amphetamine and LSD. Tracings were made at the peak of lever in ten rabbits from 36 points. Examples of typical curves obtained before and after administration of the drugs are presented in the table. After discussion of the results and comparing them with data from the literature, it was concluded that pyretogenic drugs can be classified also on the basis of their effect on bioelectric activity of the central thermal receptor. Among the studied drugs, delbecin and LSD exert central action, while amphetamine and dinitrophenol act peripherally. Noradrenaline and serotonin are probably chemical mediators of the action of these drugs.

A68-80547
CHANGES IN MELATONIN CONCENTRATION IN PINEAL GLAND IN RATS EXPOSED TO CONTINUOUS LIGHT OR DARKNESS.
Maria Elena Tomatis and R. Orias (Inst. de Invest. Méd. "Mercedes y Martin Ferreyra", Córdoba, Argentina).
Acta Physiologica Latino Americana, vol. 17, no. 3, 1967, p. 227–233. 18 refs.
Consejo Nacl. de Invest. Cient. y Tec. supported research.

The concentration of melatonin in the pineal gland of rats was studied in animals exposed to continuous light or darkness. Animals kept in continuous light for three days presented a significant fall in melatonin concentration and this decrease was of the same degree after 80 days of constant light. On the contrary, in animals kept in darkness the melatonin concentration significantly increased. The weight of the pineal decreased with constant light and did not change in the animals kept in darkness. The removal of the eyes or the superior cervical ganglia interfered with the fall in melatonin concentration observed in the intact animals under constant illumination. No difference in the concentration in melatonin of the pineal gland was found in animals kept in constant light in which either the eyes or the superior cervical ganglia were removed. But, when both eyes and ganglia were removed simultaneously a higher content of melatonin was found than in the animals in which only only one of these structures was absent. It is concluded that light affects pineal melatonin concentration and that the eyes and superior cervical ganglia can interfere with this effect without this indicating that they are involved in a common pathway.

A68-80548
METHOD OF KINEMATIC STUDY OF NORMAL UPPER EXTREMITY MOVEMENTS.
Thorkild J. Engen and William A. Spencer (Baylor U., Coll. of Med., Dept. of Rehabil., Houston, Tex.)
(Am. Congr. of Phys. Med. and Rehabil., 44th Ann. Session, San Francisco, Aug. 31, 1966).
Archives of Physical Medicine and Rehabilitation, vol. 49, Jan. 1968, p. 9–12.
Grant VRA RD-1564.

Progressive developments in externally powered orthotic systems at Baylor University College of Medicine indicate a need for detailed analysis of the complex, synchronized musculoskeletal actions in normal upper extremity motions involved in daily activities. Mirrors were positioned to show three perspectives of each subject as a 35-mm. movie camera photographed the subject performing activities of feeding, hair grooming, page turning, writing, and diagonal reaching. Two techniques used to analyze these film data, manual analysis and computer processing, enabled measurement of the pattern of movements, relationship between anatomic points, angulation, and acceleration of each point. After analysis of normal subjects, a mean is established for each activity. Later the same procedure will be followed, using patients with powered assistance for comparison with normal subjects. By providing data for determining discrepancies in body movements, range of motion, and velocity of motion imposed by orthotic devices, these studies identify mechanical changes necessary to improve function.

A68-80549
EFFECT OF CELL CYCLE ON RECOVERY FROM RADIATION DAMAGE IN THE MOUSE LIVER.
J. E. Coggle (St. Bartholomew's Hosp., Med. Coll., Dept. of Radiobiol., London, Great Britain).
Nature, vol. 217, Jan. 13, 1968, p. 180–182. 13 refs.
PHS and Brit. Empire Cancer Campaign supported research.

Chromosomal aberrations which were induced in mouse hepatocytes by single and fractionated doses of X-rays given at various times before or after surgical partial-hepatectomy were studied. The data presented showed that the different phases of the cell cycle possibly differ not only in their sensitivity to chromosomal damage by radiation but also in their ability to recover from such damage.

A68-80550
IODINE COMPOUNDS IN PLASMA OF RATS: EFFECT OF EXPOSURE TO HIGH ENVIRONMENTAL TEMPERATURE.
M. K. Yousef and H. D. Johnson (Mo. U., Dept. of Animal Husbandry, Columbia).
Nature, vol. 217, Jan. 13, 1968, p. 182–183. 7 refs.
Food Protec. Res. and Div of Environ. Eng. supported research.

Fifty-six rats were maintained in a climatic chamber at 28°C. and 50% relative humidity (RH). After three wk., 24 rats were exposed to 34°C. and 50% RH, and both groups were maintained in these conditions for more than 20 wk. in order to determine the nature of the iodinated compounds in the plasma of rats during heat exposure. Carrier-free iodine 131 was administered intraperitoneally. A significant effect of long-term exposure to heat on the composition of iodine 131 compounds in plasma was found, and the results confirmed that thyroxine is the principle iodine 131 compound in rat plasma. The data also indicated that the composition of the thyroid secretion changes during acclimatization to heat. Several explanations for the changes were presented.

A68-80551
CROSS-ADAPTIVE OPERATOR LOADING TASKS.
Charles R. Kelley and Michael J. Wargo (Dunlap and Assoc., Santa Monica, Calif.)
Human Factors, vol. 9, Oct. 1967, p. 395–404. 16 refs.
Contract Nonr 4986(00).

Performance measures often fail to indicate the amount of effort expended by an operator in reaching various levels of task performance. Secondary or loading task techniques have been developed to overcome this problem. However, with the loading task technique, a problem of interpretation arises when both primary and secondary task measures vary with operator performance. The cross-adaptive operator loading technique, which automatically adjusts the difficulty level of the loading task on the basis of primary task performance, is suggested as a solution to this problem. Data are presented which demonstrate that the cross-adaptive technique effectively standardizes scores on the primary task while casting all the variance in performance to the loading task scores. The cross-adaptive secondary scores thereby become a single unambiguous and sensitive index of effort expended to reach a pre-established level of task performance. Procedures for the implementation of the cross-adaptive techniques are discussed and guidelines for its use are suggested.

A68-80552
CHEMICAL RADIOPROTECTION OF MRNA IN A NIRENBERG CELL FREE SYSTEM.
S. Robev and D. Jankova (Inst. of Radiol. and Radiation Hyg., Dept. of Radiation Biochem., Sofia, Bulgaria).
Nature, vol. 216, Dec. 30, 1967, p. 1319–1320. 6 refs.
Intern. Atomic Energy Agency supported research.

The behavior of MRNA was studied with respect to the possibility of its chemical radioprotection when subjected to ionizing radiation in the Nirenberg cell free system. The effect of chemical radioprotection of polyU using various concentrations of cysteamine hydrochloride was given. The concentration of cysteamine hydrochloride in the system seemed to be a controlling factor; thus, a specific cysteamine radioprotection could not be excluded.

A68-80553
DISPLAY-CONTROL RELATIONSHIPS WITH BISENSORY SIGNALS.
A. Douglas Perriment and William R. Webster (Monash U., Victoria, Australia).
Human Factors, vol. 9, Oct. 1967, p. 461–469. 22 refs.

Using a bi-sensory signal, simultaneously presented in the visual and auditory modes, an experiment was carried out to examine the effects of varied display-control relationships upon information transfer rate. Of the three response variables examined i.e., limb relationship, control position, and digit correspondence, that of control position was found to have the most significant effect upon performance. Controls which were centrally placed, gave higher information transfer rates than those placed laterally to the line of the incoming signal. The complex interactions, which were observed between all three response variables suggest the need for system specific examination of S–R ensembles where complex bi-sensory signals are used.

A68-80554
LEGIBILITY OF NUMBERS AS A FUNCTION OF CONTRAST AND ILLUMINATION.
Charles M. Williams (Bell Telephone Labs., Inc., Holmdel, N. J.)
Human Factors, vol. 9, Oct. 1967, p. 455–460.

While contrast is recognized as an important variable affecting legibility, scant information of what happens in the mid-ranges is available. Thus nine contrast conditions consisting of black or white lettering on white, black, or grey backgrounds were compared under three levels of illumination—0.06, 0.60, and 6.0 footcandles. Eighteen subjects were asked to search a stimulus array for a particular stimulus and then indicate its relative position among the other stimuli. Reaction time and errors were recorded. Illumination proved to be the single most important factor. Significant differences in performance were observed between the contrast conditions under poor illumination. It was concluded that for recognition tasks of short duration, varying contrast within wide limits has little effect on speed and accuracy of performance as long as illumination remains above 0.60 footcandles. Black lettering on a white background and white lettering on a black background did not differ significantly and were associated with the shortest reaction times and the least number of errors at all light levels.

A68-80555
JUDGMENTS OF RELATIVE DISTANCE BASED ON SEPARATE 2-D TV VIEWS.
Billy M. Crawford and William N. Kama (Aerospace Med. Res. Labs., Human Eng. Div., Wright-Patterson AFB, Ohio).
Human Factors, vol. 9, Oct. 1967, p. 447–454. 11 refs.

An experiment was conducted to determine human capabilities for making judgments of relative distance based on cues obtained from two ordinary, two-dimensional, closed-circuit television systems. The two cameras were placed so that their lines-of-sight converged symmetrically upon the mid-point between the two rods of a modified Howard–Dolman depth perception apparatus. Four camera lines-of-sight convergence angles were investigated: 15°, 30°, 60°, and 90°. Difference thresholds for relative depth perception were determined for 24 subjects by the psychophysical Method of Limits. Thresholds were on the order of 12–13 min. of arc in terms of the parallactic difference angle for the camera lines-of-sight. The results are related to the design of viewing systems for remote operations.

A68-80556
CONFUSION MATRIX ANALYSIS FOR FORM PERCEPTION.
Raymond D. Engstrand and George Moeller (Naval Submarine Med. Center, Submarine Med. Res. Lab., Naval Submarine Base New London, Groton, Conn.)
Human Factors, vol. 9, Oct. 1967, p. 439–446. 11 refs.

The Constant-Ratio Rule (CRR), an empirical technique for analysis of confusion matrices, was developed for use in predicting intelligibility of speech syllables. This study investigated the validity

of the rule when applied to the data from experiments on visual form perception. English letters and simple geometric figures were tachistoscopically presented in the center of a viewing field. Response proportions for subsets of this master set of stimuli were predicted by CRR. Results indicated that the rule (1) accurately predicted numeric response proportions for subsets of stimuli when experimental conditions were similar and (2) predicted ordinally accurate data when experimental conditions varied within the limit which might be encountered in "operational situations." These results, as well as arithmetic factors which can result in errors in prediction, are discussed.

A68-80557
APPLICATION OF SERVO THEORY TO A MANUAL REPETITIVE OPERATION.
Charles W. Suggs (N. C. State U., Raleigh).
Human Factors, vol. 9, Oct. 1967, p. 433–438. 7 refs.
Grant OH 144.

The purpose of this study was to develop a model to describe the response of a subject feeding items into a machine. Analysis of a set of data produced a first order servo system with a corner frequency of about 110 cycles per min. At low frequencies the gain of the system approached one and at high frequencies it decreased at a rate which approached −6 db. per octave. An additional analysis based on the distribution of the time periods required to handle the items gave a response curve very closely fitting the first order servo system and the experimental data.

A68-80558
DRIVING PERFORMANCE UNDER NIGHTTIME CONDITIONS OF VISUAL DEGRADATION.
Francisco Matanzo, Jr. and Thomas H. Rockwell (Ohio State U., Columbus).
Human Factors, vol. 9, Oct. 1967, p. 427–432. 10 refs.

Nighttime driving performance was studied in relation to four different driving tasks and four levels of visual degradation. Four matched but task-differentiated groups of four subjects each drove an instrumented vehicle at night on a superhighway. The four levels of visual degradation presented the roadway to the driver at overall luminance levels of 5.228 mL, 2.688 mL, 0.744 mL, and 0.168 mL. The two dependent variables were vehicle speed and vehicle distance from the white shoulder line. The visual degradation caused the subject to slow down and position the vehicle slightly farther away from the shoulder. It was found that a driver also is capable of driving at a constant speed and of maintaining a constant lane position at very high degrees of visual degradation. These results were explained by the different instructions given to each task group.

A68-80559
SPECIFIC POTENTIATION OF PHOTICALLY EVOKED ACTIVITY IN THE VISUAL CORTEX.
M. Steriade and D. Ionescu (RSR Acad., Inst. of Neurol., Bucharest, Rumania).
Experimental Brain Research, vol. 4, Nov. 10, 1967, p. 256–274. 46 refs.

The visual cortex response to a contralateral flash is composed in the dark-adapted unanesthetized cat of an initial a wave, with 14–22 msec. latency, and a subsequent (post-primary) b complex, at 40–50 msec. after the onset of the photic stimulus, consisting of a single or two main deflections followed by a fast (60–100 per sec.) afterdischarge. The complex alterations of the cortical afterdischarge induced by variations in parameters of photic stimulation are not referrable to the optic tract oscillatory activity. The central (cortical) origin of the post-primary component is suggested, among other evidences, by its selective enhancement following a conditioning stimulation of the lateral geniculate body. Steady light applied to the same retina as the testing flash electively potentiates the post-primary component evoked in the contralateral striate and parastriate cortex (increase in amplitude, shortening of latency and faster evolution), developing it to the pattern of a shock-evoked response, with positive spikes preceding the diphasic wave. The potentiation of the post-primary component by continuous illumination is additive with that induced by lateral geniculate or direct visual cortex stimulation. Inequalities between surface- and depth-recorded flash evoked components become more marked under steady light, which induces a greater potentiation of the reversed post-primary components in the depth than at the surface. Steady light potentiation at the cortical level is associated with reduction of the first deflection and ensuing oscillations evoked at the level of the optic tract and lateral geniculate body. The level of steady light potentiating effect and its mechanisms are discussed.

A68-80560
READABILITY OF DIALS AT DIFFERENT DISTANCES WITH CONSTANT VISUAL ANGLE.
Alphonse Chapanis and Lorraine C. Scarpa (Johns Hopkins U., Dept. of Psychol., Baltimore, Md.)
Human Factors, vol. 9, Oct. 1967, p. 419–426. 15 refs.
Contract Nonr-4010(03).

The purpose of this experiment was to study the readability of dials at different distances when the visual angle subtended by the dials is held constant. Five dials, the sizes and markings of which were proportional to viewing distance, were tested at distances ranging from 14 to 224 in. Each of 20 subjects made 20 readings on each dial. Care was taken to select subjects with excellent uncorrected near and far visual acuity. A focus sign above each dial was used to hold accomodation time constant. Directions to the subject stressed accuracy. Response times, errors of estimation, and questionnaire data were recorded. The results show a significant effect of distance on readability: dials located at distances greater than 28 in. were read faster than two smaller, closer dials. Although there are no significant differences among the errors made on the five dials, the error data are consistent with the time data.

A68-80561
PENTOBARBITAL AND DEXTROAMPHETAMINE SULFATE: EFFECTS ON THE SLEEP CYCLE IN MAN.
Frederick Baekeland (N. Y. State U., Downstate Med. Center, Dept. of Psychiat., Brooklyn).
Psychopharmacologia, vol. 11, Oct. 6, 1967, p. 388–396. 24 refs.
Grants NIH MH-23,901, NIH MH-10088, and NIH MH-7336.

Twenty subjects received, double blind, either a 15-mg. dextroamphetamine sulfate (DA) spansule and pentobarbital (PB) 100 mg. p.o. before bed on two nights or PB and a placebo (PL) on two other nights, all a week apart in a balanced design. Fifteen of the subjects received DA and PB placebos on two additional nights. Electroencephalographic and electrooculographic recordings were obtained over a six-hr. observation period on all nights. DA+PB produced more body movements, spontaneous awakenings and stage-2 sleep and less delta sleep (stages 3+4) than did PB, while PB reduced time to sleep onset and produced less body movements and spontaneous awakenings than did PL. These findings were thought to indicate that DA decreases "soundness" and "depth" of sleep while PB increases them. A decrease in emergent stage-1 sleep (activated sleep, AS) over the six-hr. observation period with DA+PB was made up for a corresponding increase in wakefulness (stage 0), while a decrease both in AS and stage 0 with PB was compensated for by a corresponding increase in nonactivated sleep (NAS). Both DA+PB reduced per cent AS sleep time and first AS period (ASP) latencies, DA+PB more markedly

than PB. DA appeared to produce this effect primarily by increasing first ASP latencies, while PB did so as well by shortening the first two ASPs. The tendency of PB to reduce rapid eye-movement (REM) density within ASPs (DA did not do so), to produce periods of emergent stage one without REMs, to shorten ASPs without changing the intervals between successive ASPs and to produce a maximum in the concentration of body movements in the 60–90 min. interval after sleep onset suggested that it does not induce a basic alteration in the sleep cycle but rather suppresses certain manifestations of the first ASP (REMs and stage-1 sleep), while leaving others, such as body movements, unchanged to persist as a "REM-period residue." Since DA was always administered with PB, it is not clear by what mechanisms the former delayed the appearance of first ASPs.

A68-80562
PERCEPTION OF CONTOUR ORIENTATION IN THE CENTRAL FOVEA PART I: SHORT LINES.
D. P. Andrews (Keele U., Dept. of Commun., Staffordshire, Great Britain).
Vision Research, vol. 7, Nov. 1967, p. 975–997. 20 refs.

Experimental results show that acuity for orientation and constant errors of perceived orientation of short lines are related to fixation point, viewing condition, orientation, and exposure duration; there are also changes of constant error over a period. The findings are unexpected and sufficiently specific to suggest some of the ways in which the visual system processes contours. There are independent grounds for believing that specialized contour-sensitive units occur in the human visual system. It is believed that the results show that these units have the following properties: (1) most units have inputs from both eyes; (2) units vary in selectivity for orientation, being most selective when 'tuned' near the horizontal and vertical directions; (3) units integrate their outputs by a process of mutual inhibition which has a time-constant of the order 1/4–1/2 sec. Perceived orientation corresponds to maxima in the resulting pattern of inhibition; (4) the relation between presented and perceived orientation is subject to adaptation which tends to equalize the incidence of perceived contour orientation around the clock. The storage period supporting this adaptation is a matter of days. These conclusions must be coupled with the assumption that the receptive fields of units corresponded to the stimuli used; implications for larger or smaller units would be little changed, but some additional statements would be required if the part of the visual system corresponding to the units as defined in fact comprise more than one level of processing. In particular, the level(s) to which these conclusions apply would have to be specified.

A68-80563
PERCEPTION OF CONTOUR ORIENTATION IN THE CENTRAL FOVEA. PART II. SPATIAL INTEGRATION.
D. P. Andrews (Keele U., Dept. of Commun., Staffordshire, Great Britain).
Vision Research, vol. 7, Nov. 1967, p. 999–1013. 16 refs.

Experiments were performed in which two lines were set parallel, to establish functions relating accuracy of performance to length and separation of lines. It is shown that if the best possible use were made of the retinal input, then the variance of perceived slope of a line would be inversely proportional to the cube of its length; this relation obtained experimentally up to a line length of about 9′ arc. The results were interpreted in terms of units that respond specifically to short lines at particular positions and orientations. It is concluded that these units have a field size of about 9′ arc. There is a special interaction between neighboring units which facilitates clear recognition of small details in connected contours. Separate visual objects and remoter portions of connected contours are related less precisely, being limited by continual adaptation in the dimensions of visual representation.

A68-80564
BRIGHTNESS DISCRIMINATION WITH A STABILISED RETINAL IMAGE.
D. C. West (Reading U., J. J. Thomson Phys. Lab., Great Britain).
Vision Research, vol. 7, Nov. 1967, p. 949–973. 35 refs.
Grant PHS NB-01233-07.

The discrimination of contrast in a bipartite field with a stabilized retinal image was studied in relation to several parameters. The percentage of time (V) for which the luminance difference is perceived is always very much lower than in normal vision. V is (a) independent of field luminance; (b) increases with luminance difference; (c) increases with sharpness of boundary; (d) at first increases and then decreases as field size is increased; (e) decreases when the target is moved away from the center of the visual field. White, red, green and yellow (minus blue) illumination give very similar results. Important differences are found with blue light when the target is mainly within the fovea. Many of the results can be explained in relation to spatial interaction over about 2′ in the fovea (for colors other than blue) and over larger distances outside the fovea. The range of interaction for blue within the fovea is 7′. Some results require the existence of at least two partly independent "signals" which lead to perception of contrast.

A68-80565
FLUCTUATIONS IN TARGET VISIBILITY AS RELATED TO THE OCCURRENCE OF THE ALPHA COMPONENT OF THE ELECTROENCEPHALOGRAM.
Ulker Tulunay Keesey and Dennis J. Nichols (Wis. U., Med. School, Dept. of Surg., Ophthalmol. Div., Madison).
Vision Research, vol. 7, Nov. 1967, p. 859–877. 41 refs.
Grants NIH NB-06151 and NIH FR00249; Wis. U. Res. Comm. supported research.

Under stabilized image viewing conditions, alpha component of electroencephalogram onset and termination precede respectively the report of disappearance and reappearance of the image. When a pattern of visibility is imposed on the same target viewed normally, either by defocusing or dimming it, alpha onset and termination generally follow the report of image fading and regeneration. Spontaneous fluctuations in the visibility of a normally viewed target is obtained at low luminance levels, but alpha shows no clear temporal relation to image disappearance and reappearance. Temporal alpha occurrence patterns are found to be similar when a low or high luminance target is viewed normally. Stabilized presentation of the target changes the temporal characteristics of alpha occurrence. A correlation between image visibility and alpha occurrence pattern is found only when the image is stabilized or the luminance of a normally viewed image is periodically decreased. It is proposed first that temporal patterning of alpha activity reflects the presence or absence of stimulation provided by image motions; and secondly, that fluctuations in the visibility of a stabilized image are controlled by the spontaneous fluctuations in the resting activity level of cortical structures.

A68-80566
ON AN EARLY STAGE OF RHODOPSIN REGENERATION IN MAN.
R. A. Weale (Inst. of Ophthalmol., Dept. of Physiol. Optics, London, Great Britain).
Vision Research, vol. 7, Nov. 1967, p. 819–827. 21 refs.

Measurements were made of photometric density changes in the human peripheral retina for the following conditions: (a) when the fully-dark adapted retina was exposed for 30 sec. to a blue-green light of 7:35 log scot td intensity; (b) when the retina, so illuminated, had dark-adapted for 30 sec.; (c) when the retina, so dark-adapted, was re-exposed to the above illumination. The maxima of the difference spectra moved in the above sequence from 507 nm to approximately 485 nm. Some simple assumptions are

made as regards possible chemical changes that might account for this spectral shift. When they are allowed for, it is found that the maximum of the difference spectrum measured under (a) is consistent with the photolysis of a pigment absorbing maximally at 497 nm. The complex of break-down products postulated has a photosensitivity 1/130 in value of that of rhodopsin. Rhodopsin regeneration proceeds at half the rate of that previously noted for cone-pigments.

A68-80567
INTRAMOLECULAR ENERGY TRANSFER IN RHODOPSIN.
Allen Kropf (Amherst Coll., Dept. of Chem., Mass.)
Vision Research, vol. 7, Nov. 1967, p. 811–818. 15 refs.
Grant PHS NB-01923 and Res. Corp. supported research.

Irradiation of rhodopsin with ultraviolet light which is absorbed predominantly by the protein portion of the molecule results in bleaching, which follows the cis to trans isomerization of the retinylidene chromophore. Electronic excitation energy, supplied by the u.v. photons, is therefore transferred from the protein to its chromophore. On the average, about one out of every four photons absorbed by the protein causes bleaching of a molecule of visual pigment, which is to be compared with an efficiency of about two molecules of rhodopsin bleached per 3–4 photons of light absorbed directly by the chromophore.

A68-80568
A CONTRIBUTION TO THE DEVELOPMENTAL ANALYSIS METHOD: INITIAL VALUES, REACTIVITY AND DEVELOPMENTAL VALUES [YUR METHODIK DER VERLAUFSANALYSE: AUSGANGSWERTE, REAKTIONSGROSSEN (REAKTIVITAT) UND VERLAUFSWERTE].
J. Fahrenberg and M. Myrtek (Freiburg i. Br. U., Physiol. Inst., West Germany).
Psychologische Beiträge, vol. 10, no. 1, 1967, p. 58–77, 148. 60 refs. In German.
Deut. Forschungsgemeinschaft supported research.

Psychophysiological stress experiments involving special cases of developmental analyses present a particular biometric problem. According to Wilder's law, reactivity depends on the initial values. This observation which has been corroborated in many ways can at least partly be reduced to a pseudo-correlation of mathematical values. For a correction Lacey's "autonomic lability scores" method is the best one of those listed in the article. The discussion of the presented problem and of the pertinent points of view as well as the results of the psychophysiological experiment were intended to help clarify the principle involved.

A68-80569
EVALUATION OF QUANTITATIVE IMPEDANCE PLETHYSMOGRAPHY FOR CONTINUOUS BLOOD FLOW MEASUREMENT. III. BLOOD FLOW DETERMINATION IN VIVO.
David G. Young, Jr., Robert H. Cox, Emery K. Stoner, and William J. Erdman (Pa. U., Hosp., Dept. of Phys. Med. and Rehabil., Philadelphia).
American Journal of Physical Medicine, vol. 46, Dec. 1967, p. 1450–1457. 10 refs.
VRA and Maclellan-Sloan Res. Proj. supported research.

A mathematical model originally derived by Schwan was adapated and extended for use at frequencies of operation used in commercially-available impedance plethysmographs. The model was used in conjunction with impedance measurements on the hindlimb of dogs, with the use of a venous-occlusion technique. The flow rates determined from the latter were compared to flow rates measured with an electromagnetic flowmeter. The agreement between the two methods is within experimental error. It was concluded from these results that it is justifiable to use impedance plethysmography to measure segmental blood flow clinically.

A68-80570
THE THUMBWHEEL SWITCH AS A DATA ENTRY DEVICE.
Dean W. Plath and Peter E. Kolesnik (North Am. Aviation, Inc., Autonetics, Anaheim, Calif.)
Human Factors, vol. 9, Oct. 1967, p. 479–482. 6 refs.

This study evaluated the speed and accuracy with which latitude and longitude coordinates can be entered into a computer by use of a thumbwheel switch unit. In addition, it determined the effect of flight gloves on thumbwheel operation, and compared two methods of using thumbwheels for entering coordinates. In the first method, one thumbwheel unit was used to enter both latitude and longitude of a given checkpoint before proceeding to the corrdinates of the next checkpount. In the second method, all latitude coordinates were entered sequentially, after which all longitude coordinates were entered in a similar manner. It was found that there were no significant differences in errors between gloved and ungloved operation, or between the two methods of entering coordinates. However, the two-unit method of entry was significantly faster than the one-unit method. It was concluded that the thumbwheel switch is suitable for use in entering navigational coordinates into an airborne computer.

A68-80571
VALIDATION OF AN INDICATOR OF MAMMALIAN RETINAL RECEPTOR RESPONSE: RECOVERY IN THE DARK FOLLOWING EXPOSURE TO A LUMINOUS STIMULUS.
Jay M. Enoch (Washington U., Med. School, Dept. of Ophthalmol. and Oscar Johnson Inst., St. Louis, Mo.)
Investigative Ophthalmology, vol. 6, Dec. 1967, p. 647–656. 21 refs.
Grants NIH NB-K3-15, 138-05 and NIH NB-02168-08.

A histochemical reaction was described which allowed the investigator to distinguish between light and dark adapted retinal receptors. The incubation medium employed contained nitro-blue tetrazolium, succinate, a tissue culture medium TC 199, and a buffer. The reactive process studied has its locus in the ellipsoid of the retinal receptor. Several response characteristics of this reaction have been reported, including the finding that this reactive process is dependent upon the absorption of energy by photosensitive pigment located in the neighboring receptor outer segment. In this paper, the recovery of the reactive process in the dark following exposure to light was considered. Dark adapted albino rats were exposed to calibrated luminous stimuli (500 nm.). After exposure, varying time periods (in the dark) were allowed prior to dissection of the retina from the eye of the living animal. The dissected retina was incubated in the dark in the standard medium, the reaction was stopped, and the retina was examined for the presence (or lack) of a strained image of the instrument field stop. The retinal irradiance of the (initial) stimulus was determined for threshold detection of the (subsequently) stained latent image on the retina. A relatively simple semilogarithmic relationship was found between the stimulus magnitude necessary to induce a just noticeable stained image, and the time the animal was kept in the dark following light exposure (recovery time).

A68-80572
THE INFLUENCE OF LIGHT AND DARK ON THE CATECHOLAMINE CONTENT OF THE RETINA AND CHOROID.

Charles W. Nichols, David Jacobowitz, and Marianne Hottenstein (Pa. U., School of Med., Depts. of Pharmacol. and Ophthalmol., Philadelphia).
Investigative Ophthalmology, vol. 6, Dec. 1967, p. 642–646. 15 refs.
Grants PHS 2T1-GM-957-05, PHS 1-RO1-NB-06707-01, and NIH 5-K3-NB-13,935-02.

Recent histochemical studies with the use of a fluorescence method to detect catecholamine-containing neutrons have uncovered a system of dopamine-containing amacrine cells as well as a plexus of norepinephrine-containing nerve terminals in the choroid. This study examined the effect of dark and light adaptation on the catecholamine content of the posterior segment of the eye of the albino guinea pig, rabbit, and rat by quantitative and histochemical means. In the rat and rabbit, there was a significant increase in the dopamine content with light adaptation. In the guinea pig, there was an increase, but this was not statistically significant. A significant increase in the norepinephrine content was observed in the posterior segment of the guinea pig and rabbit with light adaptation. The increase in norepinephrine appeared to be a direct effect on the choroidal nerve terminals, since with pigmented guinea pigs the increase was not observed. Likewise, decentralization of the choroid in albino guinea pigs did not alter the changes seen with light adaptation. Histochemical studies demonstrated a consistent increase in the fluorescence of the amacrine cells of the rabbit and guinea pig with light adaptation. It was not possible to show consistent changes in the rat.

A68-80573
THE EFFECTS OF IONIZING IRRADIATION ON LENS CATION PERMEABILITY, TRANSPORT, AND HYDRATION.
Brent W. Lambert and Jin H. Kinoshita (Mass. Eye and Ear Infirmary and Harvard Med. School, Howe Lab. of Ophthalmol., Boston).
Investigative Ophthalmology, vol. 6, Dec. 1967, p. 624–634. 10 refs.
(Contract AEC AT(30-1) 1368, Grants PHS 2-101 NB 05142, PHS NB 05090, and PHS S-K 3-17082.

The effect of *in vivo* X-irradiation on rabbit lens permeability was studied by the ^{86}Rb runout method. At 24 hr. following X-irradiation of the lens, the rate of ^{86}Rb runout was found to be increased and reached a maximum at one wk. Over the subsequent two wk. The rate of ^{86}Rb runout decreased, although still remaining above normal. The increase in lens permeability preceded the appearance of lens opacities and was found to be dose dependent. The active transport of cations as measured by ^{86}Rb uptake was unaffected. Alteration in lens permeability was accompanied by an increase in lens water. The effect of in vitro B irradiation on the permeability of the anterior or posterior lens surface was investigated and found to parallel *in vivo* X-irradiation to the entire lens.

A68-80574
TOXICOLOGICAL STUDIES ON CERTAIN MEDICAL GRADE PLASTICS STERILIZED BY ETHYLENE OXIDE.
R. K. O'Leary and W. L. Guess (Tex. U., Coll. of Pharm., Drug-Plastic Res. and Toxicol. Labs., Austin).
Journal of Pharmaceutical Sciences, vol. 57, Jan. 1968, p. 12–17. 17 refs.
Grant NIH CA-06120.

Ethylene oxide gas sterilization of plastics used in medical and pharmaceutical applications presents a toxicity problem which at the present time remains largely unsolved due to the increasing complexity of the plastic itself. A series of preliminary experiments was conducted to survey the problem and to present evidence of the toxic potential of plastics having a variety of chemical and physical properties. It was domonstrated that residual ethylene oxide caused extensive blood hemolysis and death to cells grown in culture.

A68-80575
A COMPARISON OF THE EFFECTS OF A RANGE OF HIGH ENVIRONMENTAL TEMPERATURES AND OF TWO DIFFERENT PERIODS OF ACCLIMATIZATION ON THE REPRODUCTIVE PERFORMANCES OF MALE AND FEMALE MICE.
Pamela R. Pennycuik (C.S.I.R.O., Div. of Animal Genet., North Ryde, N.S.W., Australia).
Australian Journal of Experimental Biology and Medical Science, vol. 45, Oct. 1967, p. 527–532. 10 refs.

A comparison was made between the effects of three different temperatures (21, 32.7 and 36.1°) on the fertility of the male mouse and of five different temperatures (21, 32.7, 34.6, 36.1, and 36.7°) on the fertility of the female mouse. At two temperatures (32.7 and 36.1°) the results of acclimatization for two different periods were compared. Male fertility was found to be normal in animals acclimatized as weaners to 32.7°, but at 36.1° fertility was reduced. When acclimatization was delayed until adulthood, fertility was seriously impaired at both temperatures. In the female, losses of offspring increased with rising temperature and deaths occurred at an earlier stage in the reproductive cycle. Animals acclimatized to 32.7° from weaning performed slightly better than those acclimatized as adults, but at 36.1° longer acclimatization had little effect on performance.

A68-80576
STUDIES OF INTESTINAL MICROFLORA. IV. THE MICROFLORA OF ILEOSTOMY EFFLUENT: A UNIQUE MICROBIAL ECOLOGY.
Sherwood L. Gorbach, Laila Nahas Louis Weinstein, Ruven Levitan, and James F. Patterson (Tufts U., School of Med., New England Med. Center Hosp., Boston, Mass.)
(Am. Gastroenterol. Assn., Ann. Meeting, Chicago, May 28, 1966).
Gastroenterology, vol. 53, Dec. 1967, p. 874–880. 7 refs.
Grants PHS 5TI 276-03, PHS AI 6365-02, and PHS AM-09332.

The microbial flora of ileostomy effluent, normal terminal ileal contents, and feces were compared. There were significant differences in the numbers and relative prevalence of microorganisms in each material. Ileostomy excreta appear to harbor a unique microbial ecology that is different from the normal microflora of the small or large intestine.

A68-80577
STUDIES OF INTESTINAL MICROFLORA. III. THE MICROBIAL FLORA OF HUMAN SMALL INTESTINAL MUCOSA AND FLUIDS.
Andrew G. Plaut, Sherwood L. Gorbach, Laila Nahas, Louis Weinstein, Gunter Spanknebel, and Ruven Levitan (Tufts U., School of Med., New England Med. Center Hosp., Boston, Mass.).
Gastroenterology, vol. 53, Dec. 1967, p. 868–873. 9 refs.
Grants PHS AI 6365-02, PHS 5TIAI 276-03, PHS 5TIAI 276-03, and PHS TIAM 5424-02.

Studies of the bacterial content of small intestinal fluid and of washed intestinal biopsy specimens from the same site were carried out in man. The predominant microbial flora of the juice consisted of anaerobic streptococci and lactobacilli. Similar organisms were adherent to specimens of tissue removed by biopsy and cultured after vigorous washing. Gram-positive cocci and rods resembling bacteria were found in the mucous layer adherent to the washed jejunal mucosa. No structures resembling microorganisms were demonstrated in the intestinal wall itself.

A68-80578
STUDIES OF INTESTINAL MICROFLORA. II. MICROORGANISMS OF THE SMALL INTESTINE AND THEIR RELATIONS TO ORAL AND FECAL FLORA.
Sherwood L. Gorbach, Andrew G. Plaut, Laila Nahas, Louis Weinstein, Gunter Spanknebel, and Ruven Levitan (Tufts U., School of Med., New England Med. Center Hosp., Boston, Mass.).
Gastroenterology, vol. 53, Dec. 1967, p. 856–867. 24 refs.
Grants PHS AI-6365, PHS 5TIAI-276, and PHS TIAM-5424

Sixty-eight samples of small bowel contents were obtained from 18 normal volunteers by long tube aspiration. The validity of this method was established in animal experiments and by duplicate sampling studies in man. The small bowel microflora was found to consist of small numbers of streptococci, lactobacilli, staphylococci, and fungi. These Gram-positive elements often grew in gastric contents and appeared to increase in numbers in the distal areas of the small intestine. A marked difference in the number and types of microorganisms present on the proximal and distal sides of the ileocecal valve was demonstrated. This structure appeared to demarcate two distinct microbial ecologies. The upper small bowel contained small numbers of Gram-positive bacteria, while bacteroides, anaerobic lactobacilli, and coliforms predominated in the colon. The distal ileum harbored a variable microflora and appeared to be a transitional zone between these two microbial populations.

A68-80579
STUDIES OF INTESTINAL MICROFLORA. I. EFFECTS OF DIET, AGE, AND PERIODIC SAMPLING ON NUMBERS OF FECAL MICROORGANISMS IN MAN.
Sherwood L. Gorbach, Laila Nahas, Phillip I. Lerner, and Louis Weinstein (Tufts U., School of Med., Dept. of Med. and New England Med. Center Hosp., Infectious Disease Serv., Boston, Mass.).
Gastroenterology, vol. 53, Dec. 1967, p. 845–855. 27 refs.
Grants PHS AI-6365 and PHS 5TIAI-276.

Quantitative and qualitative studies of the microflora of the feces of 70 normal individuals, aged 20 to 100 yr., were carried out. Elderly subjects were found to harbor fewer anaerobic lactobacilli (bifidus bacteria) and larger numbers of fungi and coliforms than young persons. Great variation in the numbers of bacteria was noted in people of the same age. Careful analysis of two small groups of individuals demonstrated that these differences were not due to errors or difficulties in sampling or to variations in diet. Despite the differences between the fecal microbial flora of different individuals, the numbers of bacteria recoverable from the same person over a seven wk. or seven mo. period were noted to be remarkably stable.

A68-80580
CHANGES IN IRON METABOLISM IN NATIVES OF 13,000 FT. BROUGHT DOWN TO SEA LEVEL.
A. O. Carmena, A. Segade, F. J. Cavagnaro, and N. G. de Testa (St. Elizabeth's Hosp., Brighton, Mass.).
Nature, vol. 217, Jan. 6, 1968, p. 70–71. 5 refs.

The iron metabolism of healthy, high altitude dwellers in Argentina (average age = 18 yr.) was studied during the first 13 days after descent to sea level. There was a 20 to 30% increase in plasma iron and a decrease in the plasma iron turnover rate. Iron-59 clearance gradually increased, while red cell volume remained constant and plasma volume increased. The results showed a relationship between hypoxia and erythrokinesis in permanent dwellers at 13,000 ft.

A68-80581
INFLUENCE OF UV LIGHT ON CHOLESTEROL METABOLISM IN RATS [VPLYV ULTRAFIALOVEHO SVETLA NA METABOLIZMUS CHOLESTEROLU U KRYS].
V. Simko, P. Bobek, and V. Chorvathova.
Ceskoslovenska Gastroenterologie, vol. 21, no. 7, 1967, p. 469–474. 18 refs. In Czech.

Rats were exposed for a period of 84 days to UV irradiation. The irradiation caused a marked drop of liver cholesterol which led to a drop of the cholesterol pool in the liver, lungs and blood. In 24-hr. quantitative bile samples from irradiated rats, a markedly higher excretion of desoxycholic acid was found. The amount of excreted bile and bile cholesterol had a rising tendency after irradiation. After complete removal of bile in irradiated animals a significantly lower cholesterolaemia was recorded. The tendency of a higher fecal sterol excretion after irradiation is not significant. The drop of liver cholesterol in irradiated rats may be associated with its more rapid degradation in the liver. It is also possible that hepatic sterols shift into the irradiated skin where their content rises considerably. UV light may influence the biosynthesis of sterols.

A68-80582
EXPERIMENTAL UNDERNUTRITION. II. THE FATE OF TRANSFUSED RED BLOOD CELLS.
J. J. Haxhe (Louvain U., Lab. of Exptl. Surg., Belgium).
Metabolism, vol. 16, Dec. 1967, p. 1092–1095. 10 refs.
IAEA 185/R.B.

The fate of transfused red cells was investigated in experimentally undernourished dogs using a double tracer technique. Transfused red blood cells remained temporarily in circulation but caused a marked reduction in the volume of autologous red cells. As a result of a transfusion, the undernourished organism readapted its red cell volume to the need of the body cell mass for oxygen carriers, presumably by blocking its erythropoiesis.

A68-80583
EXPERIMENTAL UNDERNUTRITION. I. ITS EFFECTS ON CARDIAC OUTPUT.
J. J. Haxhe (Louvain U., Lab. of Exptl. Surg., Belgium).
Metabolism, vol. 16, Dec. 1967, p. 1086–1091. 27 refs.
Contract IAEA 185/R.B.

During progressive undernutrition in dogs, red cell volume, exchangeable potassium and cardiac output were repeatedly measured. After a 27% loss of body weight, the red cell volume and exchangeable potassium were reduced by 26 and 27%, respectively. Total and red cell cardiac output diminished respectively by 30 and 41%. The general slowing down of cell metabolism may also affect the activity of the cardiac muscle.

A68-80584
HANDEDNESS, EYEDNESS AND PERCEPTUAL STABILITY OF THE LEFT AND RIGHT VISUAL FIELDS.
John Paul McKinney (Mich. State U., East Lansing).
Neuropsychologia, vol. 5, Nov. 1967, p. 339–344. 14 refs.
Grants PHS MH 10363-01 and PHS MH 12511-01.

The perceptual stability of visual targets in the left vs. right visual fields was investigated by having subjects report the perceptual fragmentation of dim stimuli. The right visual field was found more stable than the left. This difference was not related to handedness but was significantly related to ocular dominance. Monocular results yielded significant laterality differences for the left eye, but not the right eye. An interpretation based on sensory cerebral dominance and retinal sensitivity was advanced to account for the results.

A68-80585
STUDIES ON THE VISUAL EVOKED RESPONSE. II. THE EFFECTS OF SPECIAL CORTICAL ACTIVITY.

Albert M. Potts and Tadashi Nagaya (Chicago U., Eye Res. Labs., Ill. and Yamaguchi Med. School, Dept. of Ophthalmol., Ube City, Yamaguchi-Ken, Japan).
(Assn. for Res. in Ophthalmol., Midwestern Sect. Meeting, Chicago, Apr. 1, 1966).
Investigative Ophthalmology, vol. 6, Dec. 1967, p. 657–665. 13 refs.
Grant PHS NB-02522.

Studies were made on the influence of stimulus through another modality on the visual evoked response (VER). The solution of simple (single digit, three operation) arithmetic problems caused a decrease in VER. The use of equal area, transilluminated letter stimuli with an associated button pushing task, maximized the VER and made it most constant.

A68-80586
THE EFFECTS OF AMPHETAMINES UPON JUDGMENTS AND DECISIONS.
Paul M. Hurst, Marianna Fry Weidner, and Robert Radlow (Inst. for Res., State College, Pa.).
Psychopharmacologia, vol. 11, Oct. 6, 1967, p. 397–404. 7 refs.
Grant NIMH MH-11294-01.

D-amphetamine sulfate, dl-amphetamine sulfate, and placebo were administered orally to 93 college student volunteers who served as their own controls in Latin Square design. Dosages were adjusted to the two-thirds power of body weight with the proportionality constant set for 14 mg./70 kg. with each drug. Effects were measured upon performances in a mathematical reasoning test, upon self-appraisals of these performances, and in a task which attached monetary payments to the accuracy of self-appraisals ("Decision Score"). The objectives of this research were (1) to reassess the biases in performance self-appraisals reported by Smith and Beecher, and (2) to determine whether these biases represent mere verbal expansiveness or whether they are reflected by changes in decision behavior. Smith and Beecher's effect upon self-appraisals was confirmed (at $p < .02$). Decision Score also was affected (at $p < .01$) in the predicted direction. Performance scores were not significantly affected.

A68-80587
BIOMECHANICS OF SPORTS MOTION [BIOMECHANIK SPORTLICHER BEWEGUNGEN.
Gerhard Hochmuth.
Berlin, Sportverlag, 1967, [230] p. In German.

The concepts of biomechanics are used in studying the motion of sports in this book. Topics included were: (1) basic laws of mechanics; (2) biomechanical hypotheses and characteristics of the human motor apparatus; (3) external force during sports motion; (4) dynamic relationship between inner and external forces; (5) biomechanical experimental methods; (6) sports techniques and biomechanical characteristics (structure of motion); and (7) biomechanical principles.

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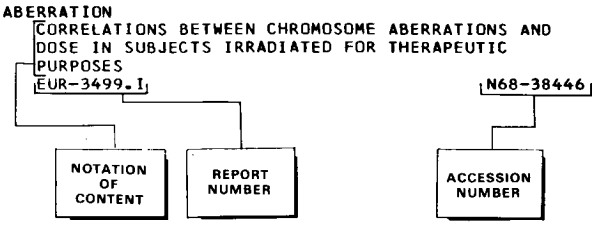

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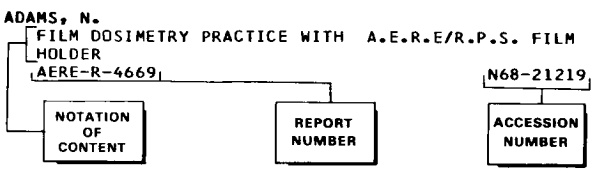

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