NASA SP-7011 (80)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Scientific and Technical Information Division
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. SEPTEMBER 1970

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Aerospace Medicine and Biology is a continuing bibliography which, by means of periodic supplements, serves as a current abstracting and announcement medium for references on this subject. The publication is compiled through the cooperative efforts of the American Institute of Aeronautics and Astronautics (AIAA) and NASA Scientific and Technical Information Facility. It assembles, within the covers of a single bibliographic announcement, groups of references that were formerly announced in separate journals, and provides a convenient compilation for medical and biological scientists. Additional background details for this publication can be found in the first issue, NASA SP-7011, which was published in July, 1964. Supplements are identified by the same number followed by two additional digits in parentheses.

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.

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American Institute of Aeronautics and Astronautics, Inc.
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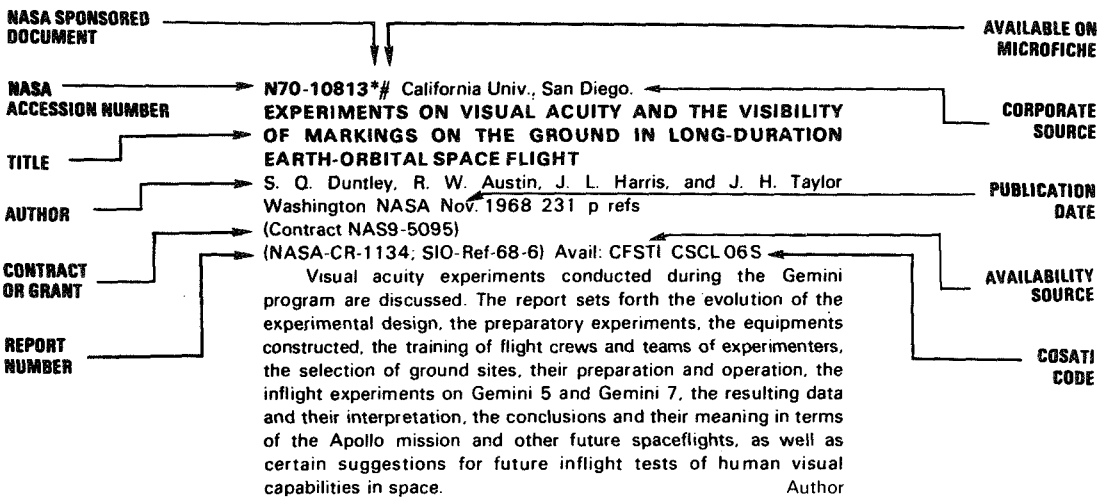

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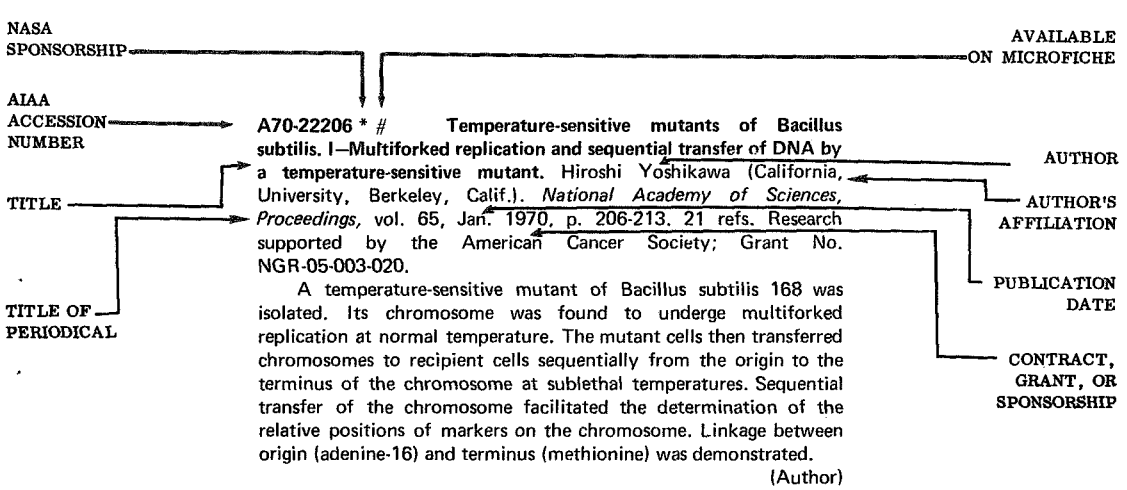

AEROSPACE MEDICINE AND BIOLOGY

a continuing bibliography SEPTEMBER 1970

STAR ENTRIES

N70-29217# *Bolt, Beranek, and Newman, Inc., Cambridge, Mass.*
AEROSOL BEHAVIOR IN HIGH PRESSURE ENVIRONMENTS: SECOND ANNUAL REPORT Final Scientific Report, 1 Mar. 1969 - 28 Feb. 1970
Robert A. Gussman and Anthony M. Sacco 28 Feb. 1970 38 p refs
(Contract N00014-69-C-0228)
(AD-700929; Rept-1894; AR-2) Avail: CFSTI CSCL 6/11

The second year of a study has been completed whose main purpose is to elucidate hazards to personnel arising from aerosols in high pressure helium-oxygen atmospheres. The years efforts included: experimental studies on the generation of aerosols in the high pressure environment, pulmonary deposition modeling, theoretical filter efficiency calculations, and the construction of a high pressure filtration efficiency test apparatus. The first two topics listed are described separately in a previous special report, AD-683 794. Author (TAB)

N70-29221# Federal Aviation Administration. Oklahoma City, Okla. Office of Aviation Medicine.
EXPERIMENTAL COMPARISON OF TRAUMA IN LATERAL (+G SUB y), REARWARD-FACING (+G SUB x), AND FORWARD-FACING (−G SUB x) BODY ORIENTATIONS WHEN RESTRAINED BY LAP BELT ONLY
Richard G. Snyder, Clyde C. Snow, Joseph W. Young, G. Townley Price, and Peter Hanson Jul. 1969 25 p refs
(FAA-AM-69-13) Avail: CFSTI

Twenty-four anesthetized Savannah Baboons (Papio cynocephalus) restrained with a lap belt were subjected to a controlled series of lateral impacts at entrance velocities ranging from 36.4 ft./sec. (15g.) to 88.2 ft./sec. (44g.) 1,200 g./sec. to 5,900 g./sec. rate of onset, for total durations of 0.076 to .100 second. Sixteen lateral tests were run with four forward-facing and four rearward-facing controls. Gross and microscopic autopsies were performed. Pathology was found to be significantly higher in lateral impact. Ruptured bladders and uteri, adrenal hemorrhage, and subdural and epidural hemorrhage occurred frequently. A major finding, with unexplained etiology, was marked pancreatic hemorrhage most typical of the lateral impact. Under these test conditions, both survival and injury tolerance levels were found to be lower in the lateral body orientation, indicating lap belt restraint alone does not provide adequate body protection. Author

N70-29302*# Exotech, Inc., Washington, D.C.
ANALYTICAL TECHNIQUES IN PLANETARY QUARANTINE Final Report
May 1970 137 p refs
(Contract NASw-1734)
(NASA-CR-110224; TRSR-70-13) Avail: CFSTI CSCL 06F

CONTENTS:

1. INTRODUCTION AND SUMMARY [OF ANALYTICAL TECHNIQUES IN PLANETARY QUARANTINE] 19 p refs (See N70-29303 15-04)
2. POTENTIAL EFFECTS OF RECENT FINDINGS ON SPACECRAFT STERILIZATION REQUIREMENTS, APPENDIX A L. B. Hall (NASA. Washington, D.C.), S. Schalkowsky, and R. C. Kline 18 p refs (See N70-29304 15-05)
3. INVESTIGATIONS INTO A DIFFUSION MODEL OF DRY HEAT STERILIZATION, APPENDIX B M. J. Barrett 18 p refs (See N70-29305 15-04)
4. AN ANALYTICAL BASIS FOR ASSAYING BURIED BIOLOGICAL CONTAMINATION, APPENDIX C R. C. Kline and P. L. Randolph 30 p refs (See N70-29306 15-05)
5. THE RELEASE OF BURIED MICROBIAL CONTAMINATION BY AEOLIAN EROSION, APPENDIX D M. J. Barrett and J. L. Woodall 16 p refs (See N70-29307 15-04)
6. IMPLEMENTATION OF A CHEMICAL CONTAMINANT INVENTORY FOR LUNAR MISSIONS, APPENDIX E 35 p refs (See N70-29308 15-04)

N70-29303*# Exotech, Inc., Washington, D.C.
INTRODUCTION AND SUMMARY [OF ANALYTICAL TECHNIQUES IN PLANETARY QUARANTINE]
In its Anal. Tech. in Planetary Quarantine May 1970 19 p refs (See N70-29302 15-04)
Avail: CFSTI CSCL 06M

Results of work to support the NASA Planetary Quarantine Office are reported. The four areas discussed include review and interpretation of planetary quarantine requirements, analysis of microbial survival, development and application of pertinent analytical techniques, and implementation of a lunar chemical contamination inventory. Author

N70-29304*# Exotech, Inc., Washington, D.C.
POTENTIAL EFFECTS OF RECENT FINDINGS ON SPACECRAFT STERILIZATION REQUIREMENTS, APPENDIX A
S. Schalkowsky, L. B. Hall (NASA. Washington, D.C.), and R. C. Kline *In its* Anal. Tech. in Planetary Quarantine May 1970 18 p refs (See N70-29302 15-04)
(Contracts NASw-1558; NASw-1666)

Avail: CFSTI CSCL 06M

An important task related to the formulation of planetary quarantine standards is the achievement of an acceptable compromise between (1) the prevention of planetary contamination and (2) the impact of quarantine requirements on the conduct of planetary missions. An analytical framework is provided for the assessment of data which has become available during the past year or which is currently being evolved. In particular, an evaluation is made of the probability of release of viable organisms from the spacecraft as a function of: (1) impact velocity magnitudes and the probability of their occurrence; (2) the degree of equipment fracturing at impact velocities; and (3) the number of viable organisms in spacecraft materials. Work being done to quantify each of three types of contamination, i.e. that on open surfaces, mated surfaces and buried contamination, is described in the context of seeking an approach to spacecraft sterilization that would be most compatible with the implementation of planetary missions. It is concluded that the results of work now in progress may lead to less severe dry-heat sterilization of planetary spacecraft than had been considered necessary in the past. Author

N70-29305*# Exotech, Inc., Washington, D.C. Systems Research Div.

INVESTIGATIONS INTO A DIFFUSION MODEL OF DRY HEAT STERILIZATION, APPENDIX B

M. J. Barrett *In its* Anal. Tech. in Planetary Quarantine May 1970 18 p refs (See N70-29302 15-04)

(TRSR-041) Avail: CFSTI CSCL 06M

The analytical model described formalizes the hypothesis that dry heat inactivation of microorganisms is closely related to the water content of the spore and its micro-environment. Experimental data are examined relative to this model and it appears to be valid. The model is aimed at overcoming the well known deficiencies of the logarithm model. Author

N70-29306*# Exotech, Inc., Washington, D.C. Systems Research Div.

AN ANALYTICAL BASIS FOR ASSAYING BURIED BIOLOGICAL CONTAMINATION, APPENDIX C

Robert C. Kline and Phillip L. Randolph *In its* Anal. Tech. in Planetary Quarantine May 1970 30 p refs (See N70-29302 15-04)

(TRSR-036) Avail: CFSTI CSCL 06M

An analysis of a procedure for assaying biological contamination buried or embedded in spacecraft materials is presented. The procedure requires the controlled fracture of representative samples of a material whose buried loading is of interest. Each sample is tested for biological contamination on the totality of surfaces exposed as a result of the fracturing process. The basic datum or observation consists of the proportion of samples which yield contamination upon culturing. Conventional statistical techniques, combined with an assumed relation between the mean concentration of organisms buried within the material and the observed datum, produce an upper bound estimate for the unknown mean concentration, expressed to any prescribed level of confidence. In principle, the conservativeness of the resulting estimate is directly related to the sample size and the amount of surface area exposed by fracture; as the sample size and/or exposed area increase(s) the difference between the estimate and the unknown mean load tends to decrease. Author

N70-29307*# Exotech, Inc., Washington, D.C.

THE RELEASE OF BURIED MICROBIAL CONTAMINATION BY AEOLIAN EROSION, APPENDIX D

Matthew J. Barrett and J. Lyndon Woodall *In its* Anal. Tech. in Planetary Quarantine May 1970 16 p refs (See N70-29302 15-04)

(TRSR-70-14) Avail: CFSTI CSCL 06F

The impact of a lander on a planet could have serious consequences if it is desired not to contaminate the planet. The implications of fracturing and exposing of surfaces which might instantaneously or subsequently release viable spores are considered. The relatively slow process of erosion is discussed, although the fracture and the erosion phases are not necessarily independent. The fracture is assumed to have occurred and is characterized by a fracture-ratio. The fracture-ratio is defined as the area exposed through fracture divided by the volume of the sample. An expression for the erosion of spherical shaped particles and an expression for the probability of release given that a quantity of the sample erodes in the quarantine period are derived. Calculations based on experimental data are made for the erosion rate. Author

N70-29308*# Exotech, Inc., Washington, D.C.

IMPLEMENTATION OF A CHEMICAL CONTAMINANT INVENTORY FOR LUNAR MISSIONS, APPENDIX E

In its Anal. Tech. in Planetary Quarantine May 1970 35 p refs (See N70-29302 15-04)

(TRSR-70-07) Avail: CFSTI CSCL 06F

The study represents the initial step in the implementation of the given approach in that it considers the detailed procedures and tasks to be undertaken to collect, evaluate, store and disseminate data which will serve anticipated needs of lunar sample investigators, consistent with the requirement that costs associated with implementation and operation of the inventory be consistent with known needs for this information. The primary tasks pertinent to this effort involved: (1) determining the availability of lunar mission vehicle documentation and the means for collecting it in a form suitable for future evaluation; (2) the collection and utilization of spacecraft trajectory parameters, landing sites, and dispersion patterns for crash and soft landings, and (3) evaluating the compatibility of required data inputs with the existing planetary quarantine information system. Author

N70-29310# Oakland Univ., Rochester, Mich. Inst. of Biological Sciences.

BIOCHEMICAL STUDIES ON THE OCULAR LENS IN RELATION TO CATARACTOGENESIS Progress Report, 1 Dec. 1968 -31 Jan. 1970

V. Everett Kinsey and V. N. Reddy 31 Jan. 1970 14 p

(Contract AT(11-1)-2012)

(COO-2012-4; PR-4) Avail: CFSTI

The onset of cataracts following exposure to ionizing radiation is accompanied by a fall in the concentration of glutathione (GSH). In view of this, a C-14 tracer study was designed to determine whether variations in the permeability of the lens surface membrane were responsible for the phenomenon. Barring the existence of an extended latent period, which is currently under study, it was found that x irradiation did not alter the permeability of the lens membrane to GSH. Research is also continuing in the investigation of the source of the potential difference that exists between the inside and the outside of the lens. Results of experiments involving the movement of chlorides across the membrane strongly suggest that sodium is actively transported across the membrane and that this is responsible for the current. It was further concluded that the negative lens fiber potential results from the action of this sodium pump. NSA

N70-29325# Los Alamos Scientific Lab., N. Mex.

HEALTH AND SAFETY MANUAL OF THE ANALYTICAL CHEMISTRY GROUP

William H. Ashley, Arthur L. Henicksman, Al Zerwekh, and Charles F. Metz Aug. 1969 30 p refs

(Contract W-7405-eng-36)

(LA-4092) Avail: CFSTI

Topics covered include: emergency action, heart-lung resuscitation, general safety, safety in handling hazardous materials, shop safety, electrical safety, fire safety, and safety in handling fissionable materials. NSA

N70-29333 Mississippi Southern Coll., Hattiesburg.
A CORRELATIONAL ANALYSIS OF MONAURAL TEMPORAL SUMMATION AND LOCALIZATION
Jane Vivian May (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-20154

The purpose of this study was to investigate the relationship between the ability to monaurally match brief stimuli and to binaurally localize these stimuli in space, in order to explore the role time sensitivity of individual ears plays in ability to localize tones. Thirty subjects, fourteen males and sixteen females, served as experimental subjects. The task of the subject consisted of matching durations of a series of pure tones for each ear, and localizing these tones free field. Analysis of the results indicated that the ability of the left ear to match durations and detect azimuths was better than that of the right ear. Correlation coefficients of measures indicated that relationships between the ears for duration matching were dependent upon the duration of the tone, whereas the relationships for localization were dependent upon frequency. Dissert. Abstr.

N70-29346# Institute for Cancer Research, Philadelphia, Pa.
STUDIES OF THE EFFECTS OF ULTRAVIOLET RADIATION ON CELL STRUCTURE AND BEHAVIOR Annual Progress Report, Jan. –Nov. 1969
Jerome J. Freed 8 Dec. 1969 14 p refs
(Contract AT(30-1)-2356)
(NYO-2356-36) Avail: CFSTI

Two haploid lines of frog cells were found to be chromosomally stable through more than 200 generations in culture. From the more vigorous line chemical mutagens were used to elicit a high yield of clones resistant to BUdR; all of these appeared to lack the enzyme thymidine kinase. The haploid line, which has a single nucleolar organizer, proved useful in studies of nucleolar function. As a result of studies on puromycin resistance, a stable and highly resistant heteroploid line with useful marker chromosomes was derived. Resistance to both puromycin and actinomycin D is associated with restricted incorporation of the drugs. Electron microscope studies were conducted on HeLa cells to determine the relationship of cell motility to the cytoplasmic microtubule system. Measurements of the rate of cell spreading after subculture by the trypsin procedure suggested that microtubules were required for extension of the cells on a growth surface. NSA

N70-29376*# Sandia Corp., Albuquerque, N.M. Planetary Quarantine Dept.
USER'S MANUAL FOR PLANETARY QUARANTINE LUNAR PROGRAMS INFORMATION SYSTEM USING THE CDC 217 REMOTE CONSOLE
A. L. Wyer and A. L. Roark Oct. 1968 31 p refs
(NASA Order R-09-019-040)
(NASA-CR-110339; SC-M-68-602) Avail: CFSTI CSCL 06M

Portions of the research report describing the planetary quarantine computer programs and portions of the computer manufacturer's instructions were extracted, rearranged, and combined to provide the remote console operator with a workable set of instructions. Author

N70-29377# Department of the Army, Fort Detrick, Md. Protection Branch.
COMPARISON OF MICROBIAL CONTAMINATION LEVELS ON BARBAC AND COTTON HERRINGBONE TWILL CLOTH
Dorothy M. Portner 16 Dec. 1968 8 p ref
(NASA Order R-35)
(NASA-CR-110338; Rept-6-69) Avail: CFSTI CSCL 06M

An investigation to determine whether the cloths repel microorganisms and to determine a decontamination procedure for astronauts' isolation garments is reported. Pieces of cloth in vertical and horizontal positions were contaminated by natural aerial fallout by an artificial aerosol. Greater contamination was found in pieces in the horizontal position than in the vertical one, but no significant difference was noted between the barbac and the control twill. Air resistance of the cloth was tested before and after treatment with hair spray, and it is felt that the use of hair spray does aid in preventing microorganisms from passing through a garment. N.E.N.

N70-29383*# Naval Aerospace Medical Inst., Pensacola, Fla.
GROWTH OF 'STAPHYLOCOCCUS AUREUS' IN A NULL MAGNETIC FIELD ENVIRONMENT
Dietrich E. Beischer and Glenda S. Cowart 23 Apr. 1970 10 p refs
(NASA Order W-12766; NASA Order ER-19841)
(NASA-CR-110239) Avail: CFSTI CSCL 06M

No significant differences were observed between the growth of S. aureus in the geomagnetic field with a field strength reduced by a factor of 1000. Pigmentation, mannitol fermentation, gelatinase activity, coagulase production, and catalase activity were also not influenced by the low magnetic field. The results are discussed in their relation to previous findings of R. O. Becker who observed a reduction of growth rate in fields of lower field strength than the geomagnetic field. Author

N70-29400 National Lending Library for Science and Technology, Boston Spa (England).
EQUIPMENT AND MATERIALS FOR THE TROPICS
Z. G. Razumovskaya et al 25 Jan. 1970 9 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 3, 1957 p 69–72
(NLL-RRE-Trans-258A-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The growth of fungi spores on the glasses of optical instruments was investigated. Observations showed that the fungi tested grew best of all on quartz, the surface of which is neutral for them. In individual trials, the development of the fungi mycelia was abundant on the TF4, BF17, K8, and TK16 types of glass. In the case of KF3, either no development of fungi occurred or only the growth of a few spores and a little development of mycelia was observed. This glass contains a large amount of alkali which is liberated by the moisture and this, probably, was the reason for the poor development of the fungi. The nature of the growth and the intensity of the development were assessed. J.M.C.

N70-29461# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PAPERS ON THE PSYCHOPHYSIOLOGY OF LABOR OF ASTRONAUTS (COLLECTION OF ARTICLES)
F. P. Kosmolinskiy et al 24 Sep. 1968 203 p refs Transl. into ENGLISH from the Publ. "Ocherki Psikhofiziologii Truda Kosmonavtov" Moscow, Meditsina, 1967 p 3 167

(AD-684690; FTD-MT-24-310-68) Avail: CFSTI CSCL 5/10

Contents: Peculiarities of the work activity of astronauts during prolonged space flight; The physiological basis of human adaptation to specific conditions of activity; Sensory deprivation in space flight; Influence of various conditions of work and rest on the functional state of man during a prolonged stay in a pressurized chamber; Influence of the change of the regime of diurnal activity on the human organism under conditions of isolation; The significance of muscular activity in preserving the stability of the motor function of the astronaut; and investigation of the motor function of man under conditions of a modified diurnal regime. TAB

N70-29514# Kansas State Univ., Manhattan. Dept. of Psychology.

INTEGRATION OF RESPONSES BETWEEN DIFFERENT TYPES OF CONES AND BETWEEN RODS AND CONES

Joseph William Metz and John Lott Brown Jan. 1970 44 p refs

(Contract Nonr-3634(04))

(AD-701328; TR-11) Avail: CFSTI CSCL 6/16

Separation and identification of function of rods and cones in a mixed receptor population was achieved. Threshold level mixtures of two monchromatic stimuli with varying degrees of spectral separation showed the degree of integration of response between different receptor types. A small degree of integration of response was observed between rods and long wavelength cones. As the two monochromatic stimuli became more spectrally separated the degree of integration between different cone types decreased gradually. This was accounted for in terms of a trichromatic-opponent theory of color vision. A much larger degree of integration between different cone types was observed in the parafovea than had been observed in the fovea by previous investigators. A possible difference in the way the three cone mechanisms interact in the fovea and parafovea was suggested. Author (TAB)

N70-29540# School of Aerospace Medicine, Brooks AFB, Tex.

NEPTUNE: A MULTIELEMENT TASK SYSTEM FOR EVALUATING HUMAN PERFORMANCE Final Report, May 1963 – May 1968

Richard E. Mc Kenzie, Doyle D. White, and Bryce O. Hartman Oct. 1969 73 p refs

(AD-700313; SAM-TR-69-25) Avail: CFSTI CSCL 5/10

A multielement psychomotor test device called Neptune (for neuropsychiatric test unit) was devised to study the airmans behavior as systems operator as well as pilot. Two Neptune configurations have been developed: the Mark 1, which incorporates the functions of vigilance, arithmetic and encoding, compensatory tracking, visual monitoring with short-term memory, and problem-solving; and the Mark 2 which contains the same tasks and, in addition, an auditory monitoring task. Task descriptions, circuit design and operation, parts lists, illustrative data from subjects participating in test standardization studies, and illustrative experimental data are provided. In addition to measuring human performance, the system has the capability for inducing a unique task-stress factor. Author (TAB)

N70-29607# Pittsburgh Univ., Pa. Dept. of Pharmacology.

VESTIBULAR FUNCTION AND SPATIAL ORIENTATION Final Report, 15 Sep. 1965 – 14 Sep. 1969

Gerhard Werner 9 Feb. 1970 30 p refs

(Grant AF-AFOSR-1005-66)

(AD-701093; AFOSR-70-0336TR) Avail: CFSTI CSCL 6/16

The project was concerned with the study of the quantitative aspects of the neural activity in primary afferent nerve fibers from the vestibular organ, recorded with microelectrodes at the entry of the vestibular nerve into the brain stem; and with the characterization of the activity of individual second-order neurons in the vestibular nuclear complex. The emphasis was, firstly, on the determination of the quantitative relation between measures of single unit activity and precisely monitored position of the animal preparation in the gravitational field; and secondly, on the acquisition of these data in animal preparations which are not subjected to general anesthesia, and with the central nervous system entirely intact. Author (TAB)

N70-29619# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

SEVERAL MAN/MACHINE CONSIDERATIONS FOR HELICOPTERS

D. E. Cooper and L. S. Szustak *In* AGARD Probl. of the Cockpit Environment Mar. 1970 24 p refs (See N70-29618 15-02)

Avail: CFSTI

The helicopter, by the nature of its versatility, is assuming a greater role in a wide range of new and demanding tasks. This expanded usage requires that special considerations be given to practically all aspects of the man/machine relationship. The pilot must control his helicopter's six degrees-of-freedom by using four modes of control. Further, the pilot receives a variety of visual, motion, and force cues which, if properly presented and used, can increase the ease of the piloting task. Recent theoretical work and flight test experience on several Sikorsky helicopters in the areas of flying and handling qualities have produced a number of significant factors relating to the man/machine interface. Author

N70-29620# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

TRACKING A DISPLAY APPARENTLY VIBRATING AT 1-10 Hz

H. F. Huddleston *In* AGARD Probl. of the Cockpit Environment Mar. 1970 10 p refs (See N70-29618 15-02)

Avail: CFSTI

Thirty-six subjects tracked a 2-element visual display which was viewed through a mirror system arranged to impose apparent vertical vibration on the display. The frequency range 1-10 Hz was explored at double amplitudes of 2 deg, 4 deg and 8 deg vibration. A significant decrement in performance which was frequency-dependent and which was most marked over the range 2-5 Hz was noted. The higher vibration amplitudes were more harmful over the range 1-3 Hz, where subjects said they attempted to follow the display oscillation with their eyes, and were most helpful over the range 5-10 Hz, where a flickering nodal image of the display can be usefully fixated (at top and bottom of the vibration excursion). These findings relate to information on the breakdown of the eye pursuit system from 1-4 Hz. Data from EOG studies are presented to show how the eye decreases its pursuit amplitude and lags in phase, progressively, as frequency increases. This pursuit fails whether the target is a large retinal image eliciting the reflexive action of a presumed mid-brain center or whether subjects consciously try to follow a small target against a visible static surround. Finally, it is clear that performance on a display element requiring visual discrimination (of a vernier acuity type) along the direction of display vibration will be significantly more impaired than on that requiring discrimination across the direction of vibration. Author

N70-29621# Royal Aircraft Establishment, Farnborough (England).
OPTIMISATION OF THE COCKPIT ENVIRONMENT AND THE CREW-COCKPIT INTERFACE
G. R. Allen and J. M. Shaw *In* AGARD Probl. of the Cockpit Environment Mar. 1970 13 p refs (See N70-29618 15-02)
Avail: CFSTI

An engineer's approach to the optimization of the cockpit environment and the crew cockpit interface is presented. The position in the human engineering field is compared with that existing in other branches of aircraft engineering where optimization in terms of mechanical performance and cost is relatively successful. Optimization in terms of effectiveness is less successful because in part it involves the performance of the man. Three aspects of the overall problem are discussed to illustrate the type of information required by the engineer and how it can be obtained. Author

N70-29622# Jan Swammerdam Inst., Amsterdam (Netherlands). Lab. of Ergonomic Psychology.
OBJECTIVE MEASUREMENT OF MENTAL WORKLOAD; POSSIBLE APPLICATIONS TO THE FLIGHT TASK
J. W. H. Kalsbeek *In* AGARD Probl. of the Cockpit Environment Mar. 1970 7 p refs (See N70-29618 15-02)
Avail: CFSTI

Some methods and techniques are developed and applied in simulation experiments in order to evaluate cockpit workload. Heart beat irregularity patterns are scored as a function of the number of signals per minute answered by six subjects in a laboratory test situation. Distraction stress is evaluated in relation to the step-by-step disintegration of writing performance. A description is given of the mental task simulator which is applied to cockpit design. J.M.C.

N70-29626# Entwicklungsring Sud, Munich (West Germany).
INVESTIGATIONS OF THE TERM "REMNANT SPECTRUM" OF THE HUMAN CONTROL OUTPUT FUNCTION
Ruediger Seifert and Udo Miller *In* AGARD Probl. of the Cockpit Environment Mar. 1970 8 p refs (See N70-29618 15-02)
Avail: CFSTI

A survey of the experimental approach to find criteria to assess man's performance in a given system, and on the other hand to find methods to define the task load, and therewith the difficulty of a system, without applying known descriptive models, is given. The rationale of the approach is to investigate manual tracking control systems, while applying mathematically defined varied input forcing functions. Author

N70-29627# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
A CONSIDERATION OF THE INFLUENCE OF INFORMATION TRANSMISSION ON THE EVALUATION OF DISPLAY SYSTEMS
G. Schweizer *In* AGARD Probl. of the Cockpit Environment Mar. 1970 9 p (See N70-29618 15-02)
Avail: CFSTI

The evaluation of display systems meets difficulties because there is no certainty what criterion the man uses to optimize his performance. If one considers the man-machine system as a communication channel, measurements of the rate of the transmission of the information by the system may result in data that correlates with subjective evaluations. If there is any mismatching between the components of the display system, the transmission of the information will be reduced. Some basic problems of information theory are explained, and its use to assess the human performance in instrument monitoring tasks. Results of various simulator studies with integrated electronics displays are shown. Our experience is that this approach to assess the performance of the human monitor has benefits and potentials. The experiments indicate that the results are useful in designing integrated displays. Author

N70-29629# Litton Systems, Inc., Woodland Hills, Calif.
THE COCKPIT AS A "BRAIN CENTER" TRADE-OFF
Raymond E. Bernberg *In* AGARD Probl. of the Cockpit Environment Mar. 1970 16 p refs (See N70-29618 15-02)
Avail: CFSTI

A discussion of the problems concerned with target detection and acquisition is presented. The discussion analyzes the human operator and his information input and storage capabilities. A model of the human process is made with computing system elements. This serves as a basis for a trade-off comparison between human and computer systems; the philosophy behind these considerations is the concept of unburdening the pilot and copilot and providing a man/machine balance which is most effective at a given technological time frame. The results of the trade-off indicate that man does not execute brain type operations with a wide bandwidth as does modern computer technology. However, man does have an immense mass and associative memory storage function which is well beyond the technology of computing elements in the near future. An approach to a possible effective balance for this problem is suggested. Author

N70-29630# British Aircraft Corp., Preston (England).
CREW WORKLOAD SHARING ASSESSMENT IN ALL-WEATHER, LOW-LEVEL STRIKE AIRCRAFT
Alan F. Daniels *In* AGARD Probl. of the Cockpit Environment Mar. 1970 11 p (See N70-29618 15-02)
Avail: CFSTI

The first phase of an experimental program undertaken to investigate various aspects of crew workload and workspace assessment is described. In particular, the use of time-lapse filming techniques to assist in the evaluation of workspace utilization is detailed. The results obtained and the limitations encountered during a relatively inexpensive study in the early feasibility stages of an aircraft program are discussed. Author

N70-29632# Boeing Co., Seattle, Wash.
A DEVELOPMENT IN COCKPIT GEOMETRY EVALUATION
Leo F. Hickey, Wayne E. Springer, and Fracis L. Cundari (ONR, Washington, D.C.) *In* AGARD Probl. of the Cockpit Environment Mar. 1970 27 p refs (See N70-29618 15-02)
(Contract N00014-68-C-0289)
Avail: CFSTI

The overall problem of cockpit evaluation is discussed. Within this context, the specific problem of cockpit geometry evaluation is explored. Known methods for evaluating geometry (the physical layout of the entire cockpit complex - displays, controls, seats, personal equipment, windshield/canopy, interior surface shape, openings for ingress and egress) are summarized. Their advantages and disadvantages are presented. The application of modeling techniques that take advantage of computer capability to improve geometry evaluation is discussed. A research program, in progress, directed toward the full development of a computerized model of the physical aspects of flight crewmen and any cockpit configuration is presented in some detail. Author

N70-29633# Army Natick Labs., Mass. Pioneering Research Lab.
THE UTILIZATION OF MILITARY ANTHROPOMETRY FOR AIRCRAFT COCKPIT DESIGN
Robert M. White *In* AGARD Probl. of the Cockpit Environment Mar. 1970 11 p refs (See N70-29618 15-02)
Avail: CFSTI

Since anthropometric data constitute a basic requisite for defining the elements of body size in the human engineering of man/equipment systems, anthropometry represents an essential input to the development of such systems in order to achieve compatibility between the man and his equipment. The analysis and evaluation of anthropometric data are discussed, with reference to newly available data on the US military population. The US data indicate distinct differences in body size between flying and non-flying military personnel, primarily due to a marked difference in age. Finally, some general observations are made regarding the applications of anthropometric data in aircraft cockpit design. Author

N70-29634# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
GROUND AREAS VISIBLE FROM THE AIRCRAFT COCKPIT EYE POSITION: A METHOD OF EVALUATION
K. W. Kennedy *In* AGARD Probl. of the Cockpit Environment Mar. 1970 11 p (See N70-29618 15-02)
Avail: CFSTI

A method for evaluating and comparing aircraft in terms of the ground areas visible from their cockpits and demonstrate its use on two aircraft is described. Emphasis is placed on the visual reconnaissance activity. The method of evaluating vision toward the ground consists of calculating the areas of selected sectors of the surface of the earth which are visible from the cockpit eye position. Author

N70-29635# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
PILOTS' ASSESSMENT OF THEIR COCKPIT ENVIRONMENT
J. F. Murrell *In* AGARD Probl. of the Cockpit Environment Mar. 1970 8 p refs (See N70-29618 15-02)
Avail: CFSTI

Assessment by the user pilot is an important source of information as to the efficiency of aircraft display and control systems. Much information can be gained and reduced to quantitative form by use of open-ended questions. In the study reported, 229 civilian airline pilots representing nine different aircraft types, responded to five open-ended questions about design and layout of their cockpit. Pilots flying different types of aircraft agreed in the frequency of their comments and criticisms. They most often criticized their radio and navigation aids. Application of these results is discussed. Author

N70-29660# Factory Mutual Research Corp., Norwood, Mass.
AN ENGINEERING STUDY OF FIRE PROTECTION RESEARCH Final Report
Myron J. Miller and John Andrias Jun. 1969 114 p refs
(Contracts N00025-68-C-0026; NBy-88566)
(AD-700337; FMRC-18733) Avail: CFSTI CSCL 13/12

The purpose of the study was to assess available fire research information, review current efforts in fire research, and condense the resulting findings into a statement of guidelines for action. The basic emphasis is on the protection required and the protection being provided by the Naval shore establishment. The two primary areas of consideration are the protection of buildings and their contents, and aircraft crash/rescue activities. Author (TAB)

N70-29671# School of Aerospace Medicine, Brooks AFB, Tex.
PROCEEDINGS OF THE SIXTEENTH ANNUAL CONFERENCE OF AIR FORCE BEHAVIORAL SCIENTISTS
Jack A. Davis, ed. Nov. 1969 180 p refs Conf. held at Brooks AFB, Tex., 20-22 Jan. 1969
(AD-702102) Avail: CFSTI CSCL 6/5

Contents: A group counseling and group counselor training program in an Air Force corrections setting; U.S. Air Force psychiatry in the Republic of South Vietnam 1967; The effect of observed violence on group and individual behavior; The CHAP clinic; Learning failure; Common errors in technique in parent group therapy; Staff reactions to the readmission of psychiatric patients; Relatedness of birth order to sucesses in aviation; A second look at fear of flying; The marathon group in the military; Chaplaincy sponsored group therapy-a military treatment modality without jeopardy; The Air Force psychiatry clinic viewed as a complicated small group; T group experience and level of performance in USAF hospital corpsmen; A modification of psychodrama as employed at the malcolm grow USAF hospital-some roles and their employment; Introduction to group psychotherapy; and Transactional analysis and the group therapist. TAB

N70-29692# Mitre Corp., Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. PART 21: THE RELATIVE LEGIBILITY OF SYMBOLS FORMED FROM MATRICES OF DOTS
Donald A. Shurtleff Feb. 1970 44 p refs
(Contract F19628-68-C-0365)
(AD-702491; MTR-798; ESD-TR-69-432) Avail: CFSTI CSCL 5/5

The purpose of the study was to determine the legibility of symbols formed from matrices which contained different numbers of dot elements. A set of alphanumeric symbols was constructed from each of the following dot matrices: 3 x 5, 5 x 7, 7 x 11, and 9 x 15. The four symbol sets were shown for identification to one group of operators under nearly optimal viewing conditions and to a second group under degraded viewing conditions. Both rate and accuracy of identification were recorded. The results indicate that the 5 x 7 symbols are as legible as 7 x 11 and 9 x 15 symbols for most of the conditions studied, but in one condition the 7 x 11 was more legible than the 5 x 7. Author (TAB)

N70-29713 National Lending Library for Science and Technology, Boston Spa (England).
THE DANGERS CAUSED BY OXIDES OF NITROGEN AND METHODS USED FOR THEIR PREVENTION [NEBEZPECHI KYSLICHNIKU DUSIKU A MOZHNOSTI JEJICH ZNESHKODNHOVANI]
J. Frkal 1970 10 p ref Transl. into ENGLISH from Uhli (Prague), v. 11, no. 2, 1969 p 64-66
(NLL-SMRE-Trans-5764-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The effects of oxides of nitrogen produced by shotfiring in mines are discussed with respect to their effects on the human organism. The oxides are also shown to act as an active catalyst to ignition of an explosive mixture of methane and air. Two methods are considered for reducing the concentration of oxides of nitrogen produced in mining operations. R.B.

N70-29733*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING

BIBLIOGRAPHY WITH INDEXES
Apr. 1970 108 p refs
(NASA-SP-7011(75)) Avail: CFSTI CSCL 06E

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. 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. Each entry consists of a standard citation accompanied by its abstract. Author

N70-29769# *Joint Publications Research Service, Washington, D.C.*
SIGNIFICANCE OF V. N. SAKACHEV'S STUDY ON BIOGEOCENOSIS FOR CREATING CLOSED SYSTEMS
V. P. Dadykin 26 May 1970 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 2, 1970 p 229-237
(TPRS-50594) Avail: CFSTI

The applicability of the basic principles of biogeocenosis to the development of artificial closed ecological systems is examined. The special features of creating this type of system and the limitations resulting from the use of artificial systems for supporting human life in space projects are pointed out. Author

N70-29784# California Univ., Berkeley. Dept. of Cell Physiology.
ENZYME SYSTEMS IN PHOTOSYNTHESIS Final Report
Daniel I. Arnon 22 Dec. 1969 18 p refs
(Contract Nonr-3656(20))
(AD-700303) Avail: CFSTI CSCL 6/1

Contents include: Mechanism of nicotinamide adenine dinucleotide phosphate reduction; Ferredoxin and oxygen evolution; Ferredoxin and noncyclic photophosphorylation; Ferredoxin and cyclic photophosphorylation; Separation of cyclic and noncyclic photophosphorylation; Activation of fructose diphosphatase by reduced ferredoxin; Ferredoxin and CO2 assimilation. TAB

N70-29788# *Pittsburgh Univ., Pa. Dept. of Occupational Health.*
FEASIBILITY STUDY OF THE CORRELATION OF LIFETIME HEALTH AND MORTALITY EXPERIENCE OF AEC AND AEC CONTRACTOR EMPLOYEES WITH OCCUPATIONAL RADIATION EXPOSURE Progress Report, 1 Aug. 1968-31 Jul. 1969
Thomas F. Mancuso, Barkev S. Sanders, and Allen Brodsky 31 Dec. 1969 216 p refs
(Contract AT(30-1)-3394)
(NYO-3394-11; PR-5) Avail: CFSTI

Progress is reported on a five-year study to test, in selected atomic energy installations, the predicted feasibility of carrying out an epidemiological investigation of the correlation of lifetime health and mortality data with occupational radiation exposure in AEC installations. The purpose of the ultimate study would be to ascertain empirically whether there were any lasting biological effects from radiation exposure received from employment in these installations since they came into operation. The feasibility of concluding a meaningful study with the available data has essentially been established. Except for some of the very early contractors, and the recent whole-body counting data, all radiation exposure records at Hanford and Oak Ridge, as well as personal data and sibling data from Hanford, have been abstracted and transferred to magnetic tape in suitable format. NSA

N70-29792*# Techtran Corp., Glen Burnie, Md.
CHANGE IN BLOOD CIRCULATION IN THE UPPER EXTREMITY UNDER STATIC LOAD [OB IZMENENII KROVOOBRASHCHENIYA V VERKHNEY KONECHNOSTI PRI STATICHESKOM EE NAPRYAZHENII]
R. L. Timiyevskaya Washington NASA Jun. 1970 13 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 50, no. 9, 1964 p 1129-1135
(Contract NASw-2037)
(NASA-TT-F-12999) Avail: CFSTI CSCL 06S

In a series of experiments in which plethysmographic measurements were performed on test subjects as they exerted submaximal stress of the forearm by clenching the fist, an increase in the volume of the forearm was noted. Experiments were performed to differentiate muscular contraction from true vascular expansion as causes of the rise in the plethysmographic curves, demonstrating that an increase in vascular cross-section did occur. The stress in the muscles of the forearm hindered circulation to varying degrees in test subjects of varying states of training. After the voluntary static stress, a significant increase in blood flow into the muscles involved was noted. Author

N70-29810*# California Univ., Los Angeles. Center for the Health Sciences.
PHYSIOLOGY OF CHIMPANZEES IN ORBIT Progress Report, Sep. 1969-Mar. 1970
6 May 1970 13 p
(Contract NSR-05-007-158)
(NASA-CR-110349; POCO-PMH-70-014) Avail: CFSTI CSCL 06P

Progress is reported on the circadian rhythms and biochemical analyses of urinary excretion in unrestrained chimpanzees; a 30-day isolation study of a chimpanzee in simulated flight; an implantable telemetry system; behaviorial trainers; and the test chamber used in the 30-day isolation. R.B.

N70-29881*# *National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.*
AN AUTOMATIC CELL COUNTER
Leon Bess Washington Jun. 1970 25 p
(NASA-TN-D-5821; C-121) Avail: CFSTI CSCL 06B

A completely automatic cell counter using analog techniques and standard electronic TV components has been devised and is described here. It promises to perform with a counting error of around + or - 15 percent, and complete its operation in less than 2 minutes. Author

N70-29900# *Joint Publications Research Service, Washington, D.C.*
FUNCTIONAL DISORDERS IN HUMANS DURING HYPOKINESIS
L. I. Kakurin et al 26 May 1970 10 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech. Fiz. Kul't. (USSR), no. 1, 1970 p 19-24
(JPRS-50595) Avail: CFSTI

Restriction of muscular activity and the characteristic redistribution of blood due to the change in hydrostatic pressure during bed rest were studied. The effects of these factors were compared by having one test group remain in a horizontal position for 62 days with minimum motor activity, while another group performed physical exercises every day. The tests show that functional disorders caused by hypokinesis are not fully eliminated by physical exercise, but physical conditioning does reduce the effects of prolonged bed rest. R.B.

N70-29904*# Systems Technology, Inc., Hawthorne, Calif.
THE MEASUREMENT AND ANALYSIS OF PILOT SCANNING AND CONTROL BEHAVIOR DURING SIMULATED INSTRUMENT APPROACHES
David H. Weir and Richard H. Klein Washington NASA Jun. 1970 122 p refs
(Contract NAS2-3746)
(NASA-CR-1535; TR-170-4) Avail: CFSTI CSCL 05H

Seven subjects flew Category 2-like ILS approaches in a six degree of freedom fixed-base DC-8 simulator. A conventional instrument panel and controls were used, with simulated vertical gust and glide slope beam bend forcing functions. Pilot eye fixations and scan traffic on the panel were measured using a recently developed eye point-of-regard (EPR) system. The EPR data were reduced for 31 approaches with a cross section of subjects to obtain dwell times, look rates, scan rates, and fractional scanning workload. These data are compared with previous experimental results. Simultaneous recordings were made of displayed signals, pilot response, and vehicle motions to permit their correlation with the eye movement results during the next phase of the overall program. The scanning results showed the attitude and glide slope/localizer instruments to be primary in a manual ILS approach, sharing 70 to 80 percent of the pilot's attention. The glide slope/localizer instrument required shorter dwell times with a fixed instrument sensitivity. Differences in dwell time between pilots only occurred on the attitude instrument. Author

N70-29910*# Naval Aerospace Medical Inst., Pensacola, Fla. Bureau of Medicine and Surgery.
THE EFFECT OF GRAVITOINERTIAL FORCE UPON OCULAR COUNTERROLLING
Earl F. Miller, II and Ashton Graybiel 23 Mar. 1970 13 p refs
(NASA Order T-81633; NASA Order R-93)
(NASA-CR-110340; NAMI-1104) Avail: CFSTI CSCL 06S

Normal subjects and persons with severe or complete loss of otolith function in the amount of ocular counterroll associated with several tilt angles as a function of g-loading were studied. A group of six normal subjects manifested a compensatory eye roll which increased as a direct and essentially linear function of the component of the gravitoinertial force acting laterally upon the subject. This increase in response was not observed in five deaf subjects with severe or complete bilateral loss of their vestibular organs. The findings confirm similar results found by other authors using other measuring techniques which show that the reflex eye movement is dependent upon and limited to the magnitude of the gravitoinertial stimulus when the otolithoocular system is functioning normally. However, when this function is impaired or lost, the magnitude of the compensatory eye roll is limited to that manifested at 1 g and possibly to nonotolithic contributions. The findings offer means for differentiation between otolithic defective individuals and normal persons who exhibit little counterrolling. Author

N70-29936# Army Behavioral Science Research Lab., Arlington, Va.
SUMMARY OF BESRL SURVEILLANCE RESEARCH
A. H. Birnbaum, Robert Sadacca, R. S. Andrews, and M. A. Narva Sep. 1969 60 p refs
(AD-701907; BESRL-TRR-1160) Avail: CFSTI CSCL 15/4

The SURVEILLANCE SYSTEMS research program of the U. S. Army Behavioral Science Research Laboratory has as its objective the production of scientific data bearing on the extraction of information from surveillance displays and the efficient storage, retrieval, and transmission of this information within an advanced computerized image interpretation facility. The present technical research report summarizes in integrated fashion the major problem areas, the rationale of BESRLs approach to their solution, and the general course of research studies completed or in progress in the surveillance areas of manned systems experimentation. The research effort is conducted within the following Work Units: (1) Interpreter Techniques--The determination of interpreter techniques in a surveillance facility; (2) Image Interpretation Displays--Influence of displays on image interpreter performance; (3) Intelligence Systems--Intelligence information processing systems; (4) Image Systems--Information processing in advanced image interpretation systems. Studies of the Surveillance Systems research programs conducted by the Support Systems Research Division of BESRL have resulted in findings which are applicable in optimizing human component performance in existing systems and in providing systems developers with information useful in design specifications for future systems. Author (TAB)

N70-29982*# Aztec School of Languages, Inc., Maynard, Mass.
DEVELOPMENT OF RECEPTOR STRUCTURES IN THE INNER EAR OF VERTEBRATES
L. K. Titova Washington NASA May 1970 276 p refs Transl. into ENGLISH of the book "Razvitiye Retseptornykh Struktur Vnutrennogo Ukha Pozvonochnykh" Leningrad, Nauka Press, 1968
(Contract NASw-1692)
(NASA-TT-F-615) Avail: CFSTI CSCL 06P

Unpublished data on the embryonal development of receptor structures of the vestibular apparatus and of the Corti organ (the organ of hearing), obtained by application of an original method of isolation of a developing inner ear in representatives of five classes of vertebrates, are considered. The morphological and cytochemical changes which originate in the process of differentiation of the receptor structures of the inner ear (the vestibular portion of the labyrinth in the higher and lower vertebrates, the organ of hearing in birds and mammals) are compared. In a sufficiently complete literary survey, data on the morphological, submicroscopic, and cytochemical construction of the receptor structures of the inner ear of mammals and their change with adequate influences are selected. The nature of the chemical and ultrastructural changes in the process of differentiation of the organ and its definitive function is analyzed. Author

N70-29991*# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
TOLERANCE SPACES AND BEHAVIOR
Mario Dal Cin Feb. 1970 20 p refs
(Grants NGL-10-007-010; AF-AFOSR-1268-67)
(NASA-CR-110348; CTS-B-70-1) Avail: CFSTI CSCL 05J

Certain events of human behavior are confronted with mathematical objects in order to reach a better understanding of such behavior. In this approach the concept of tolerance is made central and connected with various kinds of inactivity such as rest, inhibition or repression as well as with arousal of conflict situations. Author

N70-29995*# California Univ., Los Angeles. Space Biology Lab.
THE SLEEP CYCLE AND SUBCORTICAL-CORTICAL EEG RELATIONS IN THE UNRESTRAINED CHIMPANZEE
James J. Mc New, R. C. Howe, and W. Ross Adey [1969] 38 p refs
(Contract NSR-05-007-158)
(NASA-CR-110351) Avail: CFSTI CSCL 06P

The sleep cycle and subcortical-cortical EEG relationships were studied in the unrestrained chimpanzee. Sleep was recorded for 7 consecutive nights from each of 3 chimpanzees via biotelemetry techniques. The animals averaged 6.5% of their total nocturnal sleep time in Light Sleep (LS), 53.9% in Medium Sleep (MS), 20.3% in Deep Sleep (DS) and 19.3% in rapid eye movement

sleep (REM). The mean duration of the chimpanzees' sleep cycle was 86 min. A first night effect was evidenced by a lower percentage of rem, a higher percentage of light sleep, more time spent in the awake stage, and longer latencies to the onset of both deep sleep and REM. Computer analysis techniques. were used in the description of the physical parameters of the EEG to investigate subcortical-cortical relationships during the various stages of the sleep cycle. The unrestrained chimpanzee's sleep cycle as well as his subcortical-cortical EEG patterns were found to compare closely with that for man. Author

N70-30005# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

DETERMINATION OF THE LIGHT-SCATTERING PROPERTIES OF RIBOSOMAL PARTICLES [DETERMINAZIONE DELLA PROPRIETA DI DIFFUSIONE DELLA LUCE DELLE PARTICELLE RIBOSOMICHE]

A. Reale Scafati, M. R. Stornaiuolo, and P. Novaro 15 Jul. 1969 54 p refs In ITALIAN; ENGLISH summary

(ISS-69/29) Avail: CFSTI

The light scattering method has been used on 30S-50S-70S ribosomes from Escherichia coli cells, selected and purified by several methods and analyzed by analytical ultracentrifuge. The purpose of this work was to determinate the molecular weight, the size, and the possibility of interaction of the ribosomes particles in solution, i.e. in the same hydrated state as in actual cells. This information has been obtained extrapolating the data both to a zero angle and to infinite dilution, according to Zimm. The results obtained on the chosen conditions are the following: 30 S M = 1.03 million; 50S M = 1.7 million; 70S M = 2.93 million. Author

N70-30016# Martin Marietta Corp., Orlando, Fla.

TARGET ACQUISITION STUDIES: VISUAL ANGLE REQUIREMENTS FOR DIRECTLY VIEWED TARGETS Final Report, Oct. 1968 - Jan. 1970

James W. Bergert Jan. 1970 69 p refs

(Contract N00014-67-C-0340)

(AD-700328; OR-10399) Avail: CFSTI CSCL 5/5

The study investigated the target acquisition capability of the unaided eye in a simulated real world environment. By investigating the component parts of a target acquisition problem separately, and under their dynamic interactions. It included target search, detection and recognition in an unbriefed target mode and in static and dynamic threshold modes. Author (TAB)

N70-30054# Federal Aviation Administration, Washington, D.C.

TIME-ZONE EFFECTS ON THE LONG DISTANCE AIR TRAVELER

P. V. Siegel, Siegfried J. Gerathewohl, and Stanley R. Mohler Sep. 1969 13 p refs

(FAA-AM-69-17) Avail: Issuing Activity

Findings are presented on the consequences of rapidly crossing numerous time zones, such as occurs in present-day jet aircraft travel. Conclusions reached by FAA researchers and scientists of other laboratories are included, together with recommendations for overcoming time-zone fatigue. These recommendations are for use by the individual long distance traveler. A practical formula is given which describes how one may compute the rest period following a long distance trip. This period is to enable the biological rhythms to rephase in order that the traveler will be in proper physical and mental condition to pursue his responsibilities. Author

N70-30055# General Electric Co., Schenectady, N.Y. Specialty Materials Handling Products Operation.

HARDIMAN 1 ARM TEST: HARDIMAN 1 PROTOTYPE PROJECT Summary Report

P. F. Croshaw 31 Dec. 1969 76 p

(Contract N00014-66-C-0051)

(AD-701359; S-70-1019) Avail: CFSTI CSCL 6/2

A discussion is presented of the test and evaluation of the Hardiman I left arm assembly. The Hardiman I prototype is powered exoskeletal harness which will amplify mans strength and endurance while retaining his versatility and dexterity. The objective of the arm test was to investigate human factors and servo performance while lifting a load. Author (TAB)

N70-30057# Yale Univ., New Haven, Conn. School of Medicine.

MULTI-CHANNEL TRANSDERMAL STIMULATION OF THE BRAIN Final Report, 1 Jul. 1967 - 31 Dec. 1969

Jose M. R. Delgado Holloman AFB, N.Mex. 6571st Aeromed. Res. Lab. Feb. 1970 29 p refs

(Contract F29600-67-C-0058)

(AD-702525; ARL-TR-70-1) Avail: CFSTI CSCL 6/16

A system was developed for multichannel electrical stimulation of the brain through the intact skin. The stimulator which is implanted subcutaneously, has no batteries and may be used for the lifetime of the experimental subject. Power and information are provided by a small pack carried externally and activated by radio (100 MHz). A combination pulse width and frequency modulation technique is employed to encode the signal information. Three channels are available and in each, repetition rate, pulse durations, and intensity are remotely controlled, allowing the adjustment of parameters of brain stimulation in completely unrestricted subjects. Author (TAB)

N70-30061# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN ALGORITHM FOR DISTINGUISHING UNCENTERED VISUAL FORMS

V. S. Vainshtein 1 Oct. 1969 9 p refs Transl. into ENGLISH from Vses. Inst. Nauchi i Tekhn. Inform. (Moscow), 1967 p 86 - 89

(AD-700388; FTD-HT-23-1425-68) Avail: CFSTI CSCL 6/4

An algorithm based on potential functions for positioning images is proposed. Each point in the n-dimensional space of receptors which appears when the objects are displayed, is considered to be a potential source (its potential has a maximum value and decreases away from this point). The process of teaching a machine to recognize visual images is based on an improved algorithm of potentials where the potentials of the images are computed from a given equation. The block diagram of the algorithm used in conjunction with the BESM-2M computer is presented. TAB

N70-30077*# Department of Health, Education, and Welfare, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.

[MICROORGANISMS DETECTED ON APOLLO SPACECRAFT] Technical Report, Jan. - Mar. 1970

Martin S. Favero Apr. 1970 18 p refs

(NASA Order W-13062)

(NASA-CR-110410; Rept-29) Avail: CFSTI CSCL 06M

A cooperative study is described to determine the effect of test systems and personnel on dilution values at 125 C for two spore crops of Bacillus subtilis var. niger. The three phases of the study at two different sites are compared, and it is concluded that although one method of analysis is more consistent, the same general trends and conclusions do not vary. R.B.

N70-30127*# TRW, Inc., Cleveland, Ohio. Mechanical Products Div.

AIRCREW OXYGEN SYSTEM DEVELOPMENT: WATER ELECTROLYSIS SUBSYSTEM REPORT

A. D. Babinsky and T. P. O'Grady May 1970 169 p
(Contract NAS2-4444)
(NASA-CR-73394; TRW-ER-7256-20) Avail: CFSTI CSCL 06K

Results are presented of a program to develop a closed loop aircrew oxygen system which generates oxygen on-board the aircraft as required. A water electrolysis module is used as the oxygen generator while the amount of oxygen required is decreased significantly under open-loop requirements through the use of a closed loop rebreather subsystem. The Water Electrolysis Module (WEM) was designed as a laboratory type module utilizing air-cooled fins for heat removal and a static water feed system such that the module is capable of operation in all degrees of rotation. The individual cell structural components were machined from extruded polysulfone sheets. Endplates were machined of 3/8 inch thick stainless steel plate. Current collectors were formed by nickel plating copper sheets, followed by drilling and shearing to size after the plating operation. Electrodes, asbestos matrices and plastic screens were hand-cut to size. Module assembly was accomplished by stacking the individual components for ten cells on an assembly fixture. Insulated drawbolts, torqued in a predetermined pattern complete the module assembly. Parametric tests of the module are described and the results are summarized. Author

N70-30188*# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.

STATISTICAL AND HIERARCHICAL ASPECTS OF BIOLOGICAL ORGANIZATION

Michael Conrad Mar. 1970 56 p refs
(Grant NGL-10-007-010)
(NASA-CR-110357; CTS-B-70-2) Avail: CFSTI CSCL 06D

Biological organization has a compartmental structure. The organization and variability of these compartments, or the degree of differentiation and uncertainty associated with them, are expressed in terms of certain entropy measures. Uncertainty is related to the adaptability of the compartment. The condition for most efficient operation of biological systems is discussed in these terms, as are various processes, such as computation, control, and competition. A principle of static equilibrium is proposed, according to which the uncertainty associated with the system approaches the uncertainty associated with the environment, including other biological systems. This is represented in terms of a vector model of biological organization. The relation only expresses conditions which biological systems tend to fulfill in the course of evolution. However, this makes it useful to treat the uncertainty associated with the biological system as a whole as an approximately conserved quantity. The distribution of variability to different levels of organization is discussed on this basis, and the model is compared to the background of biological fact. Author

N70-30192*# Department of Health, Education, and Welfare, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.

EVALUATION OF A VERTICAL LAMINAR FLOW BIOLOGICAL SAFETY CABINET

Norman J. Petersen Jun. 1970 52 p
(NASA Order W-13062)
(NASA-CR-110404) Avail: CFSTI CSCL 06L

A commercially available vertical laminar flow biological safety cabinet was subjected to a variety of tests to determine the degree of product and personnel protection provided under conditions of microbiological challenge. Directional and non-directional aerosols of Serratia marcescens were used to simulate sources of microbial contamination. Settling plates, Reyniers slit samplers, and sieve samplers were used to detect the presence of contamination. Common laboratory practices were used to create conditions that might make the cabinet fail. Results demonstrate that failures in both product and personnel protection can be induced. However, the degree of protection provided by the cabinet is consistently high for both product and personnel. In a direct comparison of personnel protection with a conventional biological safety cabinet the laminar flow unit is consistently equal or superior. Author

N70-30193*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.

EXTRAVEHICULAR ATTITUDE CONTROL BY USE OF HEAD MOTIONS

Lonnie Charles Von Renner (M.S. Thesis) Jun. 1970 97 p refs
(Grants NGL-22-009-025; NGR-22-009-312)
(NASA-CR-110353; MVT-70-1) Avail: CFSTI CSCL 05E

On the basis of a survey conducted on existing techniques for astronaut extravehicular attitude control in space, experiments were performed to determine the usefulness of bioelectric currents generated in muscle tissue as a control signal source. Muscle sites were identified on the neck and bio-currents were detected using surface electrodes. Raw signals were generated by turning the head right or left with respect to the body; subsequent conditioning was performed using a hybrid computer. Motion cues (yaw) were provided by a rotating chair which a subject attempted to control by moving his head. Performance levels based upon integrated squared error were compared for two spearate plant dynamics between electromyographic and conventional pencil-stick control. The data revealed that control of yaw attitude using EMG's was a practical means of providing hands-off control. However, EMG performance was in all cases poorer than equivalent tests conducted using a stick. This probably resulted from the large deadband which existed in the physical angle of turn required of the head to produce a measurable signal. Recommendations are made for describing function analysis of the data and the investigation of other mechanical methods for using head position as a control signal source. Autho

N70-30194# System Development Corp., Santa Monica, Calif.

THE DEVELOPMENT OF A COMPUTER-DIRECTED TRAINING SUBSYSTEM AND COMPUTER OPERATOR TRAINING MATERIAL FOR THE AIR FORCE PHASE 2 BASE LEVEL SYSTEM Final Report

30 Nov. 1969 298 p
(Contracts F19628-67-C-0427; F19628-68-C-0399)
(AD-702529; ESD-TR-70-27) Avail: CFSTI CSCL 5/9

The report describes a study concerned with the design development and evaluation of an integrated Computer-Directed Training Subsystem (CDTS) for the Air Force Phase II Base Level System. The development and evaluation of a course to train computer operators of the Air Force Phase II Base Level System under CDTS control is also described. Detailed test results for validation of the computer operator course and Formal Qualification testing of the CDTS are presented. Conclusions and recommendations with respect to the current CDTS recommendations for additional capabilities and further implications are discussed. Author (TAB)

N70-30213# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 114

26 May 1970 31 p refs Transl. into ENGLISH from various eastern European publications
(JPRS-50589) Avail: CFSTI

Summaries are given for programs in medical cooperation, veterinary research, cancer detection tests, reporting of diarrhea illnesses, production and application of radioactive isotopes, and application of digital computers. R.B.

N70-30245# California Univ., Berkeley. Lawrence Radiation Lab.
PHYSICAL PROBES OF NERVE MEMBRANE STRUCTURE
Gerald Entine (Ph.D. Thesis) Dec. 1969 125 p refs
(Contract W-7405-eng-48)
(UCRL-19334) Avail: CFSTI

The properties of the nerve axon membrane are studied. The source of the nerve axon's uniqueness in its membrane, a layer only about 100 A thick, which is the only part of the axon which changes significantly during the action potential. The composition, structure and mechanism of the membrane is virtually a complete mystery, and it is to these three questions that this research was directed. The major difficulty in this problem is that the 100 A membrane cannot be isolated from the surrounding cell structures which together are one hundred times thicker than the membrane. The fact that during the action potential only the membrane changes significantly was used to distinguish it from the bulk of the cellular structure. Two techniques were developed, one using optical methods and one using electron spin resonance. Both of these techniques have the possibility of being specific enough to indicate directly the composition, structure and mechanism of at least some of the active parts of the membrane. Author

N70-30256# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF ENGINEERING PSYCHOLOGY (COLLECTION OF ARTICLES)
B. F. Lomova et al May 1968 466 p refs Transl. into ENGLISH from Probl. Inzh. Psikhologii, Materialy Konf. (Leningrad), no. 2, 1965 p 1-319
(AD-684372; FTD-MT-24-228-67) Avail: CFSTI CSCL 5/5

The document contains 28 articles on human performance in mechanical systems. TAB

N70-30257# Air Force Systems Command, Lackland AFB, Tex.
PROCEEDINGS OF THE ANNUAL CONFERENCE (10TH) MILITARY TESTING ASSOCIATION
Oct. 1968 296 p refs Conf. held at San Antonio, 16-20 Sep. 1968
(AD-679145) Avail: CFSTI CSCL 5/9

The papers presented reflect a diversity of concerns and developments in areas related to military testing. Participants included representatives of the military services, governmental agencies, and the civilian community. Author (TAB)

N70-30264# Bunker-Ramo Corp., Canoga Park, Calif. Human Factors Dept.
THE EFFECT OF AMOUNT AND TIMING OF HUMAN RESOURCES DATA ON SUBSYSTEM DESIGN Technical Report, 1 Apr. 1968-31 Mar. 1969
David Meister, Dennis J. Sullivan, Dorothy L. Finley, and William B. Askren Oct. 1969 137 p refs
(Contract F33615-68-C-1367)
(AD-699577; AFHRL-TR-69-22) Avail: CFSTI CSCL 5/5

Human resources data HRD inputs supplied during design often fail to exercise a significant effect upon that development. It is possible that inputs are both insufficient and presented at incorrect times during development. The study described in the report had two main purposes: to determine whether the amount and timing of HRD influence design and to investigate the effect upon design of different personnel quantity and quality requirements. Author (TAB)

N70-30266# School of Aerospace Medicine, Brooks AFB, Tex. Neuropsychiatry Branch.
THE PHYSIOLOGIC/PSYCHOLOGIC RELATIONSHIP: SOME EXPERIENCES DURING EXPERIMENTS IN A MEDICAL RESEARCH INSTITUTION
Bryce O. Hartman Nov. 1969 41 p refs
(AD-702098; SAM-TR-69-80; SAM-Review-8-69) Avail: CFSTI CSCL 5/10

Fifteen studies conducted at the USAFSAM on environmental stress are reviewed for information regarding the relationships between physiologic and psychologic stress effects. In most studies, there did not seem to be a direct correspondence. Tolerable stress levels may have been the primary factor in this finding. Author (TAB)

N70-30293# Sassari Univ. (Italy). Inst. of Biological Chemistry and General Pathology.
IDENTIFICATION OF PHOTODYNAMIC SYSTEMS IN THE RETINA Final Scientific Report, 1 Oct. 1968-30 Jun. 1969
Leonida Santamaria 30 Jun. 1969 12 p refs
(Contract F61052-68-C-0073)
(AD-702470; AFOSR-70-0784TR) Avail: CFSTI CSCL 6/5

The retina lesions caused by light (so called solar retinitis) is not related to a heat effect due either to the collimation of infra-red rays or to the transformation in heat of visible light by absorption from the pigment layer. Our data on isolated calf retina demonstrated for the first time that light produces an oxygen dependent damage of the retina respiratory enzymes. The present final scientific report refers to the demonstration that: (a) the reciprocity law i x t = k (i is the intensity of light, and t is the exposure time) holds for the photodynamic sensitivity of the retina; (b) the threshold dosage of such a sensitivity is about 200,000 erg/(sq cm) for isolated bovine retina; (c) the chromophores active in producing the damage are in the range of 320-380 nm and 380-500 nm. Author (TAB)

N70-30294# Northrop Corporate Labs., Hawthorne, Calif. Medical Systems Lab.
DETECTION OF BIOLOGIC CHANGES IN ANIMALS EXPOSED TO LOW LEVELS OF IONIZING RADIATION Final Report, Jan.-Dec. 1968
Frank M. Maciasr and Jack M. Beattie Brooks AFB, Tex. AF School of Aerospace Med. Nov. 1969 25 p refs Submitted for publication
(Contract F41609-68-C-0014)
(AD-700724; NCL-69-5R; SAM-TR-69-41) Avail: CFSTI CSCL 6/18

Urinary excretion of fluorescent products was investigated in Macaca mulatta exposed to whole-body, single dose cobalt-60 gamma irradiation of 28, 53, and 106 rads. Ion-exchange and gel-filtration chromatography were used to fractionate and quantitate radiation-responsive urinary products. Radiation dose response relationships were measurable in one major fluorescent fraction within 72 hours postirradiation at all dose levels. A radiation response relationship was measurable within 6 hours at the 106-rad level. The radiation responsive fluorescent subfraction appears to be predominantly composed of large molecular weight (700 to 1,500) acidic heterocyclic amines. The major source of deviation from linearity of response to dose arose from the large variation in the volume of urine excreted by the monkeys. Much greater and

earlier correlation between the low irradiation doses and the level of excretory products could probably be obtained by controlling the water intake of the animals. Author (TAB)

N70-30302# School of Aerospace Medicine, Brooks AFB, Tex.
RECOVERABLE TEMPERATURE-SENSING IMPLANT Final Report, Jun. 1968 - May 1969
Henry Buchanan, Willis F. Moore, and Calvin R. Richter Nov. 1969 12 p refs
(AD-700737; SAM-TR-69-69) Avail: CFSTI CSCL 6/5

A temperature-sensing device suitable for chronic implantation in 3- to 8-kg. animals was designed to be recoverable. The implant case and screw-on cap were machined from Teflon stock, which provides a moisture-impervious seal between case and cap. The configuration of the finished assembly permits the sensor circuitry and battery to slide readily into the case. The screw-on cap permits battery replacement without damaging the case-to-cap seal. The sensor was calibrated over a temperature range of 34 degrees to 42 degrees C. The physical size of implant is contingent on battery size. The devices transmitted primate core temperatures within plus or minus 0.1 degrees C. for periods of from 173 to 204 days. Author (TAB)

N70-30304# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
AN INVESTIGATION OF THE USE OF A DIGITAL COMPUTER FOR PROCESSING RADIOISOTOPE SCAN DATA
W. J. McClain (Ph.D. Thesis—Tennessee Univ.) 27 Mar. 1970 209 p refs
(Contract W-7405-eng-26)
(CTC-26) Avail: CFSTI

Radioisotope scanning is a very useful diagnostic procedure in the field of nuclear medicine. Activity maps, displayed as two-dimensional plots with varying intensities, provide a means by which clinicians can detect abnormal or malfunctioning tissue in vital organs. Two major factors limit the detectability of tumors in a scan display: (1) the response of the imaging system and (2) the statistical variations in the detected counts. The objective of this study was to determine the effectiveness of a digital computer in overcoming these limitations. The investigation included the development of the hardware and software required for on-line computer operation. The theoretical background and results of the use of six algorithms are included. Common data obtained from a scan of the standard IAEA phantom having a fifty-percent tumor-to-background contrast were used. The data were displayed on a laboratory cathode-ray oscilloscope to provide a comparison of the detectability of tumors in the processed data. Author (NSA)

N70-30322# Atomic Energy Commission, Washington, D.C.
RADIOBIOLOGY [RADIOBIOLOGIYA]
[1969] 209 p refs Transl. into ENGLISH from Radiobiol. (Moscow), v. 9, no. 5, 1969 p 659-792 Prepared by JPRS
(AEC-tr-7136) Avail: CFSTI

Papers within the scope of NSA from the original language journal are presented. NSA

N70-30323# Atomic Energy Commission, Washington, D.C.
RADIOBIOLOGY [RADIOBIOLOGIYA]
[1969] 261 p refs Transl. into ENGLISH from Radiobiol. (Moscow), v. 9, no. 4, 1969 p 483-652 Prepared by JPRS
(AEC-tr-7109) Avail: CFSTI

Papers within the scope of NSA from the original language journal are presented. NSA

N70-30420# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
MORPHOLOGY AND STRUCTURE OF CRYSTALLITES IN BONE
D. Steve Bocciarelli 12 Mar. 1969 26 p refs
(ISS-69/15) Avail: CFSTI

Morphological data and electron diffraction patterns of microcrystals in bone, as compared with those obtained from synthetic crystalline apatites, show that at least a large percentage of the crystal phase in bone must be identified with octacalcium phosphate. In agreement with this result is the fact that stereoscopic views demonstrate that the well-known needle-like microcrystals in bone are actually edge views of platelets. Author

N70-30431# Joint Publications Research Service, Washington, D.C.
ECHO LOCATION PROCESS IN OXYGNATHOUS BATS IN FREE FLIGHT
G. N. Simkin 4 Jun. 1970 15 p Transl. into ENGLISH from Biol. Nauki (Moscow), no. 3 (75), 1970 p 61-71
(JPRS-50665) Avail: CFSTI

Certain methods are considered for correlating the parameters of orientation signals with distinctive features of the experimental situation and with characteristics of the target to be located. Main attention is concentrated on regularities in the variation of repetition rate, length of orientation signals and interpulse intervals, as well as on the character of pulse grouping in a train and within the series. Variation in repetition rate is linked with the resolving power of the direction-finding system, and variation in length with the system's operational capabilities. As the most important factor in discovering the laws governing the structural and functional organization of the orientation process, the necessity of making experimental conditions more complex is singled out with enlarging the number of classes of targets to be located. Author

N70-30464 National Lending Library for Science and Technology, Boston Spa (England).
AETIOLOGY OF ULTRA-HIGH FREQUENCY EXPOSURE
I. R. Petrov 27 Feb. 1970 7 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), no. 5, 1968 p 21-24
(NLL-Trans-2629-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The combined effects of microwave radiation and rarefied atmosphere at high-altitude radar stations was investigated. The experiments show a decrease in some important immunization reactions when the human body is exposed to decimeter radiation and breathes air with 11.2% oxygen content. In particular, there is a reduction in the number of erythrocytes in the blood, and their number increases only slightly after continued breathing of the rarified air. Persons who are acclimatized over a period of 10 consecutive days prior to being subjected to microwave radiation show no significant changes in immunization reactions. R.B.

N70-30510*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECTS OF ALCOHOL ON THREE LEVELS OF COMPLEX HUMAN BEHAVIOR
Grady Vancil Maraman (Ph.D. Thesis—Virginia Commonwealth Univ.) Jun. 1970 99 p refs
(NASA-TM-X-62961) Avail: CFSTI CSCL 060

Each level of complexity contained an increasing component indicative of cognitive behavior. The motor component of all three levels was maintained approximately constant. The blood alcohol concentrations studied were 0.000, 0.010, 0.050, and 0.100 percent, as determined with the Breathalyzer. Alcohol was

administered in the form of 50 percent ethanol mixed with frozen orange juice concentrate. All blood alcohol concentrations were studied in the same subject during one test session. The study was replicated. The study was repeated twice without alcohol. Data are presented which indicate that cognitive processes were not affected by these blood alcohol concentrations. Performance on all three tasks was affected significantly; however, the effect of the alcohol appeared to be on the subject's ability to make precision positioning movements of the limbs. Author

N70-30513# Joint Publications Research Service, Washington, D.C.

STORY OF USSR COSMONAUT TRAINING CENTER RELATED

I. Kamanin 8 Jun. 1970 9 p Transl. into ENGLISH from Komsomol'skoye Znamya (Kiev), 25 Apr. 1970 p 31
(JPRS-50683) Avail: CFSTI

A journalistic account of the founding and development of the Cosmonaut Training Center is presented. Parachuting and weightlessness training are mentioned. F.O.S.

N70-30530# National Lending Library for Science and Technology, Boston Spa (England).

CHANGE IN THE THRESHOLD OF ACCELERATION SENSITIVITY UNDER CONDITIONS OF TRANSITORY WEIGHTLESSNESS [OBIZMENENII POROGOV AKTSELERATSIONNOI CHUVSTVITELNOSTI V USLOVIYAKH KRATKOVREMENNOI NEVESOMOSTI]

K. L. Khilov et al Feb. 1970 5 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), no. 8, 1966 p 60-62
(NLL-RTS-5632) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d or 1 NLL photocopy coupon

Tests were made during horizontal and weightlessness flights to determine the trend of threshold changes of acceleration sensitivity. The subjects sat in the Baranyi chair, and were turned from 180 deg in 20 sec to 360 deg in 15 sec. It was found that in all subjects a change of the sensitivity threshold of horizontal semicircular canals to angular acceleration under conditions of dynamic weightlessness was established. In a few subjects the sensation in weightlessness was absent. In the remaining subjects the onset of the sensation of rotation under weightlessness was retarded by 3-11 sec. It is felt that the feeling of loss of weight in otolith causes a decrease of the activating effect of the otolith receptor upon the sensory reactions from the semicircular canals. This causes an increase in the sensitivity thresholds in the horizontal semicircular canals in a state of dynamic weightlessness. N.E.N.

N70-30561# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung E. V., Munich (West Germany). Inst. fuer Hygienisch-Bakteriologische Arbeitsverfahren.

OLD GOALS, NEW METHODS: APPLIED HYGIENE, A PART OF MODERN RESEARCH [ALTE ZIELE, NEUE WEGE: ANGEWANDTE HYGIENE, EIN BESTANDTEIL MODERNER FORSCHUNGSRICHTUNG]

E. Kanz *In its* Examples of Appl. Res. Jun. 1969 p 64-67 In GERMAN (See N70-30551 15-34)
Avail: CFSTI

Two important criteria are cited for modern hygiene as an applied science: (1) The reduction in the degree of probability of an infection is the measure of hygienic success, and (2) The knowledge of hygiene research must be properly applied to humans in the correct form, in the proper measure, and at the right time. ESRO

N70-30563# Technische Hochschule Munchen (West Germany). Inst. fuer Nachrichtentechnik.

MAN AS AN INFORMATION STORE AND SOURCE [DER MENSCH ALS INFORMATIONSSPEICHER UND INFORMATIONSQUELLE]

H. Marko *In* Fraunhofer-Ges. Examples of Appl. Res. Jun. 1969 p 73-81 refs In GERMAN Sponsored partly by Fraunhofer Ges. (See N70-30551 15-34)
Avail: CFSTI

Human beings as information stores are treated from the viewpoint of the communications engineer, and with experimental results from other disciplines are used in an integrated cybernetic concept. The investigation was restricted to memory in its narrowest sense, including the processes of information acquisition, transmission, and generation, but excluded phylogenetic memory. ESRO

N70-30621# Michigan State Univ., East Lansing. Dept. of Biophysics.

THE SOLID STATE ELECTRICAL PROPERTIES OF PROTEINS AND BIOLOGICAL SYSTEMS Technical Progress Report, 16 Feb. 1969 - 20 Feb. 1970

Barnett Rosenberg Feb. 1970 5 p refs
(Contract AT(11-1)-1714)
(COO-1714-4) Avail: CFSTI

A theory of quantum mechanical tunnelling from activated energy levels as the physical mechanism for the compensation law behavior was developed. It is found that biological semiconductors are of a mixed type with both electronic and protonic charge carriers. It is also found that at hydration states where the nuclei acid is in the disordered form, the dominant charge carriers are purely electronic. As hydration increases, there is a sharp transition from purely electronic to purely protonic charge carriers at the hydration levels where DNA undergoes a phase transition from the disordered to the ordered state. In the case of hemoglobin and cytochrome C there appears to be a linear relationship between the contribution of protonic conductivity to the total conductivity with the hydration state. Conductivity in the solid state of bimacromolecules is dependent solely on the effective dielectric constant regardless of the nature of the absorbent causing the change in the dielectric constant. J.M.C.

N70-30631# Brookhaven National Lab., Upton, N.Y.

INFLUENCE OF THE LATENCY FLUCTUATIONS AND THE QUANTAL PROCESS OF TRANSMITTER RELEASE ON THE END PLATE POTENTIALS AMPLITUDE DISTRIBUTION

Branko Soucek [1969] 17 p refs
(BNL-14393) Avail: CFSTI

Probability distribution functions of e.p.p. amplitudes, obtained from experimental data, show peaks at 1,2,3, etc., times the mean amplitude of the spontaneous miniature potentials. Number of data in peaks are distributed according to the Poisson law with the mean quantum content m. It is shown that the shape of the peaks is a function of the m.e.p.p. amplitude distribution P(A), m.e.p.p. pulse shape h(t), latency distribution alpha(t), and the mean quantum content m. The developed theory takes all of these functions into account. Through sequential use of equations, one takes into account influences of alpha(t), h(t), P(A) and m, respectively, and can describe different models for building e.p.p.'s from m.e.p.p.'s. The most complete model takes all functions into account and produces the distribution composed of asymmetrical peaks. Author

N70-30700*# Uppsala Univ. (Sweden).
EXPERIMENTAL STUDIES OF THE ELICITING MECHANISM OF MOTION SICKNESS
Arne Stjoeberg *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 7-28 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

After an analysis of ship movements and calculation of the maximal acceleration values for a normal-sized passenger vessel on high seas, it is concluded that angular acceleration is unimportant in the elicitation of seasickness. The vertical up-and-down motions of a ship are the most important, and experimental motion sickness can easily be provoked in human beings and dogs exposed to vertical movements in rapid elevators or hoisting cranes. Deaf mutes with reactionless labyrinths and dogs after labyrinthectomy have no symptoms of motion sickness after exposure to these rapid elevator movements. Results of hydromechanical studies and experiments on labyrinth models and temporal bones show that, when a person is exposed to linearly accelerated horizontal and vertical movements or to the movements of a ship on a heavy sea, pressure variations with accompanying displacements and flows in both the perilymph and the endolymph must occur at every point in the contents of the labyrinth. It is assumed that the symptom complex of motion sickness arises from the two receptor systems of the labyrinth: the otoliths and the ampullar cristae. The intermittent headache and some of the psychic symptoms accompanying motion sickness may be due to the intracranial pressure variations caused by the linear acceleration movements. Author

N70-30701*# Rochester Univ., N.Y.
EXPERIENCES WITH RESEARCH ON MOTION SICKNESS
George Richard Wendt *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 29-32 refs Sponsored in part by ONR and Rochester Univ. (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Studies of motion sickness are briefly described and include studies of the nature of susceptibility to motion sickness, of the effects of wave character on incidence of motion sickness, of other factors related to motion sickness, including preventive drugs, and of the effects of sickness on performance. Author

N70-30702*# Defense Research Establishment Toronto, Downsview (Ontario).
NEURAL MECHANISMS UNDERLYING THE SYMPTOMATOLOGY OF MOTION SICKNESS
K. E. Money and J. D. Wood *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 33-34 refs (See N70-30699 16-04)
(DRET-720) Avail: SOD $4.50; CFSTI CSCL 06S

A review of knowledge about the neural mechanisms of motion sickness is presented, and recent unpublished attempts to increase that knowledge are related. The participation of peripheral afferent nerves, peripheral efferent nerves, and central structures is described and the integrated action of these structures is discussed. The structures that are indispensable for the vomiting of motion sickness are the vestibular apparatus, the vestibular nerve, the vestibular nuclei, the uvula and nodulus of the cerebellum, the chemoceptive emetic trigger zone, the vomiting center, and the somatic peripheral nerves to the respiratory muscles and to the muscles of the abdominal wall. Author

N70-30703*# Naval Aerospace Medical Inst., Pensacola, Fla.
CONFLICTING SENSORY ORIENTATION CUES AS A FACTOR IN MOTION SICKNESS
Fred E. Guedry, Jr. *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 45-52 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Evidence is adduced to support the hypothesis that conflicting sensory data relating to spatial orientation from among visual, vestibular, and somatosensory systems can induce motion sickness in the absence of any strong, long, or periodic stimulus to the semicircular canals or otolith system. Author

N70-30704*# Naval Aerospace Medical Inst., Pensacola, Fla.
THE OTOLITH ORGANS AS A PRIMARY ETIOLOGICAL FACTOR IN MOTION SICKNESS: WITH A NOTE ON OFF-VERTICAL ROTATION
Ashton Graybiel and Earl F. Miller, II *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 53-66 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Among investigators who agree that the vestibular organs are essential in producing motion sickness, there is either uncertainty or disagreement as to the roles of the otolith organs and the semi-circular canals which, under natural living conditions, furnish different information in response to linear and angular accelerations. The shifting emphasis on the essentiality of the two organs is briefly traced, leaving in doubt the role of the otolith organs formerly regarded as essential in the causation of seasickness and airsickness. This doubt has arisen by the demonstration that nystagmus, easily evoked when the canals are stimulated by angular or Coriolis accelerations, also may be manifested when a person is exposed to rectilinear accelerations or to rotating linear acceleration vectors (RLAV) in the absence of angular or Coriolis accelerations. Some experimental findings on man are reviewed. In one series, it was demonstrated that, in highly susceptible subjects, motion sickness may be experienced when the RLAV is within 4 deg of the physical upright. In a second series of experiments, nystagmus was evoked in subjects regarded as possibly having residual otolith function, based on the ocular counterrolling test, but absent canalicular function, based on lack of response to high angular accelerations and to irrigation of the external canal with ice water. Author

N70-30660# Biotechnology, Inc., Falls Church, Va.
HUMAN PERFORMANCE IN THE UNDERSEA ENVIRONMENT: AN ANNOTATED BIBLIOGRAPHY
Raymond E. Reilly Jan. 1970 91 p refs
(Contract N00014-70-C-0052)
(AD-702781) Avail: CFSTI CSCL 6/19

The report is an annotated bibliography of 149 references concerning human performance and physiology in the undersea and dry hyperbaric environment. Also included are lists of additional bibliographies and scientists engaged in undersea research. Author (TAB)

N70-30699*# Naval Aerospace Medical Inst., Pensacola, Fla.
FOURTH SYMPOSIUM ON THE ROLE OF THE VESTIBULAR ORGANS IN SPACE EXPLORATION
Washington NASA 1970 393 p refs Held at Pensacola, Fla., 24-26 Sep. 1968; Sponsored by NASA, the Comm. on Hearing, Bioacoustics, and Biomech., and NAS-NRC
(NASA-SP-187) Avail: SOD $4.50; CFSTI CSCL 06C

The etiology, symptomatology, and treatment of motion sickness are considered with respect to the vestibular organ and related neurological functions. The interrelationships of the vestibular nuclei, cerebellum, and reticular formation together with their direct and indirect reciprocal connections with the brainstem, cord, and cerebral cortex are discussed. For individual titles see N70-30700 through N70-30730.

N70-30705*# Naval Aerospace Medical Inst., Pensacola, Fla.
THE SEMICIRCULAR CANALS AS A PRIMARY ETIOLOGICAL FACTOR IN MOTION SICKNESS
Earl F. Miller, II and Ashton Graybiel *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 67-82 refs (See N70-30699 16-04)
(NASA-Order T-81633; NASA Order R-93)
Avail: SOD $4.50; CFSTI CSCL 06S

Data are presented which support the view that the semicircular canals can act as the essential factor for the production of motion sickness and the evocation of symptoms characteristic of this malady in the absence of motion. Quantitative grading of acute symptoms demonstrate that motion sickness can be evoked by stimuli which are at once adequately provocative and unique for the canals. The results are compared with those of two provocative tests that introduce Coriolis forces and with one that generates a rotating linear acceleration vector when human subjects are exposed in rotating devices. Wide interindividual differences but only slight intraindividual differences among the six provocative test conditions are revealed. The pattern of symptoms manifested by the group of 10 subjects at the test endpoint, moderate malaise, is also similar among these tests. The fact that typical symptoms of motion sickness were produced by bithermal irrigation as well as simple angular acceleration in several subjects representing a wide range of susceptibility adds to the evidence that the semicircular canals can act as the primary etiological factor in this malady. Author

N70-30706*# Toronto Univ. (Ontario).
SECONDARY ETIOLOGICAL FACTORS IN THE CAUSATION OF MOTION SICKNESS
Walter H. Johnson *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 83-88 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Although individual differences in sensitivity of the nonauditory labyrinth undoubtedly constitute the primary factor involved, extralabyrinthine influences constitute secondary etiologic factors of importance under certain circumstances. Vision, cerebral activity, olfaction, food, ambient air temperature, sexual differences, age, and chemical toxicity including alcohol, illness, and adaptation are discussed in relation to their influence on motion-sickness susceptibility. Author

N70-30707*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE SYMPTOMATOLOGY OF MOTION SICKNESS
Jack E. Steele *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 89-98 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Motion sickness is defined as maladaptation to a dynamic environment. The major symptoms are caused by inadequate and inappropriate vascular and circulatory responses, resulting mainly from inadequate perception (integration and analysis of the pertinent sensory data) of the dynamic environment and consequent misestimation of the nature and degree of the threat involved. Author

N70-30708*# Louisiana State Univ., Shreveport. Medical School
USE OF DRUGS IN THE PREVENTION OF MOTION SICKNESS
Charles D. Wood *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 99-108 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06E

The most potent drugs for the prevention of motion sickness are those with central autonomic activity. Drugs which block parasympathetic or stimulate sympathetic activity are most effective. Drugs such as the phenothiazines, phenoxybenzamine, or meprobamate, which reduce sympathetic activity, appear to increase susceptibility to motion sickness. Scopolamine was the most effective single drug, and when combined with *d*-amphetamine, it was even more effective in prevention of motion sickness. The antihistamines appeared to be more suitable for use with exposure to mild forms of motion. In highly susceptible individuals, or during exposure to more intense motion, the combination of scopolamine with *d*-amphetamine was the most effective preparation tested. Author

N70-30709*# Naval Aerospace Medical Inst., Pensacola, Fla.
PREVENTION OF MOTION SICKNESS IN THE SLOW ROTATION ROOM BY INCREMENTAL INCREASES IN STRENGTH OF STIMULUS
Ashton Graybiel *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 109-116 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The accelerations were generated by motions of the subject's head out of the plane of the room's rotation. In the first experiment, control of the accelerations was maintained principally through regulation of the room's velocity. In the second, the adaptation was speeded up by control over head motions made by the subjects as well as over the room's velocity. The cardinal findings in the experiments have important theoretical and practical implications in adaptation to Coriolis accelerations, as well as in the prevention of motion sickness by natural means in a rotating spacecraft. Author

N70-30710*# Dartmouth Coll., Hanover, N.H. Medical School.
A RESUME OF SESSIONS ON MOTION SICKNESS
Herbert L. Borison *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 117-120 (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The neurological elements responsible for coordinating the vomiting sequence of motion sickness are reviewed and the input and output components of the emetic reflex are discussed. Questions are raised as to the nature of the reflex arc in the vomiting of motion sickness, the cause for the long onset of the effects of motion sickness, and the mechanism by which anti-motion-sickness drugs act. Author

N70-30711*# Uppsala Univ. (Sweden).
THE FIRST-ORDER VESTIBULAR NEURON
Hans Engstroem *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 121 – 136 refs (See N70-30699 16-04)
(Contract F61052-68-C-0064)
Avail: SOD $4.50; CFSTI CSCL 06P

The vestibular part of the statoacoustic nerve contains both afferent and efferent fibers, the former being much more numerous than the latter. The afferent neurons have bipolar ganglion cells located in one single ganglion cell in the inner meatus. The ganglion cells belonging to the vestibular nerve are considerably larger than those of the spiral ganglion and they also differ slightly in structure. Several of the vestibular fibers are thicker than the cochlear fibers. The majority of the vestibular ganglion cells are surrounded by a multilayered myelin sheath. In this sheath some regions are found where the myelin is very regular, but in most areas the myelin is quite irregular with alternating regions of loose and semicompact myelin. The majority of the ganglion cells are myelinated, but a small percentage (2 to 5 percent) have only a single or a double layer of Schwann-cell cytoplasm. These cells differ considerably from the myelinated ones, not only in structure for they are also much smaller. The way they are related to the sensory cells is not yet known, nor is their function known. Similar unmyelinated cells are found in about 10 percent of the spiral ganglion of the cochlea, and it has not yet been possible to certify their sensory-cell relation in the cochlea either. The efferent fibers are rather thin compared with afferent ones. They have their ganglion cells in the brainstem. Their peripheral endings form a rich plexus in the vestibular epithelia where they form many en passant synapses with sensory cells, nerve calyces, and nerve fibers. The vestibular nerve contains a large number of unmyelinated fibers found intermingled with the afferent and efferent nerve fibers. Author

N70-30712*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTER ANALYSIS OF SINGLE-UNIT DISCHARGES IN THE VESTIBULAR NERVE OF THE FROG
Jorge Huertas and Ruth S. Carpenter *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 137 – 144 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The applicability of computer codes to the study of vestibular units during spontaneous and provoked activity is discussed. A computer window technique that analyzes the frequency, the shortest interval, the longest interval, and standard deviation is described. This technique seems to be particularly suited to describe the changes in activity of vestibular neurons. The results are discussed in light of present knowledge of neurophysiology and anatomy. Author

N70-30713*# Rockefeller Univ., New York.
VESTIBULAR AND SOMATIC INPUTS TO CELLS OF THE LATERAL AND MEDIAL VESTIBULAR NUCLEI OF THE CAT
Victor J. Wilson *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 145 – 158 refs (See N70-30699 16-04)
(Grant PHS-5R01-NB-02619)
Avail: SOD $4.50; CFSTI CSCL 06C

An important input to Deiters' cells is that from the labyrinth, which includes fibers from static receptors. The input from the labyrinth is seen in a larger fraction of the cells projecting to the cervical and thoracic cord than of the cells projecting to the lumbosacral cord. Both groups of cells can be facilitated by impulses ascending the spinal cord. These impulses are due to activity in a variety of peripheral nerves coming from different receptors, but apparently not from primary spindle endings or Golgi tendon organs. The cells of Deiters' nucleus, that influence the excitability of motoneurons at all levels of the spinal cord via the vestibulospinal tract, are therefore themselves impinged upon by a variety of inputs that share in the regulation of their excitability. Some cells in the medial vestibular nucleus project to the spinal cord, but many more project rostrally. Both types of projecting cells are almost completely absent from the caudal region of the nucleus, as is the monosynaptic input from primary vestibular fibers. The vestibular input originates in the horizontal canal and utricle, and probably in other parts of the labyrinth. Electric stimulation of the labyrinth activates many projecting cells as well as many cells without long axons. There is also a somatic input to cells in the medial nucleus, and it is of particular interest that vestibular and somatic inputs, as well as commissural inputs and inputs from fibers descending from higher levels of the central nervous system, converge on many cells lacking long axons projecting rostrally or to the spinal cord. It is probable that among these cells there are interneurons that regulate the activity of projecting cells. Author

N70-30714*# Birmingham Univ. (England).
ELECTROPHYSIOLOGICAL EXPERIMENTS ON THE ISOLATED SURVIVING LABYRINTH OF ELASMOBRANCH FISH TO ANALYZE THE RESPONSES TO LINEAR ACCELERATIONS
Otto E. Lowenstein *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 159 – 166 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The classical assumption that semicircular canals respond exclusively to angular acceleration and cannot be involved in the elicitation of responses to linear acceleration has recently been challenged by a number of observations. Experiments are described in which the isolated surviving labyrinth of elasmobranch fishes (dogfish and ray) was subjected to linear acceleration. Recordings from horizontal and vertical canals as well as from the utriculus and lagena indicate that semicircular canals under these physiological conditions (interruption of blood supply and opening into the perilymphatic space) do yield responses to tilting and to rotating vectors of linear acceleration which resemble those obtained from the otolith organs. As compared with the latter, however, the responses from the semicircular canal have a significantly higher threshold. Author

N70-30715*# Oslo Univ. (Norway).
ANATOMICAL ASPECTS ON THE FUNCTIONAL ORGANIZATION OF THE VESTIBULOSPINAL PROJECTION, WITH SPECIAL REFERENCE TO THE SITES OF TERMINATION
Rolf Nyberg-Hansen *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 167 – 182 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The spinal projection from the vestibular nuclei can be separated into two different fiber systems: the classical vestibulospinal tract and the fibers descending in the medial longitudinal fasciculus. Because of their origin from the medial vestibular nucleus and their medial course in the brainstem and the spinal cord, the latter are called the medial vestibulospinal tract, and the more laterally coursing classical vestibulospinal fibers are called the lateral vestibulospinal tract. The lateral tract comes from the lateral vestibular nucleus and descends in the ventrolateral funiculus organized in a somatotopical manner throughout the whole cord. The fibers terminate ipsilaterally in the entire lamina VIII and the

neighboring parts of lamina VII of the spinal gray matter. No terminations are found among the perikarya of the motoneurons in lamina IX. The medial tract descends bilaterally in the dorsomedial part of the ventral funiculus to the rostral half of the cord only. There is no evidence of a somatotopical organization within this tract. The fibers terminate bilaterally in the dorsal half of lamina VIII and the adjacent part of Lamina VII. The fibers on the ipsilateral side outnumber those on the contralateral side. The medial vestibulospinal tract is concerned with movements of the head and neck and, according to recent physiological observations, also with presynaptic inhibition of primary afferents in the spinal cord. Author

N70-30716*# Tokyo Univ. (Japan).
THE CEREBELLOVESTIBULAR INTERACTION IN THE CAT'S VESTIBULAR NUCLEI NEURONS
Masao Ito *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 183-200 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

Postsynaptic effects of the vestibular and cerebellar impulses were investigated in the cat's vestibular nuclei neurons with intercellular recording techniques. These neurons were identified by their antidromic invasion from the spinal cord or the cerebellum and/or by their location determined with histologically controlled micromanipulation. The vestibular nerve impulses exert monosynaptically an excitatory effect upon many vestibular nuclei neurons, producing the excitatory postsynaptic potentials. Polysynaptic actions, however, involve both excitation and inhibition. In contrast, the cerebellar impulses along Purkinje axons evoke the inhibitory postsynaptic potentials monosynaptically in any of their target neurons. These vestibular and cerebellar impulses converge upon vestibular nuclei neurons in the fashion that the cerebellum is superposed on the reflex arcs which primarily formed between the vestibular nerve and certain vestibular nuclei cells. On the basis of these observations, an attempt is made to interpret the role of the cerebellum in terms of basic concepts of the control theory.

N70-30717*# Toronto Univ. (Ontario).
MULTISENSORY INFLUENCE UPON SINGLE UNITS IN THE VESTIBULAR NUCLEUS
John M. Fredrickson and Dietrich Schwarz *In* Naval Aerospace Med. Inst. 4th Symp. on theRole of the Vestibular Organs in Space Exploration 1970 p 201-208 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

Cells in the vestibular nucleus responsive to vestibular end-organ and joint simulation were studied by the method of single-unit analysis in the unanesthetized cat. Ninety-nine percent of the units responded to vestibular stimulation and 80 percent to joint movement. There were no responses to muscle pressure, or to optic or acoustic stimuli. The convergent pattern of the two effective sensory systems on single cells was usually summative. Cerebellectomy did not grossly alter the pattern of joint influence. The vestibular cells responsive to joint movement function to detect the angular positions of joints, and through discharge patterns indicate the rate and direction of movement, as well as the steady position of joints. The convergence of the two main position-sense receptors (joints and labyrinth) in the vestibular nucleus is discussed from the standpoint of its significance for rapid, reflex, postural adjustments, and postural stability. Author

N70-30718*# Pisa Univ. (Italy).
INTERACTION BETWEEN VESTIBULAR AND NONVESTIBULAR SENSORY INPUTS
Ottavio Pompeiano *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 209-236 refs (See N70-30699 16-04)
(Grant PHS-NB-05695-03)
Avail: SOD $4.50; CFSTI CSCL 06C

During the deep phase of sleep the activity of the second-order vestibular neurons increases phasically due to extralabyrinthine inputs to the vestibular nuclei. This activity leads to sudden contractions of somatic and extrinsic eye muscles (rapid eye movements, or REM sleep). Experiments were performed to find out whether the increase in the vestibular discharge is also able to effect transmission of somatosensory volleys through the ascending lemniscal pathway. The orthodromic lemniscal response recorded from the contralateral medial lemniscus on single-shock stimulation of the forelimb nerves is phasically depressed during the bursts of REM. This effect is still present after interruption of the spinocervical (Morin's) pathway, thus indicating that somatic afferent transmission through the cuneate nucleus is phasically depressed at this time. The synaptic mechanisms responsible for this effect were investigated. In particular, the antidromic group II cutaneous and group I muscular volleys led, respectively, from the superficial and the deep radial nerves on single-shock stimulation of the cuneate nucleus are phasically enhanced during the bursts of REM. This increased excitability of the central endings of the cuneate tract fibers is taken to indicate presynaptic depolarization of the terminals of the primary afferents within the cuneate nucleus, thus leading to presynaptic inhibition of synaptic transmission through the cuneate nucleus. Author

N70-30719*# Naval Aerospace Medical Inst. Pensacola, Fla.
VESTIBULAR ACTIVITY IN THE DESCENDING MEDIAL LONGITUDINAL FASCICULUS
Bo E. Gernandt *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 237-242 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The functional importance of the medial longitudinal fasciculus (MLF) in carrying vestibular impulses into the spinal cord was studied in cats. The amplitude, duration, and latency of the gross motor responses evoked by vestibular stimulation and recorded from cervical and lumbar levels do not show any significant or persistent changes after a selective bilateral disconnection of the descending MLF. Thus, in evaluating the hierarchical importance of the three descending vestibulofugal pathways, it becomes obvious that the MLF offers a much weaker link than the connections represented by the vestibulospinal and reticulospinal tracts. By sectioning all pathways other than the MLF in the brainstem at the cerebellopontine angle, this tract can be investigated in anatomical isolation from adjacent vestibular connections. Vestibular stimulation applied to this MLF animal preparation evokes motor responses which could be recorded as far down as midthoracic levels. No sign of activity was recorded from lumbosacral levels. Single MLF axon recordings demonstrate that the discharge frequency in response to vestibular stimulation may reach values that are more than twice the value of ventral-root alpha-fiber discharge in response to identical stimulation, and that the synaptic transmission across the vestibular nuclei occurs with a considerable safety factor. Author

N70-30720*# Rochester Univ., N.Y.
EVOKED POTENTIAL AND MICROELECTRICAL ANALYSIS OF SENSORY ACTIVITY WITHIN THE CEREBELLUM
Ray S. Snider and Karl Lowy *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 243-258 refs (See N70-30699 16-04)
(Grants NIH NB-04592; NIH NB-06827)
Avail: SOD $4.50; CFSTI CSCL 06C

The extensive to-and-fro connections between the cerebellum

and the vestibular system were reviewed. Purkinje-cell inhibition to the vestibular system is recognized in the direct pathways, and the role of the crossed fastigiovestibular pathway is discussed. There is no overlap of auditory and vestibular areas in the cerebellar cortex, but there may be in the nuclei fastigii. In the cerebellocerebral projections, there is overlap at the cerebral levels. Microelectrode studies on the auditory area indicate that it has electrophysiological properties similar to those reported for other cerebellar areas. The functions of the cerebellum in the habituation of nystagmus is discussed and some electrophysiological interpretations given. Author

N70-30721*# Temple Univ., Philadelphia, Pa. Medical School.
CORTICAL PROJECTION OF LABYRINTHINE IMPULSES: STUDY OF AVERAGED EVOKED RESPONSES
E. A. Spiegel, E. G. Szekely, H. Moffet, and J. Egyed *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 259–268 refs (See N70-30699 16-04)
(Grant NIH-US-PHS-04418)
Avail: SOD $4.50; CFSTI CSCL 06C

While the observation of the eyeballs, the reactions of the trunk, and the extremities permits only a study of the vestibulo-ocular and the vestibulospinal reflex arcs, the perrotatory or postrotatory recording of the electroencephalogram or electrocorticogram may help one to ascertain the conduction of labyrinthine impulses and their projection to the cerebral cortex. The cortical responses to single rotations were summed by a Mnemotron computer. After cessation of rotation, long-latency, slow, sometimes multiphasic responses appeared in human subjects and in cats. In man they were either diffuse or were noted chiefly or exclusively in the region of the area preoccipitalis and/or parastriata. They are probably due to excitation of the diffuse thalamic projection system. Short-latency responses in the cat's cerebral cortex at the start of rotation were not limited to the second somatic sensory area, but were found also in parts of the auditory cortex and in the so-called association cortex; in some experiments they were also close to, or in parts of, the second visual area. The initial as well as the postrotatory reactions in posterior parts of the cerebral cortex were not prevented by bilateral ablation of the second sensory area; they depended on a functioning labyrinth. Author

N70-30722*# Uppsala Univ. (Sweden).
EXPERIMENTAL AND CLINICAL EXPERIENCES AND COMMENTS ON ULTRASONIC TREATMENT OF MENIERE'S DISEASE
Arne Sjoeberg *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 269–284 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06E

Almost 300 patients with Ménière's disease have undergone ultrasonic treatment and about 200 additional patients were not treated. The patients comprise a select series of severely disabled persons in whom no form of medical therapy had been effective. The mean duration of the disease was 8 years, but a number of patients had been afflicted for up to 20 years. The patients are carefully examined before, during, and after irradiation. The tests include nystagmography after caloric stimulation with water at 30 to 44 C, ice water, and audiometry. A clinical followup investigation of 228 consecutive patients revealed the following: freedom from or considerable improvement in vertigo was found in 89 percent; tinnitus had diminished or disappeared in 48 percent; hearing was improved or unchanged in 64 percent; and caloric reaction was clearly reduced in 58 percent. Of the last 200 surgical patients, only one has transitory facial paralysis. Author

N70-30723*# Illinois Univ., Urbana.
PATTERNS OF COCHLEAR HAIR-CELL LOSS IN GUINEA PIGS AFTER INTENSE STIMULATION BY SINUSOIDAL SOUND
Harlow W. Ades, Charles W. Stockwell, Lynn B. Poche, and Hans Engstroem (Uppsala Univ.) *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 285–298 refs (See N70-30699 16-04)
(Grant NGL-14-005-074)
Avail: SOD $4.50; CFSTI CSCL 06C

Guinea pigs were individually exposed to intense sinusoidal sound stimulation of various frequencies and varying also in intensity and duration. After a suitable period to allow for degeneration of damaged hair cells, the animals were sacrificed and surface preparations of the organs of Corti were made according to the method of Engström. Cochleograms of each organ of Corti were constructed to map the position and condition of each cochlear hair cell. The cochleograms were coded for computer reduction of data. Intercomparisons of hair-cell damage were made in terms of variants of the three parameters of the exposure stimulus. Narrow regions of severe to total hair-cell destruction were seen in the ears exposed to higher frequency stimuli. In general, greater damage was seen in outer than in inner hair cells. This difference was greatest in ears exposed to low frequencies, in which extensive outer-hair-cell damage was seen near the apex. Relations between damage and stimulation patterns are discussed in terms of the nonlinear response of the ear to high-intensity stimulation. Author

N70-30724*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THRESHOLDS FOR THE PERCEPTION OF ANGULAR ACCELERATION ABOUT THE THREE MAJOR BODY AXES
John D. Stewart and Brant Clark (San Jose State Coll.) *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 299–306 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The specific purpose was to determine thresholds for the perception of rotation about the x-, y-, and z-axes and to compare these results for the group and for the individual observers. The thresholds of 18 men with normal vestibular function were established for the x-, y-, and z-axes by use of a precision rotation device. The angular acceleration was ordered, using a random, forced-choice, double-staircase procedure, and the order of determination of the three thresholds for each observer was established by a Latin-square method. Mean thresholds were found to be equal for the x- and z-axes. The mean threshold about the y-axis (somersaulting axis) was found to be substantially greater than those about the x- and z-axes, but these differences were both just below statistical significance. There was a great range in thresholds for all three conditions. The intercorrelations among the three thresholds were not significantly different from zero. It is concluded that under optimum testing conditions, the mean thresholds about the x-, y- and z-axes are essentially the same but that the threshold about one body axis does not predict the threshold about the other two axes for a given observer. Author

N70-30725*# General Dynamics/Convair, San Diego, Calif.
EFFECT OF INSTABILITY DURING ROTATION ON PHYSIOLOGIC AND PERCEPTUAL-MOTOR FUNCTION
Bernard D. Newsom and J. F. Brady *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 307–328 refs (See N70-30699 16-04)
(Contract NAS9-6986)
Avail: SOD $4.50; CFSTI CSCL 06S

The requirement for an artificial-gravity space station has not been established because of the limited duration of space missions to date. The eventuality of such a system is generally

accepted on the justification of comfort, training, facilitation of mechanical operations, and the more natural environment it offers for prolonged missions. A rotogravity environment was studied on the basis of radius requirements and rotational velocity limitations for crew habituation and performance. The added parameter that influences design and propellant costs is the stability required for the crew to operate satisfactorily. The effect of perturbation during rotation is emphasized. Author

N70-30726*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CERTAIN ASPECTS OF ONBOARD CENTRIFUGES AND ARTIFICIAL GRAVITY
Ralph W. Stone, Jr., W. M. Piland, and William Letko *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 329-346 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Artificial gravity is an exceedingly complex environment within which man must work and requires habituation to the environment. There appears to be the potential of a physically induced ataxia tendency, a tendency to leg heaviness while walking, and numerous unnaturally induced acceleration phenomena. Design criteria for artificial gravity are presented which show a vehicle of 55 feet in diameter may meet potential criteria. Some limited data indicate that smaller vehicles may be satisfactory. Onboard centrifuges, which have a relatively short radius, require much larger centrifugal forces than are anticipated for basic artificial gravity and exceed some of the tolerable limits for artificial gravity. Thus a restriction of movement on centrifuges is required. Author

N70-30727*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WALKING IN SIMULATED LUNAR GRAVITY
William Letko and Amos A. Spady, Jr. *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 347-352 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Experience in aircraft and in ground-based simulators indicates that man will be able to walk in lunar gravity with no apparent difficulty. Metabolic measurements indicate that the energy cost of locomotion in simulated lunar gravity is considerably less than in 1 *g*, as was found in earlier studies. The simulation technique used was unimportant for level walking, but generally had a large effect on the metabolic data obtained while ascending grades. Increases in the loads carried generally had a relatively small and inconsistent effect on metabolic costs. Changing the walking surface from a hard, smooth surface to one of sandy soil caused a large increase in the metabolic rate at the higher locomotion rate. Author

N70-30728*# Merrimack Coll., North Andover, Mass.
PROGRESS IN VESTIBULAR MODELING. PART 1: RESPONSE OF THE SEMICIRCULAR CANALS TO CONSTANT ROTATION IN A LINEAR ACCELERATION FIELD
Robert W. Steer, Jr. *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 353-362 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The disparity between the experimentally evaluated time constants of objective and subjective responses to angular accelerations and the hydromechanical time constants of the semicircular canals is further accentuated by analysis of the semicircular canals as a damped hydromechanical angular accelerometer. The dynamic response characteristics of the semicircular canals to angular acceleration are shown to be an order of magnitude faster than can be observed by nystagmus and subjective responses to vestibular stimulation. In addition, it is shown that roller pump action of the flexible canalicular duct can maintain an adequate pressure differential across the cupula to give it a constant deflection. This is physiologically equivalent to a constant angular acceleration stimulus, and offers a plausible explanation for the continuous nystagmus responses that are provoked by rotation at a constant angular velocity about an axis which is not colinear with an applied acceleration field. Author

N70-30729*# Massachusetts Inst. of Tech., Cambridge.
A MODEL FOR VESTIBULAR ADAPTATION TO HORIZONTAL ROTATION, PART 2
Laurence R. Young and Charles M. Oman *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 363-368 refs (See N70-30699 16-04)
(Grants NGR-22-009-156; NsG-577/22-09-025)
Avail: SOD $4.50; CFSTI CSCL 06S

Short-term adaptation effects are seen in subjective sensation of rotation and vestibular nystagmus. The mathematical model for semicircular canal function is improved by the addition of two adaptation terms (approximately 1/2-minute time constant for sensation and 2-minute time constant for nystagmus) to the overdamped second-order description. Adaptation is represented as a shift of reference level based on the recent history of cupula displacement. This model accounts for the differences in time constants among nystagmus and subjective cupulograms, secondary nystagmus, and decreased sensitivity to prolonged acceleration. Author

N70-30730*# Canadian Forces Medical Service, Toronto (Ontario).
A QUANTITATIVE STUDY OF VESTIBULAR ADAPTATION IN HUMANS, PART 3
Richard Malcolm *In* Naval Aerospace Med. Inst., 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 369-393 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06P

A mathematical model for short-term adaptation to vestibular stimuli is presented in which the physiological response is driven by a signal proportional to the difference between the peripheral end-organ response theta c and a central reference level R in such a way that dR/dt varies as (theta c-R). From this relation a transfer function is derived relating slow-phase angular velocity of resulting nystagmus to the angular velocity of head rotation. The resulting model has been tested by comparing its responses to controlled step and ramp angular velocity stimuli with those of human subjects. A close match was obtained in all cases, which strongly supports the view that significant adaptive effect is at play. The main time constant of the adaptive term was 82 seconds and the mean cupular restoration time constant T sub c was 21 seconds. It is suggested that previous values quoted for T sub c represent underestimates of the true value owing to superposition of the adaptive term described. The adaptive term accounts well for the phenomenon of secondary nystagmus, especially during either strong stimuli or prolonged rotations. Some implications of the findings in relation to clinical and aviation medicine are discussed. Author

N70-30770*# Minnesota Univ., Minneapolis. School of Public Health.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report, 1 Jun.-30 Nov. 1969
Irving J. Pflug Dec. 1969 92 p refs
(Grant NGL-24-005-160)
(NASA-CR-110431; SAPR-3) Avail: CFSTI CSCL 06M

CONTENTS:

N70-30771*# Minnesota Univ., Minneapolis. School of Public Health.

SURVIVAL OF MICROBIAL SPORES UNDER SEVERAL TEMPERATURE AND HUMIDITY CONDITIONS

In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 1-12 (See N70-30770 16-04)

Avail: CFSTI CSCL 06M

Continuing experiments to measure the survival rates of bacterial spores as a function of relative humidity in sealed plastic containers at 22 C and 45 C are reported. It was found that significant die-away of Bacillus subtilis var. niger spores does occur at relatively low temperatures (45-60 C). This die-away is most pronounced at very high relative humidity (> 90%) but is also significant at intermediate humidities (approximately 50% or lower). The same effect was noted for natural spores but with considerably longer D-values. Glass strips, when compared to stainless steel, appear to greatly accelerate the die-away at > 50% RH. Author

N70-30772*# Minnesota Univ., Minneapolis. School of Public Health.

THE EFFECT OF HUMDITY, LOCATION, SURFACE FINISH AND SEPARATOR THICKNESS ON THE DRY HEAT DESTRUCTION OF BACILLUS SUBTILIS VAR. NIGER SPORES LOCATED BETWEEN MATED SURFACES

In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 13-40 refs (See N70-30770 16-04)

Avail: CFSTI CSCL 06M

Analysis of recent experimental results is presented. The following conclusions were reached: (1) Treatment humidity has a much larger effect on D-values in an open system than it does in a mated-surface system. The treatment humidity effect may be neglible as far as the design of spacecraft sterilization cycles are concerned. (2) In the open system, both conditioning and treatment humidity affect D-value, y-intercept, and intercept ratio (IR). (3) Both the D-value and y-intercept must be considered in a discussion of microbial survival. The IR appears to be useful for discussion. (4) The mated-surface system shows a greater variability than does the open system. This is probably due to variabilities in the mated-surface package and in the off-the-shelf stainless steel used for the mated surfaces. (5) The location of spores in a mated surface has an important effect on their thermal destruction rate. The spores near the edge tend to have smaller D-values than spores at the center of the plate. Author

N70-30773*# Minnesota Univ., Minneapolis. School of Public Health.

DETECTION OF LOW LEVELS OF MICROBIAL CONTAMINATION ON SURFACES BY CHEMICAL APPROACHES

In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 41-43 (See N70-30770 16-04)

Avail: CFSTI CSCL 06M

Standardization processes are described for the thin-layer chromatographic procedure and the microscope photometer used to measure and evaluate the quantities of the separated nucleotides from microbial cells. The results indicate that the method produces promising results in detecting low numbers of microbial cells on surfaces. Author

N70-30774*# Minnesota Univ., Minneapolis. School of Public Health.

DRY HEAT DESTRUCTION RATES OF BACILLUS SUBTILIS VAR. NIGER IN A CLOSED SYSTEM

In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 44-50 refs (See N70-30774 16-04)

Avail: CFSTI CSCL 06M

The development of apparatus with an O-ring groove for determining dry heat D-values and preliminary data are described. Both Teflon and Viton O-rings were tested with equilibration conditions of 35-40% RH at 23 C. The Viton O-rings were chosen because of their good sealing characteristics at high temperatures (up to 204 C) and their low water absorbing properties. The heat block system appears to perform well. Author

N70-30775*# Minnesota Univ., Minneapolis. School of Public Health.

DRY HEAT DESTRUCTION RATES OF MICROORGANISMS ON SURFACES AS A FUNCTION OF RELATIVE HUMIDITY

In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 51-68 ref (See N70-30770 16-04)

Avail: CFSTI CSCL 06M

Experiments to determine D-values of Bacillus subtilis var. niger spores subjected to a 100 C temperature are described. Results show that heating in a dry-gas environment (< 0.03% RH) results in D-values considerably lower than those obtained by heating in an ambient environment (34-36% RH at 22 C or 0.65-0.86% at 110 C). A D-value ratio of approximately 1:4 was noted in almost every trial. A comparison of dry nitrogen and dry air did not reveal any difference between the two gases: although drier conditions were associated with nitrogen than with air. There was an indication that heating in a dry gas may have reduced the y-intercept (indicating that a sharper than usual reduction took place during the first heating interval), compared to heating in the clean room. Author

N70-30823*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM (EC/LSS) FOR THE 1975 SPACE STATION

Hubert B. Wells 15 Apr. 1970 95 p refs

(NASA-TM-X-64508) Avail: CFSTI CSCL 06K

The results are presented of a preliminary study to define an environmental control and life support subsystem that is applicable to a long term, earth orbital space station for the 1975 time period. The space station is capable of supporting a 12-man crew continuously over an extended period of time with regular resupply. The EC/LSS must maintain a system life requirement of 10 years through maintenance spares and redundancy. A survey was made to define a group of assemblies that is suitable for fulfilling the requirements of the EC/LSS. The primary assemblies are as follows: atmospheric supply and pressurization; oxygen

recovery; atmospheric purification; thermal control; water management; water reclamation; waste management; suit loop/PLSS; crew systems; and expendables. Author

N70-30834# Advisory Group for Aerospace Research and Development, Paris (France).
SURVEY OF PROBLEMS AND TOPICS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 6-15 (See N70-30833 16-21)
Avail: CFSTI

Human factors problems associated with ground control systems are studied. Some of the influences on the form in which they originate and on the manner in which they are solved are briefly surveyed, and probable reasons for the neglect of certain problems and the preoccupation with others are suggested. These influences include the purpose of the system, military or civil manning, and the country in which the problem occurs. The association between human factors and certain other disciplines in the solution of problems is indicated, together with possible future trends in human factors work. Author

N70-30835# Advisory Group for Aerospace Research and Development, Paris (France).
STAGES OF HUMAN FACTORS CONTRIBUTIONS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 16-27 (See N70-30833 16-21)
Avail: CFSTI

The role of human factors which depends on the stage in the evolution of the system at which it begins to contribute is analyzed. Seven stages are distinguished, at each of which a distinct contribution can be made. The earlier the stage at which human factors advice is available, the more probable it is that its requirements are met in the operational system, obviating costly remedial measures. General human factors questions, appropriate at each stage, are compiled, which together illustrate the function of human factors in ground control systems. Author

N70-30838# Advisory Group for Aerospace Research and Development, Paris (France).
THE ANALYSIS OF SYSTEMS AND JOBS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 39-49 (See N70-30833 16-21)
Avail: CFSTI

Some of the reasons for describing and analysing systems and jobs are noted. Trials of the system may be less adequate if a detailed system description is not available, and the development of a selection procedure for operators relies on a full description of the system and the job so that the required attributes of operators may be deduced. Various factors associated with the description of jobs and systems are examined, including general principles and practices applied to the study of man and his tasks in systems. Examples of vigilance tasks and the effects of faulty equipment on the operator are used to illustrate the difficulties of obtaining accurate descriptions of jobs done under operational conditions. Several factors are difficult to include or control in descriptions and trials of systems and jobs, and the effects of these on the findings obtained from descriptions and trials are assessed. Author

N70-30839# Advisory Group for Aerospace Research and Development, Paris (France).
DESIGN AND ASSESSMENT OF DISPLAYS AND CONTROLS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 50-62 (See N70-30833 16-21)
Avail: CFSTI

Research on displays has been far more extensive than that on controls, but has nevertheless failed to deal adequately with many display problems, because it has been concentrated on topics which affect the fine detail of the appearance of the display rather than the broad features of its design. Choice of display type is influenced more by technical considerations than by human factors. Numerous studies of search and vigilance tasks in the laboratory have not solved the human factors problems in the corresponding tasks under operational conditions. Issues such as large versus small displays, individual versus group displays, and vertical versus horizontal displays have still to be settled, and the value of alphanumeric data has received less consideration than its legibility. Work on display contexts has emphasised ambient lighting and console design. Controls specified for various tasks have seldom been compared with each other, but there has been greater interest in control types than in their sensitivity. Display-control relationships cannot usually be specified in general terms, but are task dependent. Author

N70-30841# Advisory Group for Aerospace Research and Development, Paris (France).
MAN IN THE MAN-MACHINE SYSTEM
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 70-78 (See N70-30833 16-21)
Avail: CFSTI

Man's relation to machines depends on the extent to which he controls them or is dependent on them, since his role in the system and his satisfaction may be influenced by the responsibilities he retains. Several broad issues have to be considered before a function is allocated to man or machine. Many of the criteria used for allocation seem to be applied, in an arbitrary way, and the principles underlying the allocation process are disputed. Man as a system component does a variety of tasks, such as decision making, tracking and vigilance, and methods for training him to be more efficient are sought and tried out. As a component he is not very reliable, he is affected by stress, and the effort he makes is determined by numerous factors. The effects of effort relate more to job satisfaction than to performance. Man forms attitudes towards his work which have not been studied. Maintenance is mostly done by man, and new training methods in maintenance are intended to improve man's ability to locate and correct faulty equipment. Author

N70-30842# Advisory Group for Aerospace Research and Development, Paris (France).
INDIVIDUAL DIFFERENCES
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 79-87 (See N70-30833 16-21)
Avail: CFSTI

Individual differences are seldom concerned with the unique features of an individual operator, but deal with differences among operators according to various measurable traits and attributes, and their effects on system efficiency. The process of selection is intended to minimise the adverse effects of individual differences on system efficiency and to select for training those individuals most likely to become proficient. Selection may be based on a few carefully selected traits, or on numerous relatively unselected ones. In either case, periodic follow-up studies are necessary to validate the selection procedure. Automation is affecting both the nature of the individual operator's tasks and the methods by which he is trained to do them. In addition to the traits which feature in selection procedures, further important individual differences relate to age, to the effects of stress and shift work on the operator, to his working environment and to his medical fitness. Operators differ significantly in their performance of most tasks, such as vigilance, decision-making, and communicating with others. Author

N70-30843# Advisory Group for Aerospace Research and Development, Paris (France).
THE ROLE OF SIMULATION
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 88 - 91 (See N70-30833 16-21)
Avail: CFSTI

In ground control systems, simulation is employed for training, for evaluation, and for research. Simulation has been extended to include games, models, and fast-time simulation, and to examine new or proposed procedures and items of equipment. The value of simulation has been acknowledge almost from the inception of ground control systems. The emphasis on displays which occurred in early work has become less pronounced with the increasing concern to simulate large segments of systems and teams of operators. The validity of most findings obtained by simulation techniques can seldom be assessed with confidence and accuracy; nevertheless more trust can be placed in items evaluated by simulation than in those which have not been properly evaluated at all. Author

N70-30844# Advisory Group for Aerospace Research and Development, Paris (France).
MEASUREMENT OF PERFORMANCE
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 92 - 100 (See N70-30833 16-21)
Avail: CFSTI

Measures of performance may refer primarily to the system or to an operator within it. They are often adversely affected by the numerous practical constraints limiting the sorts of measures which can be taken and the conditions under which they are obtained. For certain purposes, measures of actual operating systems are taken, but these must be passive and not disrupt the functioning of the system in any way. Most measures use simulated systems and tasks, often with small numbers of subjects. Measures include the study and evaluation of selection, training and maintenance procedures. Computers have affected measurement by encouraging the building of mathematical models and by influencing instructional techniques. For some tasks, such as vigilance, measures have been taken in the laboratory and often do not apply operationally. For other tasks, such as tasks performed by teams, operational situations have been simulated and traditional tools for measurement, developed in the laboratory, have been neglected. Some of the problems encountered in measuring man in ground control systems are discussed. Author

N70-30845# Advisory Group for Aerospace Research and Development, Paris (France).
IDENTIFICATION OF FACTORS RELEVANT TO TASK PERFORMANCE
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 101 - 107 (See N70-30833 16-21)
Avail: CFSTI

The factors of potential relevance to the performance of most ground control tasks are very numerous. Some can be discovered directly or indirectly by means of quite standard techniques, such as check lists, flow diagrams, and job requirements. Other methods rely on observing the operator at work and judging what factors influence his actions. Many factors, related to training and expectancies for example, are present, but their importance is difficult to gauge quantitatively. Often, factors can be identified from formal or informal assessments by the operators themselves. Factors may be revealed by equipment innovations, by changes in research or teaching methods, such as the introduction of programmed learning, or by revised opinions on what is relevant to, or part of, human factors. They may also appear when, for any reason, the difficulty of a task changes. Author

N70-30846# Advisory Group for Aerospace Research and Development, Paris (France).
RELEVANCE OF OTHER RESEARCH FINDINGS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 109 - 113 (See N70-30833 16-21)
Avail: CFSTI

Sources of findings of potential relevance to ground control systems, both in other applied work and in the laboratory are analyzed. In general, the human factors worker must be satisfied that the findings themselves are valid and that they were obtained under similar circumstances to those in ground control systems before their potential relevance can be established. They should then be treated as hypotheses requiring verification in the ground control context. Applied work of potential relevance may be in human factors, work study, ground control systems, industrial psychology, or social psychology, or in subdivisions or adjuncts of these disciplines. The basic theoretical work of greatest potential interest is probably that on learning, memory, skill, perception, motivation of personality, though from time to time other topics may become relevant. Author

N70-30877*# National Aeronautics and Space Administration, Washington, D.C.
FIFTH ANNUAL NASA-UNIVERSITY CONFERENCE ON MANUAL CONTROL
1970 720 p refs Conf. held at Cambridge, Mass., 27-29 Mar. 1969 Sponsored jointly by NASA and MIT
(NASA-SP-215) Avail:CFSTI HC$10.00/MF$0.65 CSCL 05E

Summaries are presented on research on quasi-linear models, display systems, optimal control methods, adaptive and discrete models, human performance theory, neuromuscular models, monitoring, and applications of manual control. For individual titles see N70-30878 through N70-30912.

N70-30878*# University of Southern Calif., Los Angeles.
IDENTIFICATION OF HUMAN OPERATOR MODELS BY STOCHASTIC APPROXIMATION
C. B. Neal (Hughes Aircraft Co.) and G. A. Bekey *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 3 20 refs (See N70-30877 16-05)
(Grant NGR-05-018-022)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The application of stochastic approximation to the estimation of human operator model parameters is discussed. Both continuous and sampled-data models are considered. Stochastic approximation was used successfully for parameter estimates in both types of models. In the case of sampled data models, all parameters, including the sampling interval, are estimated. Author

N70-30879*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
APPLICATION OF A MODIFIED FAST FOURIER TRANSFORM TO CALCULATE HUMAN OPERATOR DESCRIBING FUNCTION
Richard S. Shirley *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 21 - 47 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A version of the fast Fourier transform (FFT) is used in a hybrid computer program to permit processing of tracking data to yield the human operator's describing function almost immediately after the period of data-taking. The use of the FFT allows the final calculation time required to process 216 seconds of tracking data to be reduced to 3 seconds from the 10 minutes previously required on the same computer. The algorithm used permits the bulk of the analysis of the data to be performed while the data are being taken, and does not require all the data to be present in core before processing begins. Author

N70-30880*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

NONLINEAR TIME-DOMAIN MODELS OF HUMAN CONTROLLERS

Lawrence W. Taylor, Jr. *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 49 65 refs (See N70-30877 16-05)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Earlier studies of linear models for human control response are reviewed. The results of nonlinear time-domain analysis are discussed and the method of selecting the maximum memory time and the order of the nonlinear model is described. Some results of orthogonal expansion of the weighting functions for reasons of data compression and reduction computation are presented and discussed. Author

N70-30881*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME EXAMPLES OF PILOT/VEHICLE DYNAMICS IDENTIFIED FROM FLIGHT TEST RECORDS

Rodney C. Wingrove, Frederick G. Edwards, and Armando E. Lopez *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 67 71 refs (See N70-30877 16-05)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Mathematical functions describing the combined pilot/vehicle dynamics were used extensively in earlier studies to analyze manned control systems. In these studies, the describing functions were measured in simulated tracking tasks using carefully controlled forcing functions to excite the pilot/vehicle dynamics. During routine flight tests, there are no carefully controlled forcing functions. Therefore, if describing functions are to obtained from this type of flight test record, an alternate identification technique is required. Such a technique that allows identification from routine operating records was presented earlier for identification of the pilot describing function. The application of this technique to the identification of the combined pilot/vehicle describing function is outlined and some preliminary results calculated from selected flight test records are presented. Author

N70-30882*# Calif. Univ., Berkeley. Dept. of Industrial Engineering and Operations Research.

APPLICATION OF GABOR'S ELEMENTARY-SIGNAL THEOREM TO ESTIMATION OF NONSTATIONARY HUMAN SPECTRAL RESPONSE

E. R. F. W. Crossman and H. Peter Delp *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 73 - 106 refs (See N70-30877 16-05)

(Grant PHS-UI-00016-02)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

The problem of estimating the human operator's non-stationary spectral response using stationary force-functions or his stationary response using transient inputs is considered from a statistical viewpoint. The disadvantages of using a moving boxcar data-window to form sequential estimates are discussed as is the uncertainty relationship which controls the compromise between frequency and time resolution. Empirical verification is provided for simulated and human data, in the transient input case, and for filter response data in the time-varying parameter case. Author

N70-30883*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

PILOT DESCRIBING FUNCTION MODELS FOR NONLINEAR CONTROLLED ELEMENTS

Leon C. Duggar, James T. Mannen, and Russell A. Hannen *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 107 - 110 refs (See N70-30877 16-05)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

The performance of human pilot describing function models and human tracking subjects with nonlinear controlled elements are presented and compared. Nonlinear controlled elements were considered in order to simulate a manual control system representing a limited or backup flight control system that exhibits control displacement saturation on rate saturation characteristics. The results show that an equivalent gain representation of the system nonlinear element is possible using describing function models for slight and moderate levels of nonlinear action. Further, the adjustment rules for the parameters of the describing function models are predictable for the class of controlled elements considered. Author

N70-30884*# University of South Florida, Tampa. Coll. of Engineering.

A STUDY OF THE VARIABILITY OF HUMAN OPERATOR PERFORMANCE BASED ON THE CROSSOVER MODEL

August L. Burgett *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 11128 refs (See N70-30877 16-05)

(Contract NASr-54(06))

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A parameter identification method based on regression analysis is used to analyze human operator performance in two compensatory tracking experiments. The parameters which are estimated and analyzed are human operator gain K and time-delay to be based on the crossover model. The approach taken in the analysis of the parameter values is to divide the variance of both K and tau, based on 20-second data intervals, into the within-subject and between-subject components for each day of testing. The results indicate that the human operator adopts a more consistent signal processing path as he learns the task, adopts a more uniform control strategy for the more difficult of the two experiments, and has an inherent variability of gain on which training has little effect. Author

N70-30885*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

AN INVESTIGATION INTO PURSUIT TRACKING IN THE PRESENCE OF A DISTURBANCE SIGNAL

L. D. Reid *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 129 - 169 refs (See N70-30877 16-05)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

The description of man as a servo control element while performing manual tracking tasks is discussed. Most of the theory concerning the man/machine interaction has been developed for the compensatory tracking task with recent efforts being directed towards the expansion of the present theory to cover the more complex situations of pursuit tracking and multiple loop tasks. The measurement of pilot describing functions in a pursuit tracking task with system disturbances when the input power spectra are continuous in nature is considered. In this program the rms levels of the primary input and the system disturbance are the same. Author

N70-30886*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

A MODEL FOR HUMAN CONTROLLER REMNANT

William H. Levison, Sheldon Baron, and David L. Kleinman *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 171 - 198 refs (See N70-30877 16-05)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A model for human controller remnant is postulated in which remnant is considered to arise from an equivalent observation noise vector whose components are linearly independent white noise processes. Extensive analysis of data obtained from simple manual control systems verifies that this model structure holds over a

wide range of input amplitudes and bandwidths, vehicle dynamics, and display locations. When the display is viewed foveally, the component noise processes scale with signal variance. This scale factor is independent of input parameters and of vehicle dynamics. Author

N70-30887*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN INVESTIGATION INTO SOME ASPECTS OF THE HUMAN OPERATOR DESCRIBING FUNCTION WHILE CONTROLLING A SINGLE DEGREE OF FREEDOM
M. Gordon-Smith *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 203-240 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A single axis, random forcing function, compensatory display tracking task was used to investigate the effect of the manipulator on the remnant portion of the human operator's output. Pressure and free-moving manipulators were used with rate control vehicle dynamics and filtered white noise forcing functions similar in spectral shape to the STI inputs. Data is presented which shows the effect of the manipulator and forcing function on the system performance, the human operator describing function, and the remnant. Author

N70-30888*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF DISPLAY GAIN ON HUMAN OPERATOR INFORMATION PROCESSING RATE IN A RATE CONTROL TRACKING TASK
Daniel L. Baty *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 243-262 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A single axis rate control tracking experiment was conducted to determine the sensitivity of transinformation (information processing rate in bits/sec) to display gain, display type (pursuit or compensatory), and forcing function bandwidth. Four other performance measures were also derived: relative error, relative noiseless error, relative remnant, and system open-loop crossover frequency. It is shown that human information processing rates increase to a maximum and then decrease as a function of both display gain and forcing function bandwidth. In general, little difference in transinformation performance is noted between pursuit and compensatory displays. Author

N70-30889*# Technische Univ., Berlin (West Germany).
ROTATION OF VISUAL REFERENCE SYSTEMS AND ITS INFLUENCE ON CONTROL QUALITY
R. Bernotat *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 263-270 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Electronic displays pose large human engineering possibilities and, at the same time, new problems. One special aspect is the rotation of the display reference system. The human operator is unable to compensate for rotation. As a result tracking errors increase considerably at 90 deg and 270 deg rotation angles. An action-display indicating the stick signal to the control system compensates completely for the rotation effect. Author

N70-30890*# Massachusetts Inst. of Tech., Cambridge.
THREE DISPLAY TECHNIQUES AT THE MAN VEHICLE LABORATORY
Laurence R. Young, Charles M. Oman, Robert M. Vircks, Noel A. J. Van Houtte, and Gordon G. Kemp *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 271-284 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Three display techniques designed to reduce human uncertainty about his spatial orientation are presented. A 3-D display system is described in which a simple computer-generated CRT. contact analog system is controlled by movement of the observer's head, as well as by vehicle motion . A prototype VTOL guidance and control display is described. All attitude and guidance cues are presented in an integrated horizontal situation display in which pitch and roll angles appear as vehicle axis projections, and predictive display of attitude and position is used. An anti-vertigo research display is described in which visual-vestibular conflict is reduced by driving a rotating visual field at rates determined by a mathematical model for vestibular function. Author

N70-30891*# Stanford Research Inst., Menlo Park, Calif.
APPLICATIONS OF TACTILE DISPLAYS FOR PILOT CUING
John W. Hill, James C. Bliss, and Kenneth W. Gardiner *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 285 290 refs (See N70-30877 16-05)
(Contract F33615-68-C-1435)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Several vibrator, air jet, and moving button tactile displays were evaluated as cuing aids for pilot training. The best displays, as determined by tracking performance, were built into a GAT-1 trainer. The displays were further evaluated for their ability to help pilots control the trainer in some flight simulation tracking tasks. Author

N70-30892*# Illinois Univ., Urbana.
STEP TRACKING: IN WHAT SENSE IS THIS OPTIMAL?
Gyan C. Agarwal and Gerald L. Gottlieb *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 293-305 refs (See N70-30877 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Step tracking experiments were conducted to determine whether the human motor system behaves as a bang-bang servo. The studies show that in only one case of isotonic unpredictable tracking in transition neutral-dorsiflexed position is there a bang-bang characteristic of the system. The predominant control law indicated by the experiments is a unilateral activation of the appropriate muscle with some lead compensation. The antagonist muscle is turned off and not used as an active brake in the action, with one exception. Author

N70-30893*# Lear Siegler, Inc., Santa Monica, Calif.
AN EVALUATION OF A PILOT MODEL BASED ON KALMAN FILTERING AND OPTIMAL CONTROL
Rodney D. Wierenga *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 307-341 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A pilot model based on Kalman filtering and optimal control is given which because of its structure provides for estimation of the plant state variables, the forcing functions, the time delay, and the neuromuscular lag. The inverse filter and control problem is considered where the noise and cost function parameters are found that yield a frequency response which is in close agreement with that found experimentally. A good correspondence with sine wave tracking is shown including eyes closed tracking. In addition, measurement noise and time delay are shown to account for the differences in frequency response caused by two vastly different displays in a tracking task and provide insight into possible ways of evaluating displays. Author

N70-30894*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN OPTIMAL CONTROL MODEL OF HUMAN BEHAVIOR
David L. Kleinman, Sheldon Baron, and William H. Levison *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 343-366 refs (See N70-30877 16-05)
(Contract NAS12-104)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Optimal control and estimation theory are applied to problems in manual control. By assuming that the human is optimal in some sense, a model is developed for human operator behavior which is capable of accurately predicting task performance, describing functions, and all power spectra. The model is described in detail and its application is made to three basic compensatory tracking tasks. Author

N70-30895*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
APPLICATION OF OPTIMAL CONTROL THEORY TO PREDICTION OF HUMAN PERFORMANCE IN A COMPLEX TASK
Sheldon Baron, David L. Kleinman, Duncan C. Miller, William H. Levison, and Jerome I. Elkind *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 367-387 refs (See N70-30877 16-05)
(Contract F33615-68-C-1192)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

An optimal control model of the human operator is used to analyze a manual control task involving the control of longitudinal position of a hovering XV-5A aircraft. It is shown that the model can reproduce the essential characteristics of pilots performing this task as well as system performance scores. In addition, the same optimization framework is used to predict visual scanning parameters. Author

N70-30896*# Systems Technology, Inc., Hawthorne, Calif.
TRACKING QUASI-PREDICTABLE DISPLAYS SUBJECTIVE PREDICTABILITY GRADATIONS, PILOT MODELS FOR PERIODIC AND NARROWBAND INPUTS
R. E. Magdaleno, H. R. Jex, and W. A. Johnson *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 391-428 refs (See N70-30877 16-05)
(Contract NAS2-3746)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Tracking displays often present signals which are quasi-predictable from low damped vehicle modes, ship motions, etc. The practical dimensions of subjective display predictability are reviewed, and an adaptive human operator model is developed, based on the successive organization of perception theory of skill and on optimal signal prediction. Analysis of this model reveals new parameters for characterizing the subjective predictability and display performance with narrowband processes. The model explains a number of past and present experimental results. Author

N70-30897*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
DECISION PROCESSES IN THE ADAPTIVE BEHAVIOR OF HUMAN CONTROLLERS
Anil V. Phatak (MIT, Cambridge) and George A. Bekey *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 429-459 refs (See N70-30877 16-05)
(Grant NGR-05-018-022)
Avail: CFSTI HC$10.00/ MF$0.65 CSCL 05E

The development of a decision algorithm which simulates the rapid adaptive behavior of human controllers following sudden changes in plant dynamics is discussed. The control of a VTOL aircraft in hover following failure of the stability augmentation system is used as a specific example. The decision algorithm is based on the assumption that the human controller recognizes certain pattern features in the error-error rate phase plane. Experimental data, obtained from pilots facing four possible alternatives following the time of failure, are presented. The proposed decision algorithm is developed and digital simulation results are discussed. A theoretical justification for the algorithm based on statistical decision theory is presented. Author

N70-30898*# National Aeronautics and Space Administration, Washington, D.C.
MOTION SCALING ON ONE- AND TWO-AXIS COMPENSATORY CONTROL TASKS
Hugh P. Bergeron *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 463-470 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Tests consisting of one- and two-axis closed-loop tracking tasks, with and without motion, were made to define areas where motion cues are beneficial. Little or no difference in the error measurements was observed in the single-axis motion/no motion runs. Similar results were obtained when comparing two single-axis tests with different pitch orientation. The two-axis tests, which consisted of pitch and yaw and pitch and roll, did produce a difference in the error measurements in the motion/no motion comparisons. A decrease in normalized tracking error and an increase in the closed-loop system frequency was observed when motion was added. Tests were also run in pitch and yaw only, in which the scale of the motion input was reduced. The tests were performed by the subject in sequence starting with no motion all the way to full motion and back down to no motion. Each motion scale condition (none, 1/16, 1/8/ 1/4, 1/2, and full) constituted a test. The normalized tracking error remained constant for full, 1/2, and 1/4 motion scaling, but increased with a further reduction in motion scaling. Author

N70-30899*# Michigan Univ., Ann Arbor.
SUBJECTIVE SCALING OF SPRINGS, SHOCK ABSORBERS AND FLY WHEELS
Richard Pew and J. David Chananie *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 471-481 refs (See N70-30877 16-05)
(Contract NASr-54-(06))
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Twenty-four subjects judged the relative stiffness of springs, resistance of viscous dampers, and massiveness of inertias produced by a variable dynamics control stick. Perceived massiveness was found to be nonlinearly related to physical inertia. However, the presence of substantial damping tends to reduce sensitivity to massiveness and vice versa. Author

N70-30900*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HUMAN PERFORMANCE IN TIME-OPTIMAL STATE REGULATION TASKS
Duncan C. Miller *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 483-519 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Three subjects were thoroughly trained in the time-optimal state regulation of two second-order systems with several types of displays. The subjects were required to bring the state of the controlled system from a series of arbitrary initial conditions to rest at a zero reference state in minimum time by manipulating a control switch. The statistical distributions of the subjects' switching errors were modeled in terms of the sensory judgments and decisions required by the task. Author

N70-30901*# Illinois Univ., Urbana.
MATHEMATICAL DEVELOPMENT AND SOLUTION OF A PHYSICAL MODEL FOR MUSCULAR CONTRACTILE ELEMENTS
Julia T. Apter and William W. Graessley (Northwestern Univ.) *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 523-539 refs (See N70-30877 16-05)
(Grants PHS-GM-14659; PHS-HE-05808; PHS-CA-06475)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A self-consistent model based on valid physical and chemical laws known to govern the viscoelastic behavior of polymeric materials was developed to be also consistent with muscular behavior. Exposure of the model to various perturbations like stretch loading, chemical reactions, or diffusion of ions replicated events known to take place during stretch, loading, and stimulation of muscle, whether smooth or striated. The equations of motion of the model so perturbed were solved with an analog computer which generated stress, strain, and strain rate curves for the model. The curves closely resembled real shortening velocity-time curves, force-velocity curves, isometric tension development, and other muscular responses. Therefore it was possible to obtain initial estimates of model parameters from real muscular behavior. The results show some details of real muscular behavior previously not appreciated, like phase gain-angle and elastic modulus enhancement at critical sinusoidal strain frequencies. The general nature of the model makes it possible to formalize more complex perturbations and to quantify a wide range of muscular behavior. Author

N70-30902*# Illinois Univ., Urbana.
MUSCLE SPINDLE MODELS: MULTIPLE INPUT-MULTIPLE OUTPUT SIMULATIONS
Gerald L. Gottlieb and Gyan C. Agarwal *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 541-558 refs (See N70-30879 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A mathematical model is developed to describe simulations of a linear, lumped-parameter mechanical model of the muscle spindle as a neurally controlled transducer of stretch and the requirements such a model places on control mechanisms are discussed. The control exerted by the efferent nervous system on the dynamic and static behavior of the muscles is discussed. R.B.

N70-30903*# Illinois Univ., Urbana.
SOME ASPECTS OF HUMAN POSTURAL REGULATION
Gyan C. Agarwal, Gerald L. Gottlieb, and Lawrence Stark (California Univ., Berkeley) *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 559-579 refs (See N70-30877 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Two antagonistic muscular systems were studied, one of which rotates the forearm (wrist rotation) and the other flexes the ankle joint. The anatomical components of the stretch reflex include a physiological transducer, called the spindle receptor, which senses the length and the rate of change of length of a muscle and converts this information into a neural signal, the motor neutrons which combine the feedback signal from spindles with other control signals, and the muscle together with its load which is the system being controlled. R.B.

N70-30904*# California Univ., Los Angeles.
A FORMAL MODEL FOR ARM MOTION DURING TARGET APPROACH
J. W. Aldrich, J. Lyman, and H. Stassen *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 581 608 refs (See N70-30877 16-05)
(Grants HEW-RD-2904-M-69; V100SP-9779)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

One of the critical problems in the control of remote manipulators and prostheses is the ability of the human operator to control a multiple degree of freedom device effectively with a minimum number of controllers. For more than three degrees of freedom, effective control by using one controller axis for each degree of freedom becomes excessively difficult. A study of the fine structure of limb outputs in a multiple degree-of-freedom task was undertaken to analyze actual arm motion in a given multiple degree-of-freedom task and to develop a formal model for motion about each degree of freedom in a multiple degree-of-freedom voluntary task. Author

N70-30905*# Massachusetts Inst. of Tech., Cambridge.
CONTRIBUTIONS OF ROLL AND YAW MOTION CUES IN MANUAL CONTROL
L. R. Young and P. B. Dinsdale *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 609-613 (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Previous communications concerning the effects of roll motion cues on pilot characteristics emphasized the increase in low frequency gain and the phase lead contributed at higher frequencies. To determine the relative contributions of semicircular canal and otolith responses, experiments were performed in yaw and roll control of a K/s squared vehicle on a moving base rotation simulator. Comparison of human operator describing functions shows that rotation with respect to the g vector (roll) leads to higher gain than rotation in a horizontal plane, although no significant difference in phase lag appears. Author

N70-30906*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FOUR-AXIS COMPENSATORY SYSTEMS WITH SEPARATED DISPLAYS AND CONTROLS
William H. Levison and Jerome I. Elkind *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 617-636 refs (See N70-30877 16-05)
(Contract NAS2-3080)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A current experimental study of multivariable manual control systems is reviewed. Results are presented from a complementary set of single-axis and multi-axis experiments. Single-axis data show that mean-squared error scores, controller describing functions, and observation noise spectra vary in a predictable way with viewing conditions. Multi-axis tracking tasks in which visual scanning is prohibited indicate the presence of a significant amount of interference between the tasks. The scanning behavior exhibited by the subjects when tracking four axes simultaneously corresponds to the observational qualities of the various displays as revealed through the single-axis experiments. Author

N70-30907*# Systems Technology, Inc., Hawthorne, Calif.
A THEORY FOR THE HUMAN OPERATOR'S REMNANT IN MULTILOOP DISPLAY-CONTROL TASKS
W. F. Clement *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 637-654 refs (See N70-30877 16-05)
(Contract N00014-68-C-0443)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The theory comprises stochastic finite-dwell sampling among displays with continuous control output based on intersample reconstruction theory. Random sampling remnant theory introduces the notion of stability in the mean-square sense in the operator's closed-loop tracking performance. A related regression of adopted crossover frequency is shown to be sensitive to the controller's sampling remnant. Foveal or parafoveal finite dwell sampling and

intersample control output reconstruction suppress sampling remnant. A suppressed remnant will enable the operator to adopt ratios of sampling-to-crossover frequency more nearly approaching the lower bound predicted by the generalized sampling theorem. Two examples illustrate the practical application of the theory to displays for manual control. The influences of finite dwell and intersample reconstruction suggest that sampling remnant may offer a powerful practical measure for trading off the number and types of displays in a multiloop control situation. Author

N70-30908*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

APPLICATION OF PILOT MODELS TO DISPLAY DESIGN SOME BASIC EXPERIMENTS

R. O. Anderson *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 655-659 refs (See N70-30877 16-05)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A brief summary of experiments using simple controlled elements in primary tracking tasks and two forms of secondary task is presented. The results, in the form of eye movement data, task performance, etc. are compared with one existing theory, and a number of possibilities for future work are presented. The results are also applicable for workload definition. Author

N70-30909*# Ohio State Univ., Columbus.

DESCRIBING FUNCTION MODELS OF A DRIVER-AID SYSTEM FOR CAR FOLLOWING

Ronald G. Rule and Robert E. Fenton *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 663-684 refs Sponsored by the Ohio Dept. of Highways (See N70-30877 16-05)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Excellent car-following performance can be obtained by aiding the driver, this has previously resulted in asymptotic instability. A control stock with a built-in kinesthetic-tactile display aid for the driver was tested in a car-following situation, and describing function models of the resulting driver-vehicle system were calculated. Asymptotic stability was obtained by using control compensation, which also resulted in improved longitudinal handling qualities. Author

N70-30910*# Massachusetts Inst. of Tech., Cambridge.

RESOLVED MOTION RATE CONTROL OF RESOLVED MANIPULATORS AND HUMAN PROSTHESES

Daniel E. Whitney *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 685-696 refs Sponsored in part by Dept. of Health, Educ. and Welfare (See N70-30877 16-05)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The kinematics of remote manipulators and human prostheses is analyzed for the purpose of deriving resolved motion rate control. That is, the operator is enabled to call for the desired hand motion directly along axes relevant to the the task environment. The approach suggests solutions to problems of coordination, motion under tasks constraints, and appreciation of forces encountered by the controlled hand. Author

N70-30911*# Boeing Co., Seattle, Wash.

EVALUATION OF A NEW AIRCRAFT CONTROLLER CONCEPT FOR THE SST

John De Shon Warner *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 697-708 refs (See N70-30877 16-05)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A primary controller design which has the purpose of increasing the visible area on the SST instrument panel is reported. Results from a preliminary fixed base SST simulator study show that the concept is feasible from a manual control standpoint, but that more work is required to define optimum force-feel characteristics and the influence of motion. Author

N70-30912*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME APOLLO MIDCOURSE MANUAL CONTROL SIMULATION INNOVATIONS

Dexter C. Sederstrom, J. Robert Peterson, Derril B. Pratt, and O. Herbert Lindquist *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 709-713 (See N70-30877 16-05)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Analysis performed on the backup stabilization and control system for the Apollo project included man-in-the-loop studies for the service module reaction control system. The primary objectives were to establish procedures and techniques both for standard operation and in the event of failures in some of the reaction jets and to estimate the propellant consumption. The test setup included a 140 amplifier analog simulation, an electronic reaction jet breadboard, and a cockpit mockup. Three findings discussed include fast-time operation, maneuvers with failed reaction jets, and use of product-of-rate terms in the equations of motion. Author

N70-30933*# Whirlpool Corp., St. Joseph, Mich.

FEEDING SYSTEM DESIGN FOR ADVANCED ORBITAL FACILITIES Final Report

George Boswinkle [1970] 136 p refs

(Contract NAS9-9780)

(NASA-CR-108484) Avail: CFSTI

A conceptual design is defined for a feeding system for 100 men in orbiting space facilities for periods up to 90 days, providing food which maintains nutritional and psychological function in the environment of space. The areas of food preparation, food service, consumption, and cleanup were studied and optimal recommendations are presented. This plan supplies appetizing food approaching the theoretical ideal of earth-based meals. Beside supplying adequate nutrition, this system should contribute to mission accomplishment by greatly improving the morale of the crew. Recognizing the difficulties involved in preparing the varieties of foods required by such a system from basic ingredients under conditions of weightlessness, the recommended feeding system relies heavily on frozen, fully-prepared foods which need only be thawed and heated in one operation to make them ready for the table. Author

N70-30941# Pillsbury Mills, Inc., Minneapolis Minn.

MAXIMUM VARIETY FROM FEEDING UNIT OF LOW WEIGHT AND BULK

James Blodgett Natick, Mass. Army Natick Labs. Nov. 1969 76 p refs

(Contract DAAG17-68-C-0148)

(AD-702959; TR-70-29-FL; FL-103) Avail: CFSTI CSCL 6/8

A project was originated to: (1) improve organoleptic acceptability and performance of meal items, (2) develop 5 dual function food bars and (3) develop a coating material(s) and methods of application to prevent fragmentation of the components. Information is presented for the preparation of 7 improved food bars and 11 improved adjunct cubes which, when combined in defined combinations, yield 32 familiar meal items. Five dual function food bars were also prepared. Dual function bars may be consumed as is or hydrated to yield a familiar food item. Two coatings were prepared which, when applied to the food bars and adjunct cubes, prevent attrition and fragmentation during handling. Meal items prepared from the above coated components which had been stored for four months at 38 degrees C. in N2 filled cans were found

acceptable when evaluated by a 30-man panel. Hedonic ratings for the prepared meal items before and after storage with data on microbiological and moisture changes during storage and data to indicate coating effectiveness are also given. Author (TAB)

N70-30951*# Techtran Corp., Glen Burnie, Md.
PHYSIOLOGY OF THE VESTIBULAR ANALYZER
V. V. Parin, ed., et al Washington NASA Jun. 1970 250 p Transl. into ENGLISH of the book 'Fiziologiya Vestibulyarnogo Analizatora' Moscow, Nauka, 1968 p 5–240
(Contract NASw-1695)
(NASA-TT-F-616) Avail: CFSTI CSCL 06C

Papers are presented on problems related to the physiology of the vestibular analyzer of man and animals, located under conditions of terrestrial gravitation and applicable to space flight. For individual titles see N70-30952 through N70-30990.

N70-30952*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF THE VESTIBULAR ANALYZER WITH OTHER ANALYZER SYSTEMS. SOME REAL PROBLEMS OF INVESTIGATING THE ANALYZER FUNCTION OF ASTRONAUTS IN FLIGHT
M. D. Yemelyanov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 1–9 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A number of positions is put forward on the basis of analyzing disruptions of the analyzer function of cosmonauts in flight, and of experimental investigations under ground conditions. Illusory sensations of spatial orientation develop as a result of conflicting situations in perception of gravitational and visual conditioned reflex verticals. The illusions may be accompanied by motion sickness. Author

N70-30953*# Techtran Corp., Glen Burnie, Md.
VARIATION OF THE ELECTRICAL ACTIVITY OF THE BRAIN OF ANIMALS AND MAN UPON STIMULATION OF THE VESTIBULAR APPARATUS
V. G. Samsonova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 10–17 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of vestibular and light stimulations on reaction of single neurons in the visual cortex of the frog, total activity of different regions of the brain and reaction of assimilating the rhythm of light flashes in animals and man are studied. Isolated and multiple stimulation of the vestibular and visual analyzers reveal a close functional relationship between them. Author

N70-30954*# Techtran Corp., Glen Burnie, Md.
ACTIVITY OF THE PHASE AND TONIC SYSTEMS OF THE OCULOMOTOR APPARATUS IN CERTAIN VESTIBULAR REFLEXES AND VESTIBULAR NYSTAGMUS
D. P. Matyushkin *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 18–21 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The phase and tonic systems of the oculomotor apparatus in rabbits during revolutions around the longitudinal axis of the body and to rotational postnystagmus is investigated. When an animal is rotated slowly around the longitudinal axis of its body in the direction of the muscle being studied, the function of the tonic system in it is intensified, and the phase system is brought into the reaction along with the tonic system upon rapid rotations. Author

N70-30955*# Techtran Corp., Glen Burnie, Md.
ELECTROPHYSIOLOGICAL INVESTIGATION OF THE INTERACTION OF THE VESTIBULAR AND VISUAL AFFERENT SYSTEMS
G. I. Gorgiladze et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 22–37 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of vestibular stimulation (polarization of the labyrinth by direct current) on stimulation in the visual system and on the activity of individual neurons in the visual cortex of the cat is studied. Results of the experiments show that the effect of polarizing the labyrinth on the primary visual cortex of the cat is of a nonspecific nature. Author

N70-30956*# Techtran Corp., Glen Burnie, Md.
A MATHEMATICAL MODEL OF THE OCULOMOTOR APPARATUS
A. A. Petrov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 38–43 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

A mathematical model of the OMA is proposed in the form of the aggregate of neuron networks which function according to physiological principles. A qualitative explanation of certain reflex movements of the eyes is given, and results are presented of experiments on an OMA model run on an electronic computer. Author

N70-30957*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF POSTURE ON THE SENSORY-MOTOR COORDINATION OF MAN
A. A. Koreshkov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 44–47 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

Results are presented of experiments, in which test subjects executed complex movements during different positions of the body in space. Severe changes in the movements of the subjects were revealed, especially in the horizontal position. The data obtained in the experiments are considered with respect to the interaction of the vestibular, visual and motor analyzers. Author

N70-30958*# Techtran Corp., Glen Burnie, Md.
ON THE INTERACTION OF CERTAIN ANALYZERS UPON FORMATION OF MOTOR REACTIONS OF ANIMALS DURING WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 48–55 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Reactions to brief periods of weightlessness are described in cats and rabbits which are healthy, have one- or two-sided labyrinthectomies, or which are deprived of vision. The tonic and motor components are distinguished in the motor activity of the animals. Behavioral reactions of animals during weightlessness develop due to the effect of two competing information flows—from the gravireceptors and from the visual analyzer. Author

N70-30959*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE ADJUSTABLE REFLEXES OF ANIMALS DURING WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 56–63 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Experiments on cats and rabbits during weightlessness in a parabolic trajectory showed the following: 1) a sequential vestibular adjusting reaction which brings about the rotation reaction after disappearance of gravity; 2) a vestibular adjusting reaction

which stabilizes the position of the head in space during weightlessness; 3) a cervical adjusting reaction which causes straightening of the head and body with respect to the axis of the animal. Author

N70-30960*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF THE INTERACTION MECHANISMS OF THE VISUAL AND VESTIBULAR ANALYZERS
N. G. Medvedeva *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 64–69 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

The problem of the possible mechanism of interaction of the visual and vestibular analyzers is considered. The bioelectric potential of various regions of the brain and retina are recorded in a state of rest, and during single and rhythmic light stimulations in healthy and mute subjects. The interaction of these analyzers takes place at the level of the cortical-subcortical analyzer systems. Author

N70-30961*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF VISUAL STIMULATION ON NYSTAGMUS, FROM DATA OF ELECTRONYSTAGMOGRAPHY, IN THE PRESENCE OF TUMORS OF THE POSTERIOR CRANIAL FOSSA
N. S. Blagoveshchenskaya *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 70–76 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

Visual stimulation may intensify or retard spontaneous and caloric nystagus even in the same patient during dynamic investigation. This depends on the intensity of the stimulation and its characteristics (rhythmic light or a single light flash), and on application of additional stimuli (the caloric test). All characteristics of spontaneous and caloric nystagmus were altered by light stimulation in patients with tumors of the posterior cranial fossa, and periods of caloric nystagmus (phase culmination) were altered. Author

N70-30962*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF PROLONGED SLOW ROTATION ON HEARING
I. Ya. Yakovleva et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 77–80 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A study was made of the effect of the prolonged stay of man (3 and 10 days) in a rotating room at a velocity of 40 and 10 deg/sec on the functional state of the auditory analyzer. Variations in hearing were found which exceed the individual spread of the norm, and functional shifts were more severe after 3-day rotation at a velocity of 40 deg/sec, and were maintained for 5–6 hours after the experiment. Author

N70-30963*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF CENTRIFUGAL FORCE ON CALORIC NYSTAGMUS
V. A. Kislyakov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 81 - 84 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Variations in the thresholds of caloric thermal nystagmus in pigeons due to the effect of centrifugal force (0.1 – 1.0 g), acting in the tail-head or head-tail direction, were studied. Characteristic variations in the thresholds (both an increase and decrease) and the direction of nystagmus were found, depending on the magnitude and direction of the effect of centrifugal force. Author

N70-30964*# Techtran Corp., Glen Burnie, Md.
CHARACTERISTICS OF THE FUNCTIONAL STATE OF THE OTOLITHIC APPARATUS UNDER CONDITIONS OF VARIABLE WEIGHT
Ye. M. Yuganov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 85–88 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The functional state of the otolithic apparatus was studied under conditions of weightlessness and G-loads using galvanometry and a method of direct otolithometry. It was revealed that under conditions of brief periods of weightlessness, thresholds to current and linear acceleration increase uniformly, on the basis of which it is concluded that weightlessness is a specific stimulus of the vestibular apparatus. Author

N70-30965*# Techtran Corp., Glen Burnie, Md.
MICROELECTRODE INVESTIGATION OF THE VESTIBULAR NEURONS OF THE MESENCEPHALON
I. I. Leshchinyuk et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 89–93 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of afferent vestibular pulsation on neuron activity of the inferior tubers of the lamina quadrigemina was investigated under conditions of direct current polarization and acoustical and caloric stimulation of the labyrinth. The experiments were conducted on decerebralized cats. The presence of neurons in the inferior corpus bigeminum was shown. The type of reaction of neurons studied is broader than that in the vestibular neurons of the medulla oblongata. Author

N70-30966*# Techtran Corp., Glen Burnie, Md.
MICROELECTRODE INVESTIGATION OF NEURON REACTIONS OF THE VESTIBULAR NUCLEI ON THE CAT UPON POLARIZATION AND CALORIC STIMULATION OF THE LABYRINTHS
G. I. Gorgiladze *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 94–106 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Activity of vestibular neurons and the nature of their reaction to stimulation of the ipsi- and contralateral labyrinths, and also the effect of intravenous administration of strychnine to explain the nature of the interaction between vestibular nuclei are investigated in detail. It is concluded that interaction between contralateral vestibular nuclei is brought about by direct commissural connections Author

N70-30967*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL INVESTIGATION ON MODELING DIFFERENT TYPES OF NEURONS
V. I. Kiy et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 107–114 (See N70-30951 16-04)
Avail: CFSTI CSCL 06D

A mathematical model of a system, is proposed as an example of the electrical activity of vestibular neurons. The model makes it possible to overcome many methodological difficulties of electrophysiological experiments, and to model conditions of the experiment and to introduce them as a disrupting effect. Author

N70-30968*# Techtran Corp., Glen Burnie, Md.
ON THE FUNCTIONAL RELATIONSHIP BETWEEN THE SEMICIRCULAR CANALS AND THE OTOLITHIC APPARATUS
A. Ye. Kurashvili et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 115–119 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

It was established that when the combined effect of angular and centrifugal accelerations act on man and animals (rabbits, cats and dogs), the angular velocity of eye movement increases during the slow phase of pulses of rotational nystagmus. An increase begins at the moment G-loads take effect and continues until rotation reaches a constant velocity. An attempt is made on the basis of the data obtained to explain the effect of weightlessness on man. Author

N70-30969*# Techtran Corp., Glen Burnie, Md.
ON THE FUNCTIONAL STATE OF THE VESTIBULAR APPARATUS OF RATS DURING HYPOTHERMY
I. I. Voinova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 120–123 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The characteristics of post-rotational nystagmus in rats were studied during the dynamics of developing artificial hypothermy at a body temperature of 37-20 deg. When body temperature was lowered to 33–34 deg, the intensity of nystagmus was increased; cooling the rats to 28–27 deg and below caused post-rotational nystagmus to diminish, and the reaction disappeared completely at 20 deg. Author

N70-30970*# Techtran Corp., Glen Burnie, Md.
SENSORY MOTOR REACTIONS OF MAN UNDER THE EFFECT OF ROTATION ON A LOW-RADIUS INSTALLATION
S. S. Markaryan et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 124–127 ref (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Investigations were carried out on a special stand which permits variation in the position of a subject's body with respect to the vertical rotation axis. Rotation around an axis passing through the region of the pelvis with the subject in a vertical position is acceptable for no more than 20 min at a velocity of 1.5–2.0 rps. Rotation around axes passing through the region of the head, heart and feet are tolerated much worse. Author

N70-30971*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF MOTION SICKNESS AND INCREASED SENSITIVITY TO VESTIBULAR EFFECTS. ON THE PROBLEM OF VESTIBULO-VEGETATIVE REFLEXES DUE TO THE EFFECT OF CORIOLIS ACCELERATION
A. S. Kiselev *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 128–132 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Studies on 40 subjects revealed that the severity of vestibulo-vegetative and vestibulo-somatic reactions is greater during active tilting backward and forward than during tilting forward and backward. On this basis a new test which determines the degree of vestibular resistance to Coriolis acceleration is proposed for vestibular selection and conditioning of cosmonauts. Author

N70-30972*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF PROLONGED ROTATION AND CORIOLIS ACCELERATIONS ON THE VESTIBULAR FUNCTION OF MAN
R. R. Galle *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 133–137 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Fourteen experiments were conducted in a rotating chamber at a velocity of 10 and 40 deg/sec lasting up to 7 days. Some results of investigating the function of the vestibular analyzer during rotation are presented. It is proposed that prolonged rotation tests be used as diagnostic tests to determine the tolerance of man to vestibular effects. Author

N70-30973*# Techtran Corp., Glen Burnie, Md.
INVESTIGATIONS OF SLEEP IN MAN UNDER CONDITIONS OF PROLONGED ROTATION
F. D. Gorbov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 138–148 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Rotation of test subjects at an angular velocity of 10 deg/sec over a period of days had no significant effect on the quality of nocturnal sleep. Relatively superficial sleep was determined by factors of a circumstantial nature (uncomfortable bed, temperature discomfort, vibrations, etc.) rather than by rotation. Seven-day rotation at the same velocity decreased the depth of sleep (according to EEG data) without disrupting wellbeing. Author

N70-30974*# Techtran Corp., Glen Burnie, Md.
SOME DYNAMIC INDICATORS OF THE VESTIBULAR ANALYZER UNDER THE EFFECT OF CORIOLIS ACCELERATION
V. G. Strelets *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 149–155 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of prolonged Coriolis accelerations on rated athletes was studied. Vegetative reactions, and also shifts in static and dynamic equilibrium, post-rotational nystagmus and dynamometry were recorded. Grouping according to professional affiliation (flying or technical personnel) did not reveal any substantial differences between the groups. Author

N70-30975*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF DEVELOPMENT OF LATENT FORMS OF MOTION SICKNESS
A. N. Petrov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 156–160 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Motor responses to light signals were studied in 77 subjects with the help of a special device mounted on a two-beam swing. The time of complex sensory motor reactions, the amount of information perceived and processed and the capacity of the visual analyzer were determined. Statistically reliable variation of the indicators determined was revealed in seven subjects with the absence of visible signs of motion sickness. Author

N70-30976*# Techtran Corp., Glen Burnie, Md.
ON THE INTERRELATIONSHIP OF THE FUNCTIONAL TOLERANCE OF THE VESTIBULAR ANALYZER AND THE STATE OF ARTERIAL PRESSURE DURING MOTION SICKNESS
D. A. Pigulevskiy et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 161–165 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of the tenfold otolithic test on arterial blood pressure (BP) and pulse rate was investigated. BP, measured by the oscillographic method in persons resistant to motion sickness, remains unchanged or increases briefly upon vestibular stimulation. Hypotonia (57%) was noted in most persons prone to motion sickness. Author

N70-30977*# Techtran Corp., Glen Burnie, Md.
ON THE ROLE OF THE ADAPTATION FUNCTION OF SYMPATHETIC INNERVATION IN PREVENTION OF MOTION SICKNESS
V. P. Fomina-Kosolapova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 166 - 172 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Testing the effect on the excitability of the vestibular apparatus of a rabbit using sympatholytic (sympatholytin, piperoxane and pyridoxiphene), sympathomimetic (adrenaline and ephedrine) substances was carried out. Sympathomimetics caused a decrease in the number of nystagmic pulses during rotation and a reduction in post-rotational nystagmus. The sympatholytics, except for piperoxane, have the opposite effect. Author

N70-30978*# Techtran Corp., Glen Burnie, Md.
VESTIBULAR TRAINING OF TEST PILOTS BY PASSIVE METHODS
N. I. Popov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 173 - 176 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 05I

The problem of conditioning men to rotation with transfer to an unstable platform, rocking, rotation with active tilting of the head and body, balancing, and to complex vestibular and visual stimuli is considered. An increased tolerance of man to the enumerated effects was achieved in all cases after conditioning. Author

N70-30979*# Techtran Corp., Glen Burnie, Md.
ON THE NONSPECIFICITY OF VESTIBULAR CONDITIONING
B. B. Bokhov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 177 - 181 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Results presented are obtained in rabbits, which indicate the nonspecific nature of acclimatization to vestibular stimulation. After the animals had been conditioned to a single stimulus, a weakening was observed in the reaction of nystagmus in response to stimuli which were greater or less in value than the conditioning stimulus. Author

N70-30980*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF MOTION SICKNESS ON THE FUNCTIONAL STATUS OF THE HYPOPHYSIS-CORTEX SYSTEM OF THE ADRENAL GLANDS
N. I. Kastrov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 182 - 185 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of stimulating the vestibular apparatus on the content of regular elements of the blood was studied. It was established that rocking healthy subjects in a Khilov swing for 15 minutes leads to a distinct reduction of the eosinophils in the blood within 4 hours. Author

N70-30981*# Techtran Corp., Glen Burnie, Md.
MOTION SICKNESS IN DOGS BEFORE AND AFTER INTRAVENOUS ADMINISTRATION OF SODIUM HYDROCARBONATE
A. G. Kuznetsov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 186 - 188 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effectiveness of intravenous administration of hydrocarbonate and a prophylactic substance during motion sickness (vertical linear accelerations) was studied in three dogs. A two-time administration of 10 ml of a 5% solution at two-week intervals had a positive effect, which was expressed in a decrease in the frequency and severity of motion sickness symptoms. Author

N70-30982*# Techtran Corp., Glen Burnie, Md.
DEVELOPMENT OF NEW METHODS OF INVESTIGATING THE VESTIBULAR FUNCTION. THE ADI TEST AND ITS SIGNIFICANCE FOR FUNCTIONAL INVESTIGATION AND CONDITIONING OF THE VESTIBULAR ANALYZER
A. Kh. Minkovskiy *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 189 - 194 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

The combination of quantitative and qualitative characteristics of vestibulo-somatic, vegetative and sensory reactions, observed as a result of using measured angular accelerations, decelerations and tilting (the ADI test) in various planes, provides broad possibilities for correct analysis of the functional state of the vestibular analyzer. Author

N70-30983*# Techtran Corp., Glen Burnie, Md.
CERTAIN REFLEXES OF THE SEMICIRCULAR CANALS WITH RESPECT TO PROFESSIONAL SELECTION AND EVALUATION OF FLIGHT PERSONNEL
V. I. Babiyak *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 195 - 199 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The author proposes investigating the vestibular function with the help of positive and negative angular accelerations of 20 deg/sq sec. A definite relationship was discovered between illusions and nystagmus. The phase nature of variations in the indicators analyzed is emphasized. Author

N70-30984*# Techtran Corp., Glen Burnie, Md.
ANALYZING THE RAPID COMPONENT OF NYSTAGMUS IN NYSTAGMOGRAPHIC INVESTIGATIONS
M. M. Levashov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 200 - 203 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The nature of the rapid component of nystagmus is investigated with the help of photonystagmography. An attempt is made to give the quantitative characteristics of the rapid component of nystagmus. It is proved that the rapid component depends on afferent pulsation of the ampullar apparatus and may serve as a valuable indicator of the dynamics of the cupula. For total analysis of one cycle of nystagmus, it is recommended that the average harmonic velocity of the rapid and slow phases be used. Author

N70-30985*# Techtran Corp., Glen Burnie, Md.
ELECTRONYSTAGMOGRAPHY AND ITS PROSPECTS
A. Ye. Kurashvili et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 204 - 209 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06B

Electronystagmography is a simple and accurate method of recording eye movements. It may be used in the study of pathological states in the vestibular analyzer. It is used to establish a correlation between oculomotor nuclei and vegetative centers, and also to study the interaction between the vestibular and visual analyzers. Author

N70-30987*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF METHODS OF STUDYING THE VESTIBULAR FUNCTION IN A SPACESHIP
A. D. Matveyev et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 213-224 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Some ways and methods of investigating the vestibular analyzer under conditions of weightlessness are proposed. Adequate stimuli in this case may be the various movements of the cosmonaut's head and body, and rotation of the spaceship itself. The importance of complex investigation of the vestibular analyzer with recordings of EOG, EMG and EEG is emphasized. Author

N70-30988*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF THE IMPORTANCE OF PARABOLIC FLIGHT TO REPRODUCE BRIEF PERIODS OF WEIGHTLESSNESS IN VESTIBULAR EVALUATION OF COSMONAUTS
I. A. Kolosov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 225-229 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The possibility of using parabolic flights to create brief periods of weightlessness for vestibular selection of cosmonauts is considered. It was shown that parobolic flights reveal persons who are prone to motion sickness. The use of additional vestibular stimulation during weightlessness helps to reveal persons with latent forms of motion sickness. Author

N70-30989*# Techtran Corp., Glen Burnie, Md.
THE SIGNIFICANCE OF CERTAIN VESTIBULOMETRIC TESTS IN MEDICAL FLIGHT EXAMINATION OF PERSONNEL PREDISPOSED TO ILLUSORY SENSATIONS DURING FLIGHT
I. A. Sidelnikov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 230-236 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A chair with an unstable platform, pulsed current, a rotating chair with unstable platform and a rotating cylinder for optokinetic stimulation were used to study proneness to illusions of spatial orientation. It was discovered that increased susceptibility to pulsed current indicates a high probability of development of illusory sensations. Author

N70-30990*# Techtran Corp., Glen Burnie, Md.
COMPARATIVE ANALYSIS OF VESTIBULOMETRIC METHODS OF EXAMINATION USED FOR PURPOSES OF PROFESSIONAL SELECTION
S. R. Raskatova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 237-243 (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Three tests were compared in order to find more sensitive methods of vestibulometry during medical flight examination. Examinations of 900 subjects indicated that DPK is the simplest and most economical method timewise, revealing increased sensitivity of the vestibular apparatus to the effect of adequate stimulation when other methods are less indicative. Author

N70-31010*# California Univ., Berkeley. Space Sciences Lab.
CONSTITUENCY AND ORIGINS OF CYCLIC GROWTH LAYERS IN PELECYPOD SHELLS
Richard McNeil Barker (Ph.D. Thesis) [1969] 277 p refs *Its* Ser. 11, Issue No. 43
(Grant NGR-05-003-067)
(NASA-CR-110441) Avail: CFSTI CSCL 06C

Growth layers occurring in shells of 98 species of pelecypods were examined microscopically in thin section and as natural and etched surfaces. Study began with shells of eleven species known from life history investigations to have annual cycles of growth. Internal microstructural features of the annual layers in these shells provided criteria for recognition of similar, apparently annual shell increments in eighty-six of eighty-seven other species. All of the specimens feature growth laminae, commonly on the order of 50 microns in thickness. The specimens from shallow marine environments show either a clustering of growth laminae related to the formation of concentric ridges or minor growth bands on the external shell surface. Based on observations of the number of growth laminae and clusters per annual-growth layer, it was hypothesised that the subannual increments may be related to daily and fortnightly (and in some cases monthly) cycles in the environment. Author

N70-31026*# Franklin Inst., Philadelphia, Pa. Research Labs.
EFFECTS OF PUROMYCIN ON POWER SPECTRAL DENSITY AND EVOKED RESPONSE OF VISUAL CORTEX AND HIPPOCAMPAL ELECTRICAL ACTIVITY Final Report
Anthony Marmarov [1970] 49 p refs Prepared in cooperation with Maryland Univ., Baltimore. Psychiat. Inst.
(Contract NASw-1841)
(NASA-CR-110127; F-C2430) Avail: CFSTI CSCL 06E

Experiments were conducted on development and analysis of cortically evoked potentials from deep brain structures in response to bipolar electrical stimulation. Four electrophysiologic parameters were obtained in response to direct stimulation of the optic tract: evoked response of visual cortex and hippocampal regions and electrical activity of these regions under non-stimulus conditions. The responses to electrical stimulation show a marked reduction in amplitude following injection of puromycin. No significant changes were observed in latency of primary and secondary peaks. Amplitude of the secondary peak in the hippocampal regions was suppressed to a greater degree than that of the visual cortex. Author

N70-31050*# General Dynamics/Convair, San Diego, Calif.
GRAVITY-SENSITIVITY ASSESSMENT CRITERIA STUDY: THE LIFE SUPPORT SYSTEM ZERO-G STUDY Final Report, Oct. 1968-Jun. 1970
Washington NASA Jun. 1970 456 p refs
(Contract NAS1-8494)
(NASA-CR-66945; GDC-DBD70-003) Avail: CFSTI CSCL 06K

Six analytical models have been developed following an analysis of some 80 life support system equipments and a laboratory experimental program has been completed. Analysis of the experimental data obtained from the test of each analytical model has shown, 1) that the approaches followed were generally sound, 2) that the experiment produced data which could be employed to improve the analytical model, and 3) that the predictive capability of the model (and computer program) has significant potential to the design of life support systems. Two sets of documentation have

been initiated—one consisting of the formal documents, the other of informal documents. Author

N70-31055*# Scientific Translation Service, Santa Barbara, Calif.
HISTAMINE IN ALCOHOLIC BEVERAGES [HISTAMIN IN ALKOHOLHALTIGEN GETRAENKEN]
P. Marquardt et al Washington NASA Jun. 1970 7 p refs Transl. into ENGLISH from Arzneimittel-Forsch. (Aulendorf), v. 13, no. 12, 1963 p 1100–1102
(Contract NASw-2035)
(NASA-TT-F-13055) Avail: CFSTI CSCL 06A

The presence of considerable quantities of histamine in several varieties of white, red, and sparkling wines as well as in beer was demonstrated with biological and chemical methods. The significance of the findings with regard to wine quality and evoked reactions is discussed. Author

N70-31057*# Collaborative Research, Inc., Waltham, Mass.
STUDIES ON STABILIZATION OF ENZYMES Final Report
15 May 1970 48 p refs
(Contract NAS2-4525)
(NASA-CR-73460) Avail: CFSTI CSCL 06A

Dilute, aqueous solutions of beef heart lactate dehydrogenase (LDH), (the model enzyme) were stabilized under standardized conditions permitting a retention of 100% enzymatic activity for over 20 months. Significant stabilization of E. coli B asparaginase and pig heart malate dehydrogenase was also achieved in dilute aqueous media. Lactate dehydrogenase was insolubilized in an enzymatically active form, by being covalently bound to the insoluble support, diazotized Cellex PAB. Optimum binding ratios were derived and studies completed permitting the regeneration of bound and unbound enzyme. Antibodies to LDH were successfully produced in rabbits. Such antibodies were to be used as enzyme stabilizers. Other studies, including the selective alkylation of nonessential sulfhydryl groups of LDH by reaction with gamma-chloropropylthiosulfate were performed. Author

N70-31125# National Bureau of Standards, Washington, D.C.
HUMAN ENGINEERING A CONSOLE FOR THE COMPARISON OF VOLT BOXES
P. H. Lowrie, Jr. *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 217–22 refs (See N70-31104 16-09)
Avail: SOD $4.50

The principles of human engineering are as applicable to making precise measurements as they are to the production line. Too often the human element is not given adequate consideration in the design of precise measuring equipment and as a result, accuracy declines. To reduce this source of error, a calibration console was designed in which the human engineering factors were given the same consideration as the technical requirements. In this system the console operator is considered to be a decision maker, and those functions not requiring judgment are automatically processed by the console. Most of the calculations are performed automatically by internal circuits, and the results are displayed digitally upon command. Author

N70-31156# Oklahoma Univ., Oklahoma City. Dept. of Physiology and Biophysics.
MOTOR EFFECTS FROM VISUALLY INDUCED DISORIENTATION IN MAN
M. Herbert Brecher and Gerhard A. Brecher FAA Nov. 1969 13 p refs
(Contract FA-67-AC-2699-1)
(FAA-AM-69-23) Avail: CFSTI

Egocentric disorientation can be experienced by a pilot if the entire visual environment moves relative to his body without a clue of the objective position of the airplane in respect to the ground. Subjects were placed into an optokinetic drum which excluded any stationary objects from view. The walking pattern in the stationary drum served as a control. In the experimental situation the drum was rotated at various constant speeds. With faster drum speeds the deviations became systematically greater. Volitional attempts to correct the deviations after some training resulted in a fairly straight walk in a few subjects, but most subjects were not able to do so while a few persons overcompensated in the opposite direction. It is concluded that the visually induced disorientation in space overrides the sensory input from all other modalities when stationary objective targets are excluded. Author

N70-31169# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
AN ANALYTICAL DESCRIPTION OF THE LINE ELEMENT IN THE ZONE-FLUCTUATION MODEL OF COLOR VISION
J. J. Vos and P. L. Walraven 1970 89 p refs
(IZF-1970-5; TDCK-55424) Avail: CFSTI

A mathematical description is given of color discrimination which rests on the three pillars listed. Color processing occurs in a Helmholtz type three receptor-zone, followed by a Hering type neural-conversion-zone in which a luminance (L) and two antagonistic (R vs G and Y vs B) signals are formed. Color discrimination is essentially photon-noise limited; at higher luminances saturation processes come in, which keep color discrimination below this theoretical limit. The recording of the receptor output occurs in such a way that the L, R vs G, and Y vs B signals together form a set of conjugate parameters with respect to the discrimination-determined metrics of the color space. The line element (yardstick to measure color differences) is calculated for various stages of nervous saturation and for various degrees of color vision deficiency, inclusive normal. Author

N70-31176*# Exotech, Inc., Washington, D.C. Systems Research Div.
INVESTIGATIONS INTO A DIFFUSION MODEL OF DRY HEAT STERILIZATION Interim Report
M. J. Barrett 5 May 1969 17 p refs
(Contract NASw-1734)
(NASA-CR-110611; TRSR-041) Avail: CFSTI CSCL 06M

The analytical model described formalizes the hypothesis that dry heat inactivation of microorganisms is closely related to the water content of the spore and its micro-environment. Experimental data are examined relative to this model and it appears to be valid. This model is aimed at overcoming the well known deficiencies of the logarithm model. Author

N70-31177*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Aerospace Medicine Dept.
EVALUATION OF NEW PENETRATING SPORICIDE POTENTIALLY USEFUL IN SPACECRAFT STERILIZATION Progress Report
C. Aldridge and G. J. Womack 15 May 1969 26 p refs
(Contract NAS8-30157)
(NASA-CR-110612; PR-3) Avail: CFSTI CSCL 06T

Potting, elastomeric, and epoxy compounds are discussed as sources of heavy microbiological contamination of spacecraft. A sporicide made from a mixture of ethylene oxide and dimethyl sulfoxide was investigated for its ability to penetrate plastics, layers of grease, or soil to kill spores placed in or beneath such materials. The sporicide was also studied for its ability to penetrate paints,

silicone rubber, epoxy cements, and certain plastics so that such materials become self sterilizing as they cure. R.B.

N70-31193# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEDICAL AND BIOLOGICAL RESEARCH

20 Feb. 1970 28 p Transl. into ENGLISH from the Russian
(AD-704012; FTD-HT-23-622-69) Avail: CFSTI CSCL 6/3

The article deals with a series of experiments on the effects of prolonged weightlessness on healthy individuals, animals, plants, and microorganisms under simulated laboratory conditions with the help of clinically physiological, biochemical, roentgenological, and other methods. Protective measures, life support systems, and the possibility of life on other planets were investigated. Author (TAB)

N70-31198# Texas Technological Univ., Lubbock. Center of Biotechnology Fatigue and Human Performance.

EVENT FREQUENCY MEMORY AND CATEGORIZATION PERFORMANCE AS A FUNCTION OF CONDITIONS OF FEEDBACK

Nathan R. Denny and Henry C. Gruemmer, Jr. 23 Mar. 1970 14 p Presented at the Southwestern Physchol. Assoc. Meeting, Austin, Tex., 17-19 Apr. 1969
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703848) Avail: CFSTI CSCL 5/10

The purpose of the study was to investigate human statistical discrimination as a variety of memory performance which is subject to interference of a predicted kind, and the extent to which it is also influenced by feedback and motivational considerations. Human stimulus event frequency discrimination was studied in the context of two time-shared categorization tasks of differing complexities. Author (TAB)

N70-31199# Texas Technological Univ., Lubbock. Center of Biotechnology Fatigue and Human Performance.

MEMORY PERFORMANCE AND TIME-SHARED TASK COMPLEXITY

Nathan R. Denny 1969 16 p refs Presented at the Rocky Mt. Psychol. Assoc. Meeting, Albuquerque, N. Mex., 15 May 1969 Sponsored in part by Tex. State Res. Grant
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703868) Avail: CFSTI CSCL 5/10

The experiment tests the view that statistical behavior is a variety of memory performance that is differentially interfered with by time-shared tasks of differing complexity. Author (TAB)

N70-31331# RAND Corp., Santa Monica, Calif.

THE DELPHI METHOD 4: EFFECT OF PERCENTILE FEEDBACK AND FEED-IN OF RELEVANT FACTS

N. Dalkey, B. Brown, and S. Cochran Mar. 1970 49 p refs
(Contract F44620-67-C-0045)
(AD-702790; RM-6118-PR) Avail: CFSTI CSCL 5/10

Two variations in the form of feedback in Delphi exercises are investigated: the effect of feeding back the percentile location of an individuals answer in the group distribution and the effect of presenting the respondent with a single additional relevant fact. Experiments were set up to compare the improvement in responses to 20 general information type questions between two groups that received different feedback. Author (TAB)

N70-31311# Washington State Univ., Pullman. Dept. of Agronomy.

RELATIONSHIP OF RADIATION INDUCED DAMAGE IN BARLEY SEEDS TO THE INHIBITION OF CERTAIN OXIDOREDUCTASES BY SODIUM AZIDE

E. G. Sideris, R. A. Nilan, and C. F. Konzak [1969] 15 p refs
(Contract AT(45-1)-353)
(SM-121/12; RLO-353-36) Avail: CFSTI

The effects of sodium azide post-treatment on seedling height and number of chromosome aberrations during first mitotic division in shoot tips were studied using barley (Hordeum vulgare) seeds given 16 Krad of Co-60 gamma irradiation. Sodium azide exhibited an inhibitory effect on the growth of seedlings, particularly when the seeds were treated in acidic solutions. Chromosome aberrations were not detectable with sodium azide alone, but increased with treatment by both sodium azide and radiation over radiation alone. It was concluded that under acidic conditions, an interaction between the chemical and ionizing radiation treatment was present. The synergism between sodium azide and radiation and its association with a decreased catalase peroxidase, and respiratory activity is in agreement with basic postulates of radiobiology. NSA

N70-31294# Leiden Univ. (Netherlands).

THE INFLUENCE OF X-RAYS AND ULTRAVIOLET RADIATION ON NUCLEIC ACIDS OF HETEROPLOID HUMAN CELLS IN TISSUE CULTURE [DE INVLOED VAN ROENTGENSTRALING EN ULTRAVIOLET LICHT OP NUCLEINE]

Paul Herman Maria Lohman (Ph.D. Thesis) 1969 138 p refs In DUTCH; ENGLISH summary
Avail: CFSTI

The investigations were carried out with multiplying cells in monolayer cultures. Both asynchronous cultures and cultures which were synchronized by the excess thymidine method were used. The induction and rejoining of breaks in DNA after irradiation were studied and the influence of radiation on the synthesis of various RNA fractions was analyzed. Author

N70-31288# Joint Publications Research Service, Washington, D.C.

THE BEHAVIOR OF DOLPHINS IN CAPTIVITY

V. M. Belkovich et al 10 Jun. 1970 22 p ref Transl. into ENGLISH from Priroda (Moscow), Nov. 1969 p 18-28
(JPRS-50701) Avail: CFSTI

The behavior of white-bodied and bottlenose dolphins in captivity, the relationships of the animals, the structure of the communities, their games, their adaptations to new conditions and the changes in their behavior caused by these adaptations are observed. Author

N70-31221# Texas Technological Univ., Lubbock.

PERFORMANCE OF A VISUAL TASK DURING RECOVERY FROM PHYSICAL LOADING

J. D. Ramsey, M. M. Ayoub, and H. S. Edgar 11 Mar. 1970 21 p refs Presented at the Work Physiol. Symp., Kansas City, Kans., 26 Sep. 1969
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703865) Avail: CFSTI CSCL 6/19

A human operator may be required to perform a visual task under a variety of conditions of physical loading. The task may be performed during a condition of rest, during some level of physical loading, or during a recovery period after physical loading. This study is an attempt to investigate the visual performance of digit recognition during the recovery period. The experimental paradigm for this study successfully generated a set of physiological responses which were well behaved, properly spaced and of proper magnitude. These could well serve as a good basis for correlation with task performance scores, if such scores exhibited any distinguishable trend. The visual digit identification task of this study exhibited a highly variable response which was not significantly affected by either work intensity or the period of recovery. Neither an aroused effect of better performance after work, nor a detrimental effect of poorer performance after work was observed. Author (TAB)

N70-31332# RAND Corp., Santa Monica, Calif.
CHEMICAL EQUILIBRIUM PROBLEMS WITH UNBOUNDED CONSTRAINT SETS
James H. Bigelow, James C. de Haven, and Norman Z. Shapiro Feb. 1970 25 p refs
(Contract F44620-67-C-0045)
(AD-702789; RM-5952-PR) Avail: CFSTI CSCL 7/4

An investigation of the use of mathematical models to explore the chemical aspects of physiological systems; this deals with the theoretical and computational aspects of understanding the chemistry of human physiological function. The question of existence of solutions to problems having unbounded constraint sets is investigated by relating their existence (or nonexistence) to a property of a solution to an auxiliary chemical equilibrium problem with a bounded constraint set. An example system is selected consisting of gases in contact with an aqueous buffer solution at a uniform total hydrostatic pressure and temperature. The numerical problem of determining the amount of CO2 to be added to achieve a specified partial pressure of CO2 in the gas phase, and its effects on the composition of the total system, is solved by using a procedure suggested by the concept of unbounded constraint sets. Findings may apply to design of artificial life-support systems needed in extraterrestrial environments related to Air Force missions. Author (TAB)

N70-31334# Texas Univ., Austin. Center for Research in Water Resources.
RADIOACTIVITY TRANSPORT IN WATER Summary Report
Yousef A. Yousef, Akira Kudo and Earnest F. Gloyna Feb. 1970 80 p refs
(Contract AT(11-1)-490)
(ORO-490-20; EHE-70-5; CRWR-53; TR-20) Avail: CFSTI

A transport model is presented which describes the behavior of radionuclide movement in an ecological system, and considers hydraulic transport, sediment sorption and desorption, and biomass uptake and release. Solution of the transport model are programmed and verified using data obtained from the laboratory ecosystem and the research flume. The limitations and relative importance of environmental factors affecting transport were evaluated. Recommendations for the use of this prediction model are discussed. Flume experiments limited to fresh water systems and slow-moving streams were conducted. In general, radionuclide movement followed the same pattern as Rhodamine B dye releases. However, discrepancies were observed due to interactions of radionuclides with sediments, biomass and organic debris. The effects of specific environmental factors such as pH, temperature, dissolved oxygen, and oxidation-reduction potential of sunlight were studied to estimate the uptake and release rates of radionuclides. Author (NSA)

N70-31336# New York Univ., N.Y. Dept. of Environmental Medicine.
THE TUMORIGENIC ACTION OF BETA, PROTON, ALPHA, AND ELECTRON RADIATION ON THE RAT SKIN Progress Report, 1 Apr. 1961 – 31 Mar. 1970
Roy E. Albert 31 Mar. 1970 37 p refs
(Contract AT(30-1)-2785)
(NYO-2785-4) Avail: CFSTI

Research in progress is reported on the effect of pore size on tumor induction in rat skin by proton irradiation in a sieve pattern; the effect of hole size and spacing on hair follicle damage produced by sieve pattern; the damage produced by sieve pattern; the effect of hole size damage produced by sieve pattern irradiation; the comparative skin tumor and injury response to soft X-rays and other forms of ionizing radiation in rats; the basis for the low susceptibility of the mouse to radioinduced skin tumors; theoretical considerations and experimental techniques for the demonstration of a G-phase in epidermis; DNA loss replacement in irradiated skin; the incorporation of BUdR into the DNA of skin; the effect of dose fractionation on tumor induction in rat skin, tumor induction by freezing; and the use of croton resin to promote radiation-initiated tumors. NSA

N70-31355# Texas Technological Univ., Lubbock.
VIGILANCE: AN ANNOTATED BIBLIOGRAPHY
Charles G. Halcomb and Peggy J. Blackwell Aberdeen Proving Ground, Md. Aberdeen Res. and Develop. Center Nov. 1969 203 p refs
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703918) Avail: CFSTI CSCL 5/10

Vigilance, or monitoring behavior, has been of interest to researchers since World War 2. Research activity has not only continued over the past 25 years, but has increased at an ever progressing rate. This bibliography was compiled to meet the need for a continuing program of research into the problem associated with recovery from the classical vigilance decrement, and is presented with annotations in the hope that it will be of value to investigators in the field. Author (TAB)

N70-31406# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
DETERMINATION OF CENTERS OF GRAVITY OF INFANTS
J. J. Swearingen, J. M. Badgley, G. E. Braden, and T. F. Wallace Nov. 1969 9 p refs
(FAA-AM-69-22) Avail: CFSTI

Recent efforts to provide effective restraint equipment for crash protection of infants in our transportation complex and to develop satisfactory flotation equipment for the little ones have revealed that there is a lack of data concerning the location of the c.g. (center of gravity) of this age group. Various body measurements were made on approximately 135 infants ranging in age from 2 months to 36 months and their c.g. determined from several body reference points on a specially constructed c.g. machine. Determinations of c.g. locations were made for the standing position only (actually supine) and it was found that the means distance of the c.g. above the crotch for a 2-month-old infant (6.0 inches) is very close to that for a full-grown adult (5.9 inches). Author

N70-31412# Washington State Univ., Pullman. Dept. of Agronomy.
INFLUENCE OF RADIATION ENERGY ON THE OXYGEN ENHANCEMENT RATIO IN IRRADIATED BARLEY SEEDS
P. J. Bottino, R. A. Nilan, and C. F. Konzak 28 Oct. 1969 32 p refs

(Contract AT(45-1)-353)
(RLO-353-39) Avail: CFSTI

Barley seeds were brought to water contents of 2 to 14%. Irradiation was accomplished with either Co-60 gamma source that delivered a dose at 1.25 MeV energy or with an X-ray source that delivered energies of 50, 100, 150, or 300 kV, all at 10 mA. After irradiation, the seeds were hydrated immediately in either oxygen-or nitrogen-bubbled water at 0 C. Four experiments were designed to study the following: the interrelation of oxygen, radiation energy, and seed water content; the relation of oxygen enhancement ratio (OER) and radiation energy in terms of chromosome aberration frequencies; free radical production by each energy of radiation; and the effects of radiation energy on the postradiation oxygen effect. The OER decreased with increasing water content independent of the energy used. The number of dicentric bridges per cell and fragments per cell decreased from 1.25 MeV to 100 kV, then increased at 50 kV. Author (NSA)

N70-31416# Missouri Botanical Garden, St. Louis.
ENERGY EXCHANGE WITHIN ECOSYSTEMS Annual Technical Progress Report, 15 May 1969 - 14 May 1970
David M. Gates 14 May 1970 12 p refs
(Contract AT(11-1)-1711)
(COO-1711-9; ATPR-3) Avail: CFSTI

The theoretical relationship between a plant leaf and its immediate environment was tested with respect to its energy budget. Other questions concerning plant productivity, competition among plants, succession in plant communities, and ecological adaptation with respect to leaf morphology are also discussed. The relationship of energy flow to the temperature and transpiration rate of a plant is investigated. A theoretical model is derived to describe the process of photosynthesis in plant leaves. R.B.

N70-31417# South Dakota Univ., Vermillion. School of Medicine.
EFFECTS OF ULTRAVIOLET RADIATION ON ALGAE: MECHANISM OF INACTIVATION AND REPAIR Annual Progress Report, 1 May 1969 - 30 Apr. 1970
Gary D. Small 30 Apr. 1970 4 p
(Contract AT(11-1)-1793)
(COO-1793-2) Avail: CFSTI

Photoreactivating enzyme activity was found in Ochromonas danica (Chrysophyta), Euglena gracilis (Euglenophyta), and Chlamydomonas reinhardi (Chlorophyta). Studies were initiated to determine if enzyme activities of chloroplasts and nuclei were caused by two different proteins. Studies on detection of uv-induced photoproducts in DNA of algae included effects of deoxynucleosides on uptake of radioactive thymine by DNA of Euglena. Experiments were conducted on effects of caffeine and acriflavine on survival of uv-irradiated Euglena and on dark repair mechanisms of Euglena. Studies on enzymes in Chlamydomonas that may be involved in excision-repair mechanisms were begun. NSA

N70-31426# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THIRD WORKING SESSION ON DECOMPRESSION DISEASES [3. ARBEITSTAGUNG UEBER DRUCKFALLKRANKHEITEN]
O. Wuensche Sep. 1969 176 p In GERMAN Conf. held at Bad Godesberg, West Germany, 18-19 Apr. 1968
(DLR-FB-69-58; DVL-886) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

CONTENTS:

N70-31427# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
MEDICAL RESEARCH INSTITUTE FOR CAISSON WORK ACTIVITY REPORT 1965 - 1968 [BERICHT UEBER DIE TAETIGHEIT DER AERZTLICHEN FORSCHUNGSSTELLE FUER CAISSONARBEITEN IN DEN JAHREN 1965 BIS 1968]
O. Wuensche *In its* 3rd Working Session Decompression Diseases Sep. 1969 p 9 - 17 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Reported are theoretical aspects and experimental studies on responses of functional biological systems to gas bubble formation during decompression and the preventive effects of: (1) induced fever; (2) sinus shaped vibrations; (3) noise; (4) narcotic, sedative, and stimulating drugs; (5) ferments; and (6) diuretic and antiphlogistic medication. Emphasis is placed on a combination of reduced decompression time and oxygen inhalation that reduces decompression sickness in compressed air workers considerably. Transl. by G.G.

N70-31428# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THE APPLICATION OF THE COMPRESSED AIR METHOD

IN DEPTH AND UNDERWATER TUNNEL CONSTRUCTION IN COMPARISON WITH OTHER CONSTRUCTION METHODS [DIE ANWENDUNG DES DRUCKLUFTVERFAHRENS BEI TIEFGRUENDUNGEN UND UNTERWASSERTUNNELN IM VERGLEICH MIT ANDEREN BAUWEISEN]

F. Apel *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 19-31 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Technical aspects of preventing decompression sickness in depth foundation and tunnel construction workers are considered. This type of civil engineering method employs compressed air caissons to lower ground water levels during construction of bridge piles, etc., and thus keeps the workman under increased atmospheric pressure for some time. It is shown that a caisson pressure of up to 1.3 atm constitutes a safe working environment for a healthy construction worker and does not pose any problems during normal decompression procedures. Transl. by G.G.

N70-31430# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

DIFFERENCES AND SIMILARITIES OF DIVING AND CAISSON WORK [TAUCHEN UND CAISSONARBEIT, UNTERSCHIEDE UND GEMEINSAMKEIT]

K. Seemann *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 51-58 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Physiological working conditions and safe decompression procedures in diving and caisson work are compared by their induced medical indices and treatment methods. It is shown that the selection of divers requires more restricted medical guidelines and imposes certain age limits than comparative selection of caisson workers. Although both professions experience pressure fluctuations, only divers are sometimes subjected to pressure drops in lungs and other body cavities that cause sudden traumas. Poisoning through increased partial pressure of the breathing gases and caisson sickness with overexpansion of lungs and aseptic bone necroses are also discussed. Prophylactic and therapeutic treatments for divers vary in respective decompression and recompression times with oxygen inhalation and depend on the medical diagnosis. Transl. by G.G.

N70-31431# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

DANGERS OF WELDING AND CUTTING IN COMPRESSED AIR COMPARTMENTS [GEFAHREN BEI SCHWEISS- UND SCHNEIDARBEITEN IN RAEUMEN UNTER DRUCKLUFT]

K. R. Doerr *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 59-69 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform, (ZLDI), Munich: 38,70 DM

Personnel injuries and property damage during work with compressed air depend to a large extent on the training of the personnel and the type of combustible gas, pressure-relieve valve, and welding and cutting equipment used. Work with acetylene gas includes the danger of a difficult to recognize decomposition inside the pressurized bottle with subsequent sudden explosion. The explosive region of hydrogen is between 4 to 75 volume percent in a normal atmosphere and increases up to 96 volume percent in a pure oxygen atmosphere. Explosive sensitivity of pressurized acetylene starts already at 2 atm and a solution in acetone is recommended for bottling. A liquid gas mixture consisting mainly of propane and butane is given commercial preference because it is easily transportable at low temperatures and pressures; however, unnoticeable leakage and mixing with oxygen can induce asphyxiation and explosion, respectively. Transl. by G.G.

N70-31432# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

SAFETY TECHNOLOGY ASPECTS OF OXYGEN INHALATION IN HIGH PRESSURE LOCKS [SICHERHEITSTECHNISCHE BETRACHTUNGEN ZUR SAUERSTOFFATMUNG IN UEBERDRUCKSCHLEUSEN]

H. D. Fust *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 71-82 ref In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

The use of pure oxygen in compressed air chambers increases the danger of sudden explosions markedly; ignition probabilities for most objects jump about a thousand times at pressures from one to three atmospheres when compared with a normal atmosphere. Clothing materials with a potential spark energy of 0.5 millijoule are sufficient to trigger flames on clothing surfaces that spread at about 50 cm per second. The installation of oxygen concentration measuring and warning systems in recompression and caisson construction chambers with oxygen inhalation is advisable; recommended is a continuous ventilation of exhaust gases with complete recirculation of the chamber atmosphere. Another method described uses intermittent attendance in lower pressure rooms to break the eight hour shift of caisson workers in compressed atmospheres and to prevent toxic effects of the high partial oxygen pressure. Transl. by G.G.

N70-31433# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

SAFETY OF DECOMPRESSION LOCKS WITH OXYGEN INHALATION [GEFAHRLOSIGKEIT DER AUSSCHLEUSUNG MIT SAUERSTOFFATMUNG]

G. Scheele *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 83-90 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Emphasized is the efficient application of on and off oxygen inhalation during decompression that prevents oxygen intoxication at high atmospheric pressures. This hyperbaric oxygen therapy is most beneficial in the treatment of gas edema patients; even severe cases with extended infections improve fast and heal well after repeated decompression with oxygen inhalation over a period of three days. Good results are also obtained with this treatment combination in carbon monoxide poisoning and open heart surgery. Further applications in coronary insufficiency, insufficient peripheral arterial blood flow, arterial sclerosis, and blockage of brain vessels are indicated. Brief inhalations of pure oxygen two times daily are only used in the treatment of chronic bronchitic syndromes with secondary emphysema and respiratory insufficiency. It is concluded that high pressure oxygen inhalation therapy is of utmost importance during decompression from caissons and for the treatment of decompression sickness. Transl. by G.G.

N70-31434# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

OBSERVATIONS AND EXPERIENCES WITH HYPERBARIC OXYGEN THERAPY IN BRAIN DAMAGE

N70-31435

[BEOBACHTUNGEN UND ERFAHRUNGEN MIT DER HYPERBAREN SAUERSTOFFTHERAPIE BEI HIRNGESCHAEDIGTEN]

K. H. Holbach and U. Goett *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 91-109 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Electroencephalogical tracings are used to observe the degree of effectiveness of the high oxygen pressure treatment in brain damage cases. Inhalation of oxygen at two to three atm pressure over a period of two to three hours improved severe brain trauma remarkably in five out of six cases; even patients with arterial brain vessel blockages show improvement during or after oxygen inhalation therapy in high pressure chambers. Pathologically changed delta wave patterns in damaged brain activities changed to a pattern of more frequency and even alpha waves after treatment. Transient deteriorations in electric brain activity were only observed in a few cases where pressures of more than 3 atm together with treatment durations of more than three hours were used. It is shown that high pressure oxygen treatment at two to three atm for two to three hours is beneficial in acute, severe brain damaged patients. Transl. by G.G.

N70-31435# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

ASPECTS OF THE PROPOSED DRAFT FOR REGULATION OF WORK IN COMPRESSED AIR [ASPEKTE ZUM NEUENTWURF VERORDNUNG FUER ARBEITEN IN DRUCKLUFT]

O. Wuensche *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 111-118 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Principles of entrance and discharge, duration of work, and safe pressure increases for working in a compressed air environment are described and proposed are new standards that use higher working pressures with corresponding prolongation of decompression step times. Developed conditions are kept flexible and rational for practical purposes and propose the elimination of the old limitation to 3.5 atm pressure. Decompression chambers of about 2.3 to 5.5 atm pressure have to be present at working sites that require an environmental pressure of about 2.3 atm. Working pressures of about 1.3 to 2.3 atm require only decompression chamber pressures of about 3.0 atm. Transl. by G.G.

N70-31436# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

STATEMENT OF EMPLOYERS IN REGARD TO THE NEW REGULATION DRAFT [STELLUNGNAHME DER UNTERNEHMERSCHAFT ZUM NEUEN VERORDNUNGSENTWURF]

H. Baumann *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 119-123 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Considered is a new draft for regulating work under compressed atmospheres that contains detailed instructions for extended medical supervision and elaborates on decompression step times in high pressure environments. The proposed new regulation contains a requirement that compressed air workers are retained at construction sites for two hours after their shift ends so that incidents of decompression sickness are minimized even at working conditions in 32 meter depth. Also recommended is the inhalation of oxygen during decompression procedures. Transl. by G.G.

N70-31437# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

STATISTICAL EVALUATION OF COMPRESSED AIR SICKNESSES [STATISTISCHE AUSWERTUNG VON DRUCKLUFTKRANKHEITEN]

Th. Peters *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 125-132 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38, 70 DM

Developed are accident insurance criteria for compressed air workers for the use of industrial physicians in civil engineering projects. The proposed questionnaire contains besides the usual personnel data a list of physiological indices including pathological test results and clinical diagnosis. The considered decompression treatment depends on working conditions before the onset of decompression sickness, the atmospheric pressure environment during work, and the conditions after release from the decompression chamber. Transl. by G.G

N70-31438# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

PROBLEMS OF DECOMPRESSION [PROBLEME DER DEKOMPRESSION]

J. N. Meesters *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 133-143 refs In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform, (ZLDI), Munich: 38,70 DM

Prolonged step times during therapeutic decompression with oxygen inhalation for compressed air workers in civil engineering projects prevent the formation of bone necroses. New regulations prescribe a pressure drop of 60% two minutes from the original pressure in order to attain tissue saturation at 1.0 atm for 18 lb/sq inch. High pressure working time durations are also reduced and work, even prohibited if medical contraindications are observed during lung X-rays, sinutide or otide conditions, heart and circulatory disturbances, and adipositas. Included are decompression tables that constitute Dutch regulations from the year 1961. Transl. by G.G.

N70-31439# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

MEDICAL OBSERVATIONS AT THE TUNNEL CONSTRUCTION SITE KAROLINEN STREET, HAMBURG [AERZTLICHE ERFAHRUNGEN AUF DER TUNNELBAUSTELLE KAROLINENSTRASSE HAMBURG]

D. Niederstadt and R. Pott *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 145-160 refs In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

Considered are the following aspects of compressed air workers in tunnel construction: (1) organization of medical supervision; (2) survey of technical data; (3) employment examinations and reasons for disqualifications; (4) decompression chamber periods; (5) first aid stations; (6) compressed air sicknesses and their treatments; and (7) some considerations of aetiology and pathophysiology. The observation of relative numerous compression effects in workers under relative low pressure working conditions are attributed to additional effects of body vibrations and noise which hinder nitrogen solubility in bradytrophic tissues. Transl. by G.G.

N70-31440# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THE TREATMENT OF SEVERE DECOMPRESSION SICKNESSES [DIE BEHANDLUNG SCHWERER DRUCKFALLKRANKHEITEN
P. Cabarrou *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 161-167 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38, 70 DM

The successful treatment of two cases of decompression sickness in deep sea divers is described. Emphasized is the immediate fast descent in a decompression chamber to pressures corresponding to 70 meter depth and extended decompression step times of 30 minutes between each 5 to 5 meters. The author examined and interrogated patients during decompression and not before and thus was able to keep his method flexible according to observed improvements of pathological symptoms. Recompression to 70 m depth reduces the gas bubble diameter in half and thus produces better absorption in the patients tissues.
Transl. by G.G.

N70-31441# Deutsche Vorsuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
CAISSON SICKNESS AND THE NERVOUS SYSTEM [CAISSONKRANKHEIT UND NERVENSYSTEM]
I. Rozsahegyi *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 169-176 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38, 70 DM

Discussed are frequency and variations of clinical aspects in acute decompression sicknesses of the central nervous systems observed in depth foundation and underground construction workers. Multifocal syndroms of brain stem and spinal lesions are outlined by a few case histories with emphasis on the progressive slow development of secondary chronical after-effects. Characteristic neurological disturbances are expressed in pathological reflexes of the extremities and skin, impotence, disturbed vestibular functions, EEG patterns, etc. The only effective therapy constitutes recompression of the patient combined with oxygen inhalation and extremely slow, protracted discharge from the decompression chamber. If only a partial success is obtained, subsequent symptomatic treatment with intraveneous injections of 10 milliliter (ml) of a 2 percent novocain solution results in improvement. The severity and severe results of neurological disturbances underline the necessity of decompression sickness prevention in high pressure construction technology.
Transl. by G.G.

N70-31472# Hebrew Univ., Jerusalem (Israel). Dept. of Psychology.
REACTIONS TO STRESS Final Scientific Report, 1 Jan. 1967-1 Nov. 1969
Sol Kugelmass 1 Nov. 1969 5 p refs
(Contract AF 61(052)-839)
(AD-702852; AFOSR-70-0790TR) Avail: CFSTI CSCL 5/10

Consideration of the data of a series of experiments on Israeli Police trainees and criminal suspects suggests that differential psychophysiological reactivity of the GSR channel is not systematically reduced by stress within the range relevant to criminal interrogation. Further analysis of the criminal suspect data suggested that the detection rate could be raised through the combination of responses from the three polygraph channels (GSR, Breathing, and Blood Pressure). This was particularly so for subjects having positive correlations between the different channel responsivities. In a most recent replication study using a different sample of criminal suspects somewhat different results were obtained with very low rates of detection in the breathing and blood pressure channel responses. Further analysis of this data is being undertaken. In still a different sample of criminal suspects a pattern of baseline heart-rate change was noted that seemed to be systematically related to the individuals GSR differential reactivity and detectibility.
Author (TAB)

N70-31488# IIT Research Inst., Chicago, Ill.
VISUAL PERFORMANCE WITH SIMULATED FLARELIGHT IN ARTIFICIAL CLOUDS Final Report, Feb.-Aug. 1969
Sidney Katz, Paul K. Ase, Elliot Raisen, and Robert L. Hilgendorf Jan. 1970 83 p refs
(Contract F33615-69-C-1386)
(AD-704125; AMRL-TR-69-121; IITRI-C6173-1) Avail: CFSTI CSCL 19/1

The report describes a laboratory procedure for studying the effects of fog or mist on visual acuity under conditions of night illumination.
Author (TAB)

N70-31496# Mitre Corp., Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. 22: THE RELATIVE LEGIBILITY OF FOUR SYMBOL SETS MADE WITH A FIVE BY SEVEN MATRIX
Donald A. Shurtleff Bedford, Mass. ESD Mar. 1970 41 p refs
(Contract F19628-68-C-0365)
(AD-704136; MTR-833; ESD-TR-70-26) Avail: CFSTI CSCL 5/5

Legibility comparisons were made among four 5 x 7 dot fonts. The four symbol fonts were shown under nearly optimal viewing conditions to one group of operators and under degraded viewing conditions to a second group of operators. The results showed that no one symbol set was significantly superior in legibility to any of the other sets. It was concluded that new symbols designs are needed to improve the legibility of present 5 x 7 dot symbol sets.
Author (TAB)

N70-31532# Oregon State Univ., Corvallis. Radiation Center.
STUDIES ON ENVIRONMENTAL POLLUTION BY MISSILE PROPELLANTS Final Report, 1 Jul. 1967-30 Jun. 1969
Frank N. Dost and Chih H. Wang Wright-Patterson AFB, Ohio AMRL Jan. 1970 46 p refs
(Contract F33615-67-C-1750)
(AD-704126; AMRL-TR-69-116) Avail: CFSTI CSCL 21/9

The effects of NF3O on lower organisms have been surveyed. The gas causes minimum damage to plants when exposed for 30 minutes to concentrations as low as 5 ppm. Effects on goldfish maintained in aquaria under 1% NF3O for 30 minutes were negligible; salmon were moderately sensitive. Microorganisms in soil were only slightly decreased in numbers by one hour of exposure by continuously tumbling soil particles through 1% NF3O. Potentially useful decontamination reastions were studied. Interhalogens and N2F4 can probably be removed from the atmosphere by a mist of aqueous sodium bicarbonate solution. No reagent portable enough and sufficiently effective to remove OF2 and NF3O gas from the atmosphere was found. NF3 is virtually non-reactive.
Author (TAB)

N70-31555# Washington State Univ., Pullman.
A STUDY OF FACTORS GOVERNING PLANT RADIOSENSITIVITY Annual Progress Report, 1 Nov. 1968-31 Oct. 1969

Robert A. Nilan and C. F. Konzak 15 Nov. 1969 9 p refs
(Contract AT(45-1)-353)
(RLO-353-42) Avail: CFSTI

Progress is reported for studies to identify and elucidate mechanisms by which biological (especially genetic and cytogenetic) damage is induced, prevented, and repaired in irradiated plant cells. The role of gibberellic acid and sodium azide in the development and/or prevention of the free radical-catalase-peroxidase-peroxide pathway was emphasized and preliminary work was done to determine the effects of radiation on DNA and the interrelation among DNA changes, mutations, and chromosome aberrations in plant cells. Understanding of the initial physico-chemical mechanisms involved in the different components of damage was furthered. The development of standardized methods for the automatic storage and retrieval of information on induced mutants and other plant germ plasma stocks was continued. A list of publications during the report period is provided. NSA

N70-31556# Washington State Univ., Pullman. Dept. of Agronomy.
THE INFLUENCE OF TEMPERATURE ON RADIATION-INDUCED OXYGEN DEPENDENT AND INDEPENDENT DAMAGE IN BARLEY SEEDS
B. V. Conger, J. R. Hileman, R. A. Nilan, and C. F. Konzak [1970] 17 p refs
(Contract AT(45-1)-353)
(RLO-353-40) Avail: CFSTI

Himalaya barley seeds of 10.0% water content were exposed in a partial vacuum to various doses of Co-60 gamma rays at different temperatures ranging from −78 to 50 C. In one set of experiments the seeds were hydrated immediately after irradiation in either oxygenated or oxygen-free water at 0 C. In another series of experiments the seeds were stored for various periods of time at different temperatures before hydration. Changes in free radical signal during post-irradiation storage under comparable conditions were measured by EPR in one experiment. The oxygen enhancement ratio (OER) was found to be greatest in seeds irradiated at lower temperatures. The OER decreased as the temperature during irradiation was increased. There was no observable oxygen-effect (OER = 1) if the seeds were irradiated at 50 C. Although oxygen-dependent damage decreased with increasing irradiation temperature, oxygen-independent damage increased. A decrease in oxygen-dependent damage during storage was observed with increasing storage temperature. The development of a long term oxygen-independent damage component became apparent in irradiated seeds stored at 30 and 50 C. Author (NSA)

N70-31570# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DATA ON THE STUDY OF BACTERIAL CONTAMINATION OF ATMOSPHERIC AIR OF THE CITY OF ODESSA
O. Yu. Grigorashchenko et al 25 Feb. 1970 12 p refs Transl. into ENGLISH from Mikrobiol. Zh., Akad. Nauk Ukr. SSR (Kiev), V. 25, no. 1, 1963 p 35−41
(AD-704021; FTD-HT-23-35-70) Avail: CFSTI CSCL 13/2

During the years of 1956 to 1960 the city bacteriological laboratory of Odessa conducted systematic bacteriological investigations of atmospheric air. Air samples were taken by means of a Krotov apparatus and by the precipitation method at eight points in the city of Odessa. The largest content of microorganisms were observed at points Nos. 1, 3, 5, and 6. In winter the quantity of microbes in 1 m super 3 of air was considerably lower than in summer. During rainfall or snowfall the number of colonies was two, three, or even four times less than the standard quantities in dry weather. Attention is drawn to the fact that 784 strains of representatives of the intestinal group of bacteria were isolated; of them 7 were Flexners dysentery bacilla, 1 was a Newcastle dysentery bacillus, 1 was a Boyd Novogrodsky dysentery bacillus and 2 were Morgans bacilli. Of the 524 isolated strains of intestinal bacilli, 24 were agglutinated with O coli serums, 17 of them with Flexners serum. Author (TAB)

N70-31625# Naval Aerospace Medical Inst., Pensacola, Fla.
THE SEMIAUTOMATED TEST SYSTEM: A TOOL FOR STANDARDIZED PERFORMANCE TESTING
H. Rudy Ramsey 5 Nov. 1969 19 p refs
(AD-702903; NAMI-1092; USARRL-70-8) Avail: CFSTI CSCL 5/9

Performance tests which are truly standardized must be administered in a way that will minimize variation due to operator intervention and errors. Through such technological developments as low-cost digital computers and digital logic modules, automatic test administration without restriction of test content has become possible. A semiautomated test system (SATS) which incorporates programmable digital logic modules for control has been developed to allow an experimental psychologist, unassisted and with a minimum of special training, to set up and modify tests or experiments; thus, it is especially useful for exploratory studies. The structure of the SATS is described and an example is presented to clarify the operations involved in its use. Author (TAB)

N70-31626# Ohio State Univ., Research Foundation, Columbus.
EDUCATIONAL PROGRAM FOR SCIENTISTS AND ENGINEERS AT WRIGHT-PATTERSON AIR FORCE BASE, 1 OCTOBER 1967 − 31 DECEMBER 1968
Herman R. Weed, Marion L. Smith, and Richard D. Frasher Jan. 1970 193 p
(Contract F33615-68-C-1056)
(AD-702867; AFHRL-TR-69-9) Avail: CFSTI CSCL 5/9

This contract, a pilot study of Project Innovate Task C, calls for development of programs to update Air Force scientists, engineers, senior technicians, and managers of science and engineering, both military and civilian, who work in research and development at Wright-Patterson Air Force Base. The programs shall provide current knowledge and information to professional employees to help them stay abreast of rapidly advancing technology in their own and related specialties. Phase I reports identification of needs and available training programs. Needs in continuing education were assessed from: existing personnel and training records, questionnaires distributed to all appropriate personnel at WPAFB, personal interviews with five percent of engineers and scientists, and group interviews with management personnel of all laboratories and divisions. While present level of participation in educational and training programs is sizeable, there is a clear need for greatly expanded educational programs. The nature of these needs and suggested methods for meeting them at WPAFB is described. The Phase II lists recommendations for educational programs to meet the continuing education needs at Wright-Patterson Air Force Base and suggests the administrative organization for implementing these programs. Author (TAB)

N70-31656# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PATHOMORPHOLOGICAL AND HISTOCHEMICAL CHANGES IN THE ORGANS OF TURTLES ON BOARD THE AUTOMATIC STATION ZOND-5
N. A. Gaidamakin et al 30 Jan. 1970 17 p refs Transl. into ENGLISH from the Russian
(AD-704042; FTD-HT-23-618-69) Avail: CFSTI CSCL 6/3

The Zond 5 automatic station carried two steppe turtles on a circumlunar flight. Two turtles were subjected to the same ground transport as the experimental group and four specimens were retained in the vivarium as an undisturbed control sample. Hematological, pathomorphological, histochemical and EKG procedures were used to investigate the biological effects of space flight and ground disturbance on the animals. A process using combined tissue blocks from different animals for histological and histochemical studies is described. Tissue photo micrographs

illustrate the findings. The use of the disturbed control group made it possible to separate changes due to spaceflight from those due to transport and caging on the ground. (Fifteen figures are included in the parent document, which is available on microfiche). Author (TAB)

N70-31664# Armed Forces Radiobiology Research Inst., Bethesda, Md.
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE Annual Research Report, 1 Jul. 1968 – 30 Jun. 1969
30 Jun. 1969 56 p ref
(AD-704167; AFRRI-ARR-3) Avail: CFSTI CSCL 6/18

Contents include: Acute mortality response of larger mammals to ionizing radiation; Investigation of incapacitating doses of radiation in larger mammals; The effect of partial-body shielding; Acute mortality of mice and rats exposed to 14 MeV neutrons; Behavioral incapacitation studies; The behavioral performance of the unrestrained monkey following mixed gamma-neutron irradiation; Identification of prominent sites of radiation injury; Hemogram and bone marrow differential of the chinchilla; Effects of ionizing radiations on biosynthesis of complex proteins; Effect of mixed gamma-neutron radiations on plasma and urine amino acid levels in the rat; Effects of ionizing radiation on immune responses; Postirradiation gastrointentinal injury; and Radiation fields produced by the afrri-triga reactor. TAB

N70-31669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF EVALUATING THE BACTERIAL SEEDING OF ATMOSPHERIC AIR
S. I. Kudryavtsev et al 20 Feb. 1970 10 p refs Transl. into ENGLISH from Lab. Delo (Moscow), no. 3, 1968 p 164 – 168
(AD-704014; FTD-HT-23-20-70) Avail: CFSTI CSCL 13/2

The article concerns the use of various devices to evaluate bacterial seeding of the atmosphere and to develop a device to study the isokineticity of aerosol sampling. Author (TAB)

N70-31670# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPORTANCE OF CULTURE MEDIUM COMPOSITION IN DETERMINING MICROBE CONTAMINATION OF AIR
G. N. Ishchenko et al 20 Feb. 1970 5 p Transl. into ENGLISH from Med. Zh. Uzbekistana (USSR), no. 2, 1963 p 48
(AD-704018; FTD-HT-23-26-70) Avail: CFSTI CSCL 6/13

The purpose of this work is to clarify the importance of medium composition in bacteriological studies of the air. In parallel air studies using the Krotov device and the jar-cup method the following medias were used: simple meat peptone agar, sugar agar, and agar with rabbit blood. Study of the air in one and the same enclosure was carried out ten times at different periods. The cups were kept in a thermostat at 37 degrees for 40-48 hours, after which the colonies were tabulated and the number of microorganisms in 1 cu m of air were calculated. The composition of the culture medium is of great importance. Both in air seedings using the Krotov device and in using the Jar-cup method, the colonies grew least of all on simple agar. On sugar agar with the jar-cup method, the number of colonies increased from 1.5-6 times. The number of bacteria grew even more on blood agar. It can be recommended that bacteriological contamination of the air should be determined by using only medias with blood. TAB

N70-31688# Princeton Univ., N.J. Elementary Particles Lab.
PIEZOELECTRIC MECHANICAL-MICROPIPETTE STIMULATOR
G. T. Reynolds 12 Feb. 1970 12 p refs
(Contract AT(30-1)-3406)
(NYO-3406-18; TR-10) Avail: CFSTI

A simple mechanical stimulating technique is described which is capable of controlled displacements and provision of a time reference for the precise initiation of the stimulus. The method was successful with several luminescent organisms that did not respond to the usual electrical techniques. It consists of incorporating a thin walled piezoelectric cylinder as an integral part of the suction micropipette that holds the specimen. Specific results are presented for Noctiluca, Pyrocystis, Gonyaulax, and ctenophore Mnemiopsis. Author

N70-31695# California Univ., Los Angeles. Biotechnology Lab.
THE APPLICATION OF A THEORETICAL LEARNING MODEL TO A REMOTE HANDLING CONTROL SYSTEM
Amos Freedy, Frederick Hull, and John Lyman Jan. 1970 107 p refs
(Grant DA-ARO(D)-31-124-G1035)
(AD-703938; AROD-8048-1-RT; Rept-70-7; TR-47) Avail: CFSTI CSCL 6/2

The report introduces the concept of adaptive aiding as a means of improving performance in remote handling, and describes the development, realization and experimental evaluation of a system based on this concept. The system incorporates an automaton that is able to supplement the operators control of a powered manipulator arm as well as act as a parallel controller. The operator positions the manipulator in three dimensions by means of joystick control; a foot-pedal opens and closes the manipulator claw. The behavior of the automaton is established through a process of learning -- observing the human operators control actions relative to the environment and the manipulator output, and developing a decisionmaking policy. Initially, the manipulator is totally controlled by the operator, while the automaton acts as a passive observer. As operation continues, behavior patterns are acquired by the automaton, and gradually it is transformed from a passive observer to an active controller. Author (TAB)

N70-31767# Northeastern Univ., Boston, Mass. Dept. of Biophysics and Biomedical Engineering.
BIOLOGICAL EFFECTS OF LASER RADIATION Annual Progress Report, 1 Oct. 1968 – 30 Sep. 1969
Samuel Fine and Edmund Klein Sep. 1969 16 p refs
(AD-704363) Avail: CFSTI CSCL 6/18

A summary of studies carried on during the year on (1) Anterior chamber measurements on CO2 corneal irradiation; (2) corneal calcification on CO2 laser irradiation; (3) ocular injury from CO2 laser irradiation; (4) application of thermal models to retinal threshold injury; (5) toxic and explosive hazards associated with lasers; (6) pathology of internal viscera following laser irradiation; (7) a method for detecting and measuring frequency of surface vibrations using a helium neon laser; (8) exploration of potential carcinogenic effects of pulsed laser irradiation; (9) lasers in biology and medicine; and (10) rupture and tensile strength measurements of fresh and treated canine aortic tissue. Author (TAB)

N70-31781*# North American Rockwell Corp, Downey, Calif. Space Div.
LUNAR ESCAPE SYSTEMS (LESS) FEASIBILITY STUDY. VOLUME 1: SUMMARY REPORT
J. O. Matzenauer Washington Jun. 1970 25 p refs
(Contract NAS1-8923)
(NASA-CR-1619; SD-69-598-1) Avail: CFSTI CSCL 06K

The results of a feasibility study of lunar emergency escape-to-orbit systems are summarized. The mission of the lunar emergency escape-to-orbit system (LESS) is to provide a means for the crew of the lunar module (LM) or extended LM (ELM) to escape from the surface in the event that the LM/ELM ascent stage is unsafe or unable to take off into orbit. The LESS role is to carry the two astronauts to the CSM in orbit within three to four hours. Development of the LESS vehicle will provide increased

crew safety margins by covering possible failures of the critical single-engined LM/ELM ascent stage. Author

N70-31783# Naval Submarine Medical Center, Groton, Conn. Research Lab.
A PRELIMINARY INVESTIGATION OF THE EFFECTS OF NEAR INFRARED RADIATION ON VISUAL PERFORMANCE
Kevin V. Laxar (M.S. Thesis—Connecticut Univ.) 7 Jul. 1969 18 p refs
(AD-703613; SMRL-588) Avail: CFSTI CSCL 6/16

Simulated solar, near infrared radiation caused no eye damage or decrement in visual discrimination performance in Rhesus monkeys. The subjects tended to avoid the radiation, however. The study tests for a safe level of irradiance for repeated exposure to the near infrared in operational settings. Distance from the source is the limiting factor in exposure to infrared searchlights and signaling devices. No change in visor specification is required to protect Navy personnel from the suns near infrared radiation, even at high altitudes. Author (TAB)

N70-31784# Navy Experimental Diving Unit, Washington, D.C.
REPETITIVE EXCURSION DIVES FROM SATURATED DEPTHS ON HELIUM-OXYGEN MIXTURES. PHASE 1: SATURATION DEPTH 350 FEET
James K. Summitt, Jerry M. Herron, and Edward T. Flynn 15 Mar. 1970 55 p refs
(AD-703610; NEDU-RR-2-70) Avail: CFSTI CSCL 6/19

Five 350 foot saturation dives were conducted at the Navy Experimental Diving Unit to verify a no-decompression, repetitive excursion format developed by DSSP (PM-11). Twenty divers completed a total of 344 man-excursion dives from the saturation depth. No symptoms of decompression sickness were reported during the excursion dives, during the bottom time at 350 feet or during the first 200 feet of decompression back to the surface. Five cases of decompression sickness did occur during the latter stages of decompression and they are discussed briefly. The occurrance of compression arthralgia and external otitis on deep saturation-excursion dives is also discussed. Author (TAB)

N70-31793# School of Aerospace Medicine, Brooks AFB, Tex.
NYSTAGMUS COMPUTATION BY ANALOG TECHNICS Final Report, 15 Feb. 1968 –28 Oct. 1969
F. A. Brogan Feb. 1970 15 p refs
(AD-702809; SAM-TR-70-7) Avail: CFSTI CSCL 6/2

A complete system is described for on-line reduction of nystagmic data during vestibular bithermal caloric testing. The total eye movement in one direction for each 5-second interval is plotted in degrees by an X-Y recorder. A different symbol is used for each test condition. The operator does not have to be familiar with the computer system once it is set up since all controls to the computer are automatic. Control room operation is limited to adjustment of the gain of the raw data recorder for a calibrated eye movement and the changing of symbols on the X-Y point print plotter after each stimulation. A standard analog computer can be used for processing the data, or a special computer may be constructed. Author (TAB)

N70-31802*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: WATER RECOVERY SYSTEMS
John R. Tole Washington NASA Jun. 1970 59 p refs
(Grant NGR-22-009-312)
(NASA-CR-1629) Avail: CFSTI CSCL 06K

One of the vital spacecraft life support systems is that used to supply water. Short duration missions allow storage of sufficient water, but for long duration missions, the weight of such a supply becomes unacceptable. This paper reviews techniques for recovering potable drinking and wash water from spacecraft waste water. Emphasis is placed on problem areas which exist in such recovery and which may be suitable topics for university type research. Areas covered include nature of waste waters which might be processed, potability requirements and monitoring techniques, existing and possible future recovery techniques, means of selecting a suitable technique from a number of different types, and problems of a fringe nature such as means of monitoring body mass to keep track of human water exchange. An attempt is made to stimulate new ideas based on present knowledge. Author

N70-31811# Melpar, Inc., Falls Church, Va.
STUDY OF ADAPTIVE MATHEMATICAL MODELS FOR DERIVING AUTOMATED PILOT PERFORMANCE MEASUREMENT TECHNIQUES. VOLUME 2: APPENDICES Final Report, Jan. 1968 –Jan. 1969
E. H. Connelly, A. R. Schuler, and Patricia A. Knoop (Human Resources Lab., AFSC) Oct. 1969 580 p refs
(Contract F33615-68-C-1278)
(AD-704115; AFHRL-TR-69-7-Vol-2; Rept-8054-Vol-2) Avail: CFSTI HC $10.00/MF $0.65 CSCL 5/9

The report documents research on a new approach to deriving human performance measures and criteria for use in automatically evaluating trainee performance. The ultimate application of the research is to provide methods for automatically measuring pilot performance in a flight simulator or from recorded in-flight data. An efficient method of representing performance data within a computer is described. A system of adaptive mathematical and computer models is developed to examine representative performance data corresponding to known skill-levels and to independently develop a unique method of performance evaluation. Three types of models are developed, each of which is designed to derive and use (in an adaptive performance evaluation scheme) unique types of performance measures: (1) State-transfer measures, which are based on overall trends of the performance; (2) Absolute measures, which are based on a comparison of actual performance with some reference or standard; and (3) Relative measures, which are based on relations among various performance variables. A preliminary demonstration and an evaluation of the system are made, using a simulated aircraft landing program to provide hypothetical test data. Author (TAB)

N70-31814*# Gulf General Atomic, San Diego, Calif.
A STUDY TO DEVELOP NEUTRON ACTIVATION FOR MEASURING BONE CALCIUM CONTENT
H. R. Lukens, Jr., D. M. Fleishman, and J. K. MacKenzie Washington NASA Jun. 1970 84 p refs
(Contract NAS2-5178)
(NASA-CR-1606) Avail: CFSTI CSCL 06B

A study of the feasibility of utilizing neutron activation analysis for the *in vivo* determination of bone calcium in the macaque monkey has been carried out. Theoretical calculations showed that the absolute determination of bone calcium by *in vivo* neutron activation analysis is highly dependent on the use of comparator standards that accurately represent the size, shape, and composition of the specimen. Accurate models of a vertebra and a femur were constructed of calcium-loaded plastic, and analyses of two vertebrae and a femur were carried out under simulated *in vivo* conditions using the models as comparator standards. The absolute calcium values were confirmed by both high-flux neutron activation analysis and atomic absorption analyses. With sufficiently accurate comparator standards, it is estimated that *in vivo* neutron activation analysis is capable of determining absolute calcium levels in the whole body to within 2% to 3% of the actual value. Author

N70-31845*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE DEVELOPMENT AND APPLICATION OF PLETHYSMOGRAPHIC AND ISOTOPIC METHODS FOR STUDYING THE RELATIONSHIP BETWEEN INTRINSIC AUTOREGULATION OF BLOOD FLOW AND THE PARTITION OF INTERCOMPARTMENTAL FLUID VOLUMES IN SKELETAL MUSCLE
William Carter Alexander (Ph.D. Thesis—Wake Forest Univ.) Jun. 1970 68 p refs
(Grants PHS-G-HE-00487; PHS-G-HE-5392)
(NASA-TM-X-58045) Avail: CFSTI CSCL 06P

Data are presented which indicate that in the denervated canine gracilis muscle, an intrinsic mechanism is operative which is an integral part of the autoregulation of blood flow. The maintenance of constant flow to the exchange elements of the circulation despite wide fluctuations in arterial perfusion pressure provides, in addition, a regulation of capillary hydraulic pressure which defines the balance between ultrafiltration and reabsorption of fluid. This mechanism leads to an intrinsic autoregulation of solvent exchange and stable intravascular and extravascular volumes in the muscle bed. This intrinsic regulation of the exchange networks of skeletal muscle interferes with the desired systemic regulation by depleting the volume in the capacitance reservoir and reducing venous return. It may be predicted that the intrinsic response of the muscle to maintain its intravascular and extravascular volumes essentially constant during reductions in perfusion pressure is, in part, a significant contributor to the irreversible phase of hypotensive shock. Author

N70-31852# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
EXPERIMENTAL COMPARISON OF TRAUMA IN LATERAL (+G SUB y), REARWARD FACING (+G SUB x), AND FORWARD FACING (−G SUB x) BODY ORIENTATIONS WHEN RESTRAINED BY LAP BELT ONLY
Richard G. Snyder, Clyde C. Snow, Joseph W. Young, G. Townley Price, and Peter Hanson Jul. 1969 25 p refs
(FAA-AM-69-13) Avail: CFSTI

Twenty-four anesthetized Savannah Baboons (Papio Cynocephalus) restrained with a lap belt were subjected to a controlled series of lateral impacts at entrance velocities ranging from 36.4 ft./sec. (15g.) to 88.2 ft./sec. (44g.) 1,200 g./sec. to 5,900 g./sec. rate of onset, for total durations of 0.076 to .100 second. Sixteen lateral (+G sub y) tests were run with four forward-facing and four rearward-facing controls. Gross and microscopic autopsies were performed. Pathology was found to be significantly higher in lateral impact. Ruptured bladders and uteri, adrenal hemorrhage, and subdural and epidural hemorrhage occurred frequently. A major finding, with unexplained etiology, was marked pancreatic hemorrhage most typical of the lateral impact. Under these test conditions, both survival and injury tolerance levels were found to be lower in the lateral (+G sub y) body orientation, indicating lap belt restraint alone does not provide adequate body protection. Author

N70-31882# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETECTION OF STRONG CARCINOGENS: 1,2,4,5 AND 3,4,9,10-DIBENZOPYRENES IN ATMOSPHERIC AIR
P. P. Dikun 21 Jan. 1970 6 p refs Transl. into ENGLISH from Vopr. Onkol. (Moscow), v. 12, no. 1, 1966 p 90−91
(AD-704040; FTD-HT-23-614-69) Avail: CFSTI CSCL 7/4

Isomers of dibenzopyrene were isolated from air collected in Leningrad and identified by means of quasi-linear spectra. Wavelengths of quasi-linear fluorescence spectra of the pure and airborne isomers are given. TAB

N70-31892*# Matrix Corp., Alexandria, Va. Human Factors Div.
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES: MAN AND MANIPULATOR. VOLUME 1: PERFORMANCE EFFECTIVENESS EVALUATION SCHEME (PEEVS). PART B: REFERENCE DATA
Kenneth M. Mallory, Jr., Edward L. Saenger, and Thomas B. Malone 27 Apr. 1970 68 p
(Contract NAS8-24384)
(NASA-CR-102763) Avail: CFSTI CSCL 06B

Instructions are presented for using the Performance Effectiveness Evaluation Scheme (PEEVS). Reference data sheets and worksheets required to use PEEVS are also given. Author

N70-31905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREW RADIATION DOSE FROM A GAS-CORE NUCLEAR ROCKET PLUME
Charles C. Masser 1970 14 p refs Presented at 16th Ann Meeting of the Am. Nucl. Soc., Los Angeles, 28 Jun. − 2 Jul. 1970
(NASA-TM-X-52832) Avail: CFSTI CSCL 18F

Analytical calculations are performed to determine the radiation dose rate to the crew of a gas-core nuclear rocket from the fission fragments located throughout the plume volume. The rocket plume is generated by the products of the reactor and consists of hydrogen, uranium, and fission fragments. A total of 1.68 pounds of fission fragments are formed from a gas-core rocket that produces one million pounds of thrust at a specific impulse of 1500 seconds for a propellant consumption of one million pounds. The radiation dose rate from these fission fragments to two crew locations of 250 and 500 feet from the nozzle exit are calculated. The doses are calculated assuming that there is a vacuum in the space between the crew and the plume. Author

N70-31928*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
May 1970 147 p refs
(NASA-SP-7011(76)) Avail: CFSTI CSCL 06B

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. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N70-31998*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY
Jan. 1970 880 p refs
(NASA-SP-7011(72)) Avail: CFSTI HC $10.00/MF $0.65 CSCL 06B

The compiled abstract index supplements the 1969 issues of the bibliography on Aerospace Medicine and Biology. It comprises references on bioscience and biotechnology prepared from: (1) NASA entries by STAR accession numbers; (2) AIAA entries by AIAA accession numbers; and (3) LC entries identified by numbers of the A 69-80000 series. G.G.

IAA ENTRIES

A70-31433 **The normal range and determinants of the intrinsic heart rate in man.** Anthony D. Jose and D. Collison (Hallstrom Institute of Cardiology, Sydney, Australia). *Cardiovascular Research,* vol. 4, Apr. 1970, p. 160-166. 23 refs. Research supported by the National Heart Foundation of Australia and Imperial Chemical Industries.

Attempt to define the range and variability of the intrinsic heart rate (IHR) in normal subjects at different ages, and to identify its major determinants in the absence of heart disease. The IHR was defined as the heart rate 5 min after an intravenous injection of propanolol and atropine in doses sufficient to inhibit autonomic activity in the heart. Normal standards for the IHR were measured in 432 healthy adult subjects aged 16 to 70 years. At rest, with normal body temperature, the IHR was highly reproducible. In different subjects, age was the only important determinant. Differences in IHR may correspond to differences in functional capacity of the myocardium, whether determined genetically, by age, or by disease. F.R.L.

A70-31434 **A comparative study of cardiac outputs in dogs using indicator-dilution curves and an electromagnetic flowmeter.** P. C. Weaver, J. S. Bailey, and V. J. Redding (Westminster Hospital, London, England). *Cardiovascular Research,* vol. 4, Apr. 1970, p. 248-252. 12 refs. Research supported by the British Heart Foundation.

Left and right heart dye injections were used to measure cardiac output, and the results were compared with flow measurements in the aorta and pulmonary artery. Pulmonary artery flow gave a more reliable measurement of cardiac output than aortic flow; left heart dye curves gave a higher cardiac output figure than right. The significance of these findings is discussed. (Author)

A70-31435 **Development and evaluation of a hot-film velocity probe for cardiovascular studies.** W. A. Seed and N. B. Wood (Imperial College of Science and Technology, London, England). *Cardiovascular Research,* vol. 4, Apr. 1970, p. 253-263. 26 refs. Research supported by the Wales Foundation and the Nuffield Foundation.

The application of constant temperature hot-film anemometry to measurement of point blood velocity in arteries is discussed and the importance of certain aspects of design, and of provision of means for detecting flow reversal, is demonstrated. Hot film probes suitable for intra-arterial use have been constructed and tested in regimes of steady and unsteady water flow. At overheat ratios compatible with use in blood three different commercially available anemometers had unsatisfactory frequency responses. Oscillatory calibrations performed in the absence of mean flow were further subject to error due to generation of secondary flows. The likely significance of these various effects in distorting intra-arterial measurements is discussed. (Author)

A70-31500 # **Use of potassium superoxide in closed-circuit individual breathing apparatus (Utilisation du superoxyde de potassium dans les appareils individuels de respiration en circuit fermé).** H. Ducros (Centre d'Essais en Vol, Brétigny-sur-Orge, Essonne, France). *Revue des Corps de Santé des Armées,* vol. 11, Feb. 1970, p. 67-87. In French.

Results of closed-circuit respiration studies, using cartridges of potassium superoxide, made on subjects at rest and at work. The experiments at rest, in the seated position, made it possible to demonstrate the reactive qualities of potassium superoxide in actual breathing conditions. This variety of potassium oxide reacts with carbon dioxide and the pulmonary water vapor to liberate oxygen into the circuit. These reactions, operating intensely, release an amount of oxygen in excess of that required by the subject, and initiate a rise in the oxygen content of the circuit (80 parts per 100 after 90 min). It is considered that the use of potassium superoxide as a source of oxygen in self-contained breathing apparatus has a definite advantage over compressed oxygen, since the latter requires a heavy and cumbersome container. F.R.L.

A70-31575 **Psychophysical analysis of visual space.** J. C. Baird (Dartmouth College, Hanover, N.H.). Oxford and Elmsford, N.Y., Pergamon Press (International Series of Monographs in Experimental Psychology. Volume 9), 1970. 327 p. 312 refs. $10.50.

The purpose of the psychophysical analysis described in this book is to fill part of the wide gap separating theory from experiment in the field of perception. The results in visual size-distance perception are organized so as to permit a thorough treatment of old ideas, the direct testing of new ones, and a start to more extensive theories. The most prominent fields discussed are psychophysics, space perception, and physiological optics. The findings are extended from one research area to make predictions concerning the operation of variables in another, and the overall theme is in fact to construct as many of these generalities and connections as possible. G.R.

A70-31600 # **Biological problems of solar energy conversion (Biologicheskie problemy preobrazovaniia solnechnoi energii).** A. A. Shakhov (Akademiia Nauk SSSR, Institut Fiziologii Rastenii, Moscow, USSR). *(Vsesoiuznaia Konferentsiia po Ispol'zovaniiu Solnechnoi Energii, Yerevan, Armenian SSR, July 19, 1969.) Geliotekhnika,* no. 6, 1969, p. 41-54. 30 refs. In Russian.

Survey of the current state of knowledge about photosynthesis and nonphotosynthesis mechanisms of biological conversion of solar energy. The three stages of photosynthesis are examined; these include (1) the separation of hydrogen from the water molecule and the liberation of oxygen, (2) transfer of hydrogen with the aid of energy trapped by chlorophyll, and (3) use of the oxygen to reduce carbon dioxide to carbon. The nonphotosynthesis conversion process is relatively lightly studied, but it is reliably known that it is partially caused by free-radical processes. Data available in the literature are analyzed, and attention is given to artificially created photochemical conversion systems. T.M.

A70-31601 # **Analysis of neuron functioning dynamics from recordings of pulse activity (Analiz dinamiki funktsionirovaniia neirona po zapisi impul'snoi aktivnosti).** A. B. Kogan, V. N. Efimov, and P. T. Sokolenko (Rostovskii-na-Donu Gosudarstvennyi Universitet, Rostov, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 514-517. 5 refs. In Russian.

Study of pulse activity as a continuous process reflecting neuron functioning dynamics. A method of constructing a generalized neuron state function from a pulsed output flow is proposed. The method is based on the construction of a so-called 'frequency gram' - a piecewise-continuous function of time, the values of which at each point are equal to the reciprocal of the interval between the pulses. A.B.K.

A70-31602 # **Age changes in the rate of excitation along motor fibers of peripheral nerves (Vozrastnye izmeneniia skorosti provedeniia vozbuzhdeniia po motornym voloknam periphericheskikh nervov).** N. A. Timko (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 552-557. 33 refs. In Russian.

Determination of the maximum rate of excitation along motor fibers in the ulnar and peroneal nerves in subjects of various ages. The residual conduction time was calculated, and the amplitude and duration of the action potential of the abductor muscle of the little finger and the extensor digitorum brevis of the foot were determined. It is shown that the rate of excitation slows down in middle-aged and old subjects in comparison with a control group of young subjects. Also observed with an increase in age is a reduction in the amplitude of the action potential of the muscles. These differences are more pronounced in the lower extremities. The duration of the action potential of the muscles with an increase in age is reliably found to increase only in the lower extremities. A lengthening of the residual conduction time is also noted. A.B.K.

A70-31603 # **Effect of intense disadapting photostimulation on the nature of the restoration of light sensitivity in the human visual analysor (Vliianie intensivnoi dezadaptiruiushchei fotostimuliatsii na kharakter vosstanovleniia svetovoi chuvstvitel'nosti zritel'nogo analizatora cheloveka).** V. I. Shostak and E. A. Obukhova (Voenno-Meditsinskaia Akademiia, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 558-562. 24 refs. In Russian.

Study of the effect of light flashes lasting from 80 to 900 microsec (illumination powers ranging from 250 to 1600 candle seconds) on the light sensitivity of the human visual analysor. It is shown that the decisive factor in the action of stimuli of this type is their energy. However, with a decrease in the flash duration the nature of the dependences changes. The dark adaptation curves obtained in this case are characterized by considerable differences in the initial period and by an identical time required for complete restoration of light sensitivity. A.B.K.

A70-31604 # **Electrophysiological characteristics of the properties of the tonic fibers of the outer eye muscles (Elektrofiziologicheskaia kharakteristika svoistv tonicheskikh volokon vneshnikh glaznykh myshts).** D. P. Matiushkin and T. M. Drabkina (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 563-569. 18 refs. In Russian.

Study of more than 100 tonic fibers of the upper musculus obliquus of the rabbit eye. The mean membrane rest potential of these fibers was 32 mV, while the postsynaptic excitation potential was 11 mV. Two types of postsynaptic potential are noted - namely, 'peaked' and 'slow.' It is shown that many tonic fibers contain several miniature motor units which have different velocities and are independent of each other with respect to activity rhythm. A.B.K.

A70-31605 # **Electrical properties of the smooth muscle of the portal vein (Elektricheskie svoistva gladkoi myshtsy portal'noi veny).** V. M. Taranenko and M. F. Shuba (Akademiia Nauk Ukrainskoi SSR, Institut Fiziologii, Kiev, Ukrainian SSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 597-604. 31 refs. In Russian.

Study of the electrical properties of the smooth muscles of the portal vein, using the double 'saccharose bridge' method. Under the action of the anode and the cathode of the polarizing current an anelectrotonus and a catelectrotonus develop in the muscle cells of the portal vein. An analysis of these potentials shows that the membrane of these cells possesses pronounced rectifying properties. The input resistance of a single muscle cell and the resistivity of its membrane, calculated from the inflowing current (the anelectrotonus), are found to be equal, respectively, to 602 plus or minus 64 Mohm and 3600 ohm-sq cm. At the end of certain spontaneous and evoked discharges, and also at the end of the catelectrotonus, a large positive afterpotential develops, which plays an important role in the regulation of the excitability and spontaneous activity of the muscle cells. During the development of this potential the resistance of the muscle cell membrane decreases. In contrast to the anelectrotonus, the catelectrotonus increases during the development of an afterpositivity which outwardly resembles the phenomenon of anomalous rectification. A.B.K.

A70-31606 # **Special features of the development of conditioned vasodilating reflexes in humans (Ob osobennostiakh vyrabotki uslovnykh sosudorasshiriaiushchikh refleksov u cheloveka).** K. Fichtel (Deutsche Akademie der Wissenschaften, Institut für Kortiko-Viscerale Pathologie und Therapie, Berlin, East Germany). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 610-617. 22 refs. In Russian.

Study in which the biphasic thermoregulatory vascular response was evoked in eight subjects with the aid of Hauffe arm baths of increasing temperature. By combining this prolonged physical stimulus with a similarly prolonged acoustic stimulus (tape-recorded music), vasodilation conditioned reflexes were successfully developed, thus proving the reflex nature of thermoregulatory vasodilation. Discrepancies with other authors' data are discussed, and the significance of the time characteristics of both conditioned and unconditioned vasodilation stimuli is emphasized. A.B.K.

A70-31607 # **Different forms of reaction to voluntary forced breathing (O razlichnykh formakh reaktsii na proizvol'no usilennoe dykhanie).** V. L. Fantalova (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 632-639. 10 refs. In Russian.

Comparative analysis of the effect of brief forced hyperventilation in two human subjects on the basis of indices regarding changes in the respiration rhythm, the EEG, and the finger plethysmogram. It is suggested that the different types of complex reaction to hyperventilation may be related to different mechanisms of compensation of respiratory alkalosis. In the first of the demonstratable cases repeated expirator respiration pauses and an increase in the peripheral blood filling in the presence of hypersynchronization of the cortex rhythm in the EEG were found to be characteristic. In the second case hyperventilation is accompanied by a persistent increase in the amplitude of respiratory movements and a decrease in the peripheral blood filling in the absence of hypersynchronization in the EEG. The two cases also differ with respect to the degree of pH shift in the blood and with respect to subjective feelings of the subjects. A.B.K.

A70-31608 # **Change in the oxygen consumption rate constant (O2 CRC) in the presence of high oxygen pressure (Izmenenie konstanty skorosti potrebleniia kisloroda (KSP O2) pri ego povyshennom davlenii).** I. P. Berezin (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Khirurgicheskoi Apparatury i Instrumentov, Moscow, USSR). *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 640-644. 16 refs. In Russian.

Study of the effect of high oxygen pressure on the oxygen consumption rate constant for in vivo tissues. It is established that at the altitude of maximum saturation of the tissues with oxygen at an ambient pressure of three absolute atmospheres the oxygen consumption rate constant decreases to half that for respiration of air at a pressure of 1 atm abs. During the period after exposure to high oxygen pressure the oxygen consumption rate constant is also reduced, in spite of the fact that the animal is breathing air at 1 atm abs. A.B.K.

A70-31609 # **Application of the theory of stochastic functions to the mathematical description of cardiac rhythm dynamics during work (Primenenie teorii stokhasticheskikh funktsii dlia matematicheskogo opisaniia dinamiki serdechnogo ritma v protsesse truda).** A. O. Navakatikian and V. P. Grebniak. *Fiziologicheskii Zhurnal SSSR,* vol. 56, Apr. 1970, p. 645-650. 23 refs. In Russian.

Study in which the theory of stochastic processes is applied for the first time to a physiological analysis of cardiac rhythm dynamics

during an entire work shift. It is shown that it is both possible and desirable to determine, in addition to the arithmetic mean and the rms deviation of the cardiac rhythm, the correlation function, in particular, the indices of its rate of decrease. A.B.K.

A70-31662 # **Cellular changes in wheat seedlings during orbital flight.** Betty F. Edwards and Stephen W. Gray (Emory University, Atlanta, Ga.). *COSPAR, Plenary Meeting, 13th, Leningrad, USSR, May 20-29, 1970, Paper.* 8 p. 11 refs.

Discussion of cellular changes observed in seedlings of a soft red winter wheat as a biological response to weightlessness during the flight of the NASA Biosatellite II. The arrangement of the experiment and its results are discussed. It is shown that the seedlings differ from ground control seedlings in mitotic count, cell length and nuclear volume, as well as in orientation, starch grain distribution, and organ length. O.H.

A70-31664 * # **Microbial release from solids after simulated hard landings.** S. J. Fraser, R. L. Olson (Boeing Co., Aerospace Group, Seattle, Wash.), and R. H. Green (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *COSPAR, Plenary Meeting, 13th, Leningrad, USSR, May 20-29, 1970, Paper.* 10 p. 8 refs. Contract No. JPL-952511.

Viable terrestrial microorganisms may be trapped in certain solid spacecraft materials and survive decontamination or terminal sterilization processes. Upon hard impact these surviving organisms might be released into planetary environments. An investigation determined the percentage of spores released from the interior of solids after hard impact. The effect of impact on microbial release and survival was investigated in three test phases: first, internally inoculated methyl methacrylate pellets were impacted onto stainless steel; second, inoculated methyl methacrylate was impacted into sand; third, inoculated epoxy pellets were impacted onto stainless steel. The methyl methacrylate data show the percentage of spore release to be less than 1% at all four test velocities. An exception to this is seen in the epoxy results. The percentage of total spore survival after impact is velocity dependent but independent of initial spore concentration. It is significant that the total number of organisms surviving impact decreases as velocity increases. This decrease offsets an otherwise expected increase in released viable organisms as material fracturing increases with velocity. (Author)

A70-31677 # **Resistance to infections in extended spaceflight.** Edward H. Kass (Boston City Hospital, Boston, Mass.). *COSPAR, Plenary Meeting, 13th, Leningrad, USSR, May 20-29, 1970, Paper.* 17 p. 27 refs.

Although much can be done to minimize the spread of microorganisms from one individual to another, it is inevitable that an exchange of microflora will occur among individuals in an enclosed space. The chief sources of the microflora will be the respiratory tract, the gastrointestinal tract and the skin. Local care can deal with most problems of the skin, but potential problems in the respiratory and gastrointestinal tract cannot be dealt with as readily. Although many of the common pathogens can be eliminated by pre-flight procedure, the building up of normal flora represents potential hazards of substantial magnitude. The chief limitations of the effects of high concentrations of normal microbial flora are in the variety of host defensive mechanisms. Some of these have been reviewed, and it has been indicated that with respect to the bronchopulmonary defense mechanisms, the major defenses rest in the pulmonary alveolar macrophage system. This system has been shown to be adversely affected by a large variety of environmental circumstances, many of which will be operative in prolonged spaceflight. Similarly in the gastrointestinal tract, the large microbial load represents a source of microorganisms and of waste products, which represent potential hazards. Methods for minimizing the latter effects include reducing the total microbial load or implanting a monoculture of a desired microorganism which produces a minimum of the undesirable side effects. The solution to these problems requires sustained effort, and it is likely that solutions when found will have substantial application to medicine and public health in ground-based communities. (Author)

A70-31700 **Red cell flexibility and electrical resistance of blood centrifuged at low g-values.** D. Braasch and U. v. Oppen (Marburg, Universität, Marburg an der Lahn, West Germany). *Pflügers Archiv,* vol. 317, no. 3, 1970, p. 228-235. 8 refs.

The migration velocity of a red cell in a gravitational field depends in part upon the ability of the cell to adapt its shape to the external shearing forces, i.e., to achieve a hydrodynamically optimal streaming profile. The degree of shape transformation depends upon the strength of the shearing forces and on the deformability of the cells. It is shown that a close relation exists between migration speed and red-cell flexibility. The new method is sensitive enough to reveal even minute differences in cell flexibility caused by surface-active substances such as bile, free fatty acids or noradrenaline i.v. (Author)

A70-31725 # **Determination and labeling of surface-active lipoproteids of the lung (Bestimmung und Markierung der oberflächenaktiven Lipoproteide der Lunge).** H. Iwainsky, H. Reutgen, and J. Vogel (Forschungsinstitut für Tuberkulose und Lungenkrankheiten, Berlin, East Germany). *Acta Biologica et Medica Germanica,* vol. 24, no. 1-2, 1970, p. 47-58. 30 refs. In German.

Discussion of a quantitative determination of surface-active lipoproteids on the basis of an investigation employing a per-bronchial wash-out technique over the trachea, or a pervasal wash-out procedure. Labeled phosphorus is used to test the rapidity of formation of the surface-active substance. Phosphate content and the amount of P32 in blood, in lung, and in eluate and protein fractions are determined quantitatively. The implications of the results of the investigation for the biosynthesis of surface-active substances of the lung and the advantages of labeling are discussed. G.R.

A70-31739 **Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum).** Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970. 322 p. $18.40. In German.

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Foreword (Vorwort). W. Baust, p. XI, XII.

Fatigue and tiredness (Ermüdung und Müdigkeit). H. Schaefer (Heidelberg, Universität, Heidelberg, West Germany), p. 1-29. 121 refs. (See A70-31740 15-04)

Neuroanatomical introduction (Neuroanatomische Einführung). A. Hopf (Düsseldorf, Universität, Neustadt, West Germany), p. 31-38.

Principles of control and guidance (Prinzipien von Regelung und Steuerung). W. D. Hiltmann (Heidelberg, Universität, Heidelberg, West Germany), p. 39-58. 12 refs. (See A70-31741 15-05)

Circadian periodicity as a basis of the sleep-wakefulness rhythm (Circadiane Periodik als Grundlage des Schlaf-Wach-Rhythmus). J. Aschoff (Max-Planck-Institut für Verhaltensphysiologie, Erling-Andechs, West Germany), p. 59-98. 190 refs. (See A70-31742 15-04)

The phenomenology of sleep (Die Phänomenologie des Schlafes). W. Baust (Düsseldorf, Universität, Düsseldorf, West Germany), p. 99-144. 148 refs. (See A70-31743 15-04)

Mechanisms of sleep and wakefulness (Mechanismen von Schlafen und Wachen). G. Berlucchi (Pisa, Università, Pisa, Italy), p. 145-203. 208 refs. (See A70-31744 15-04)

Biochemistry of sleep (Biochemie des Schlafes). N. Matussek (Max-Planck-Institut für Psychiatrie, Munich, West Germany), p. 205-216. 61 refs. (See A70-31745 15-04)

Pathological physiology of sleep (Die pathologische Physiologie des Schlafes). H. P. Otter (München, Universität, Munich, West Germany), p. 217-245.

Pharmacologically induced sleep (Der pharmakologisch induzierte Schlaf). E. Holm (Heidelberg, Universität, Mannheim, West Germany), p. 247-308.

A70-31740 Fatigue and tiredness (Ermüdung und Müdigkeit). H. Schaefer (Heidelberg, Universität, Heidelberg, West Germany). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 1-29. 121 refs. In German.

Discussion of the nature of fatigue and the various conditions which can bring about a state of fatigue. The physiology of muscular activity is considered and the biochemical processes involved are examined. Fatigue phenomena occurring at spinal motor synapses are analyzed and the role of accompanying vegetative phenomena as a source of fatigue is investigated. Psychophysical problems and central aspects of fatigue are considered. Fatigue related concepts are classified into seven categories and the problems of an interpretation of chemical effects are discussed. G.R.

A70-31741 Principles of control and guidance (Prinzipien von Regelung und Steuerung). W. D. Hiltmann (Heidelberg, Universität, Heidelberg, West Germany). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 39-58. 12 refs. In German.

Discussion of the basic principles of control theory as a basis for a possible application to biological problems. Problems of keeping a parameter at a constant value are analyzed taking into consideration as an example the maintenance of a certain water level in a container. The signal transfer of linear control units is considered and the fundamentals of the mathematical approach used for control problems are discussed. The possibilities for applying the methods of control theory to biology are evaluated. G.R.

A70-31742 Circadian periodicity as a basis of the sleep-wakefulness rhythm (Circadiane Periodik als Grundlage des Schlaf-Wach-Rhythmus). J. Aschoff (Max-Planck-Institut für Verhaltensphysiologie, Erling-Andechs, West Germany). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 59-98. 190 refs. In German.

Discussion of rhythmical changes in biological organisms caused by the rotation of the earth giving particular attention to diurnal variations to which human beings are subjected. Investigations conducted with birds involving the measurement of their locomotorial activity as a function of time are discussed. Tests conducted under constant lighting conditions show that the 24-hr rhythm observed is not caused by the change between light and darkness. The parameters of the periodicity of the activity are examined and the mechanisms of synchronization are considered. The periodicity of the values for a number of physiological and biochemical parameters in man is explored and the significance of sleep, activity and eating is evaluated. The effects of a change in the biological rhythm are studied and periodicity under conditions of an isolation from the environment is investigated. G.R.

A70-31743 The phenomenology of sleep (Die Phänomenologie des Schlafes). W. Baust (Düsseldorf, Universität, Düsseldorf, West Germany). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 99-144. 148 refs. In German.

Study of sleep and the physiological phenomena connected with it. Some basic facts concerning sleep during the various ages of man are considered. Experimental investigations of the intensity of sleep by EEG studies are discussed. Intensity variations and the stages of sleep are examined. The stages of sleep characterized by rapid eye movements (REM) for men and animals are investigated. Variations of the vegetative nervous system during sleep are explored and the behavior of heart rate, blood pressure, respiration, motility of the stomach, and of the body temperature during sleep is discussed. The physiological correlation of dreams is considered. The influence of vegetatively controlled functions on central nervous structures is examined. G.R.

A70-31744 Mechanisms of sleep and wakefulness (Mechanismen von Schlafen und Wachen). G. Berlucchi (Pisa, Università, Pisa, Italy). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 145-203. 208 refs. In German.

Discussion of the mechanisms which are responsible for the phenomena of sleep and wakefulness and the sleep-wakefulness rhythm. The basic characteristics of sleep, wakefulness and consciousness are considered. The effect of lesions in the central nervous system on the sleep-wakefulness cycle is examined and the occurrence of sleep and wakefulness after an electrical excitation of the brain is discussed. The activity of single neurons of the brain during sleep and wakefulness is investigated. Functional factors effective in the regulation of sleep are considered. A number of theories regarding sleep and wakefulness is discussed taking into account some biochemical mechanisms. G.R.

A70-31745 Biochemistry of sleep (Biochemie des Schlafes). N. Matussek (Max-Planck-Institut für Psychiatrie, Munich, West Germany). In: Fatigue, sleep, and dream (Ermüdung, Schlaf und Traum). (A70-31739 15-04) Edited by Walter Baust. Stuttgart, Wissenschaftliche Verlagsgesellschaft mbH, 1970, p. 205-216. 61 refs. In German.

Discussion of the role of serotonin, noradrenalin and acetylcholine in the regulation of the sleep-wakefulness cycle. It is reported that in the central nervous system of various animals the amount of serotonin in the trophotropic phase of sleep is greater than in a state of wakefulness. Acetylcholine can directly cause sleep if applied to certain parts of the brain. G.R.

A70-31747 # An electromagnetic catheter blood flow meter of minimal lateral dimensions. Alexander Kolin (California, University, Los Angeles, Calif.). *National Academy of Sciences, Proceedings,* vol. 66, May 1970, p. 53-56. 7 refs. Research supported by the Cancer Detection Services.

Description of an electromagnetic catheter blood flow meter which, in addition to great simplicity, also achieves the ultimate degree of miniaturization. By means of this flow meter, the volume rate of flow through the blood vessel is measured by the potential difference between two electrodes; this principle is used to monitor the flow in the major blood vessels as well as in their branches. By using the miniaturization principles described, catheter flow sensors as well as about 0.5 mm in diameter have been made without difficulty and much smaller ones can be made without serious difficulties. This reduction in dimensions is of decisive importance in the development of a blood flow measuring device for percutaneous introduction into human subjects for clinical determination of blood flow in blood vessels. O.H.

A70-31772 The SAS system of selection of pilots. IV. Arne Trankell (Pedagogiska Institutionen, Stockholm, Sweden). *Flight Safety,* vol. 4, May 1970, p. 12, 13.

Analysis of the validity of the selection system of pilots in SAS on the basis of the scores obtained by pilots which left the airline. A study of the reasons why 72 people have left SAS shows that the group consists of at least three separate categories. The ratings given to the pilots at appointment tests are examined and differences in the scores for 'undesired resignations,' 'incompetence,' and the 'disciplinary' group are pointed out. G.R.

A70-31774 Toward uniform documentation - PHYSBE and 1130 CSMP. John McLeod. *Simulation,* vol. 14, May 1970, p. 215-220. 31 refs.

Proposal of a format for documenting simulation models as a step toward uniform documentation. It is felt that models should be documented in a uniform format to make it practical for one investigator using simulation to build on the experience of another. In order to explain the proposed method, an example of its use is given. It is pointed out that documentation uniformity can not only facilitate comparisons of models for determining their relative suitability to a given end, but may also assure inclusion of all necessary details in a manner that is suitable for ready reference.
M.V.E.

A70-31786 * # **Effect of prolonged hyperoxia on red blood cell survival parameters in the rat.** Henry A. Leon (NASA, Ames Research Center, Moffett Field, Calif.), Stephen A. Landaw, and H. Saul Winchell (California, University, Berkeley, Calif.). *International Congress on Hyperbaric Medicine, 4th, Sapporo, Japan, Sept. 2-4, 1969, Paper.* 13 p. 8 refs.

Study of red blood cell (RBC) survival parameters to determine as to whether moderately hyperoxic environments can cause hemolysis in otherwise normal animals or humans. RBC survival parameters were studied in adult Buffalo rats that ate a normal diet with adequate vitamin E and were continually exposed to 100% oxygen at pressures ranging from 197 to 600 torr. The length of exposure was as long as 105 days at pressures of 450 torr and below. The objective was to determine the effect of hypoxia on both new RBC immediately after their formation and normal RBC already in circulation, and the dose relation of the effect. The results are tabulated and discussed. O.H.

A70-31790 * # **Sensory attention.** Alfred B. Kristofferson (McMaster University, Hamilton, Ontario, Canada). *British Psychological Society and International Union of Psychological Science, International Congress of Psychology, London, England, July 27-Aug. 2, 1969, Paper.* 17 p. Grant No. NGR-52-059-001.

Examination of the problem of selective attention in terms of the all-or-none hypothesis. Two lines of research are described, both of which employ simple stimuli; the first concerns selective attention as it affects target detectability, the second the switching time of attention. Results of several experiments are reviewed and analyzed. The all-or-none hypothesis of selective attention is reasserted, and its usefulness is illustrated. A new conception of selective mechanism similar to Broadbent's filter theory (1958) is presented. O.H.

A70-31876 **Energy expenditure of pilots flying cargo aircraft.** W. C. Kaufman, G. D. Callin, and C. E. Harris (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio). *Aerospace Medicine,* vol. 41, June 1970, p. 591-596. 18 refs.

Determination of energy expenditure by analysis of expired air collected from 21 engineering test pilots on 18 flights in three types of cargo aircraft, one propeller-driven, one jet-powered, and a helicopter. Samples were taken in the aircraft while preparing for flight, during routine flight, and during simulated emergency flight. Mean value for energy expended in routine flight was 49.3 kcal/sq m-hr, not significantly different from the 47.7 kcal/sq m-hr expended during preparation for flight. During emergency procedures energy expenditure rose to 70.2 kcal/sq m-hr. These values are not markedly different from values estimated for World War II aircraft. There was no significant difference in energy expended by pilots with extensive experience in the aircraft as compared to pilots with little experience in the aircraft. Neither was there strong evidence of hyperventilation under any flight condition. These data suggest that less energy is expended in preparation for flight and routine flights but more energy is expended during emergencies in the jet than in the helicopter or propeller aircraft. (Author)

A70-31877 **Effect of exercise produced by partial immersion on the incidence of dysbarism in rats after 'free ascent.'** B. A. Gooden and D. H. LeMessurier (Adelaide, University, Adelaide, Australia). *Aerospace Medicine,* vol. 41, June 1970, p. 597-601. 12 refs.

Study, using rats as the experimental animals, simulating free ascent from deep water with continuous breathing as in an escape hood from 60 psig (equivalent to 135-ft depth) after periods of pressure from 1/4 to 6 hr. Immediately after decompression, half the rats rested and the other half performed 'swimming' activity produced by partial immersion. All animals then walked slowly in a rotating drum and any signs of dysbarism were noted. The treated animals developed a greater incidence of signs (P less than 0.0005), but a smaller proportion of deaths. The time to onset of the worst sign produced by an animal was also recorded, but there was no significant difference between time to onset of a particular grade in the treated rats compared with rested controls. Six cases of rear limb paralysis were treated by recompression schedules in which 50% of the time was spent at pressures greater than 30 psig. By this method four rats were cured and one was improved. (Author)

A70-31878 # **Hematologic changes associated with viral infection and hypobaric hypoxia.** Jerome P. Schmidt, Jarrell D. Bairrington, and Frank F. Pindak (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 602-607. 30 refs.

This study shows that the main mode of action of mengovirus infection in mice is via an inflammatory process which is exacerbated by a change in barometric pressure. There is an apparent displacement of the cellular transport mechanism as evidenced by an inability of the animal to respond to barometric pressure changes by shifting intra- and extracellular water space in a normal fashion. Further, the eosinophilia, lymphocytosis, and neutropenia seen at ground level is reversed at altitude parameters, probably via the increased action of adrenocortical hormones due to the stress reaction associated with decreased barometric pressure. Enhanced resistance, as expressed by an increase in mean survival time, was observed in mice exposed to the hypoxic environment after infectious challenge with mengovirus. (Author)

A70-31879 # **Tektite-I program - Bacteriological aspects.** Andre B. Cobet, D. N. Wright, and Phyllis I. Warren (California, University, Berkeley; California, University, Oakland, Calif.). *Aerospace Medicine,* vol. 41, June 1970, p. 611-616. 8 refs. Navy-supported research.

Four men were confined to an undersea habitat for the period of 59 days. During this time their microbial flora was monitored in order to determine what effect, if any, the environment would have on the health of men engaged in similar long term efforts. Ear infections, otitus externa resulting from Pseudomonas and Proteus, were the only medical problem encountered during the program. There was no noticeable change in the bacterial flora of either the oral cavity or intestinal tract of the divers. The greatest variety of bacteria was found on the skin of the forearm and behind the knee of the divers. Members of the genera Acinetobacter and Sarcina were found with greater regularity on these sites as the program progressed, thereby producing a change in the indigenous microflora of the skin during the dive. The bacterial flora of the wall surfaces of the habitat was composed mainly of Bacillus and Staphylococcus. This study suggests that there were no saprophytic species of bacteria present in the Tektite-I habitat environment which became pathogenic or which were predisposed to enhance virulence as a result of the environmental conditions surrounding the divers. (Author)

A70-31880 # **Tektite-I program - Aerobiological aspects.** Andre B. Cobet and R. L. Dimmick (California, University, Berkeley; California, University, Oakland, Calif.). *Aerospace Medicine,* vol. 41, June 1970, p. 617-620. 19 refs. Navy-supported research.

Study in which the number of airborne bacteria and fungi in the atmosphere of the Tektite-I habitat was monitored during the period of its submergence. The general population of airborne bacteria

increased from 3.5/cu ft before the start of the program to as high as 189 bacteria/cu ft. The fungal population averaged 0.4 organisms/cu ft, with six peak periods consisting of a mixed flora of Penicillium and Aspergillus. On two occasions, potentially pathogenic bacteria were isolated from the atmosphere; Staphylococcus on day 15, and Pseudomonas aeruginosa on day 19. Acinetobacter was the most common organism occurring in the atmosphere from day 35 to the completion of the program, possibly having its origin in the marine environment. (Author)

A70-31881 Heat stress in the cockpit of the AH-1G Hueycobra helicopter. J. R. Breckenridge and C. A. Levell (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Aerospace Medicine,* vol. 41, June 1970, p. 621-626. 8 refs.

Use of a 'sweating' copper manikin to determine heat stress levels in the cockpit of an AH-1G 'Hueycobra' helicopter parked in sunlight. After closing the canopy, changes in cockpit air temperature, wet bulb globe temperature (WBGT), and manikin heat dissipation were measured. Although air temperature usually did not exceed 80 F and clouds reduced solar radiation, cockpit air temperature rose to 134 F, and cockpit WBGT exceeded 101 F in several experiments. With severe conditions, manikin heat loss rapidly fell to zero, indicating that a pilot could dissipate no heat. A relationship is suggested which indicates that a pilot would store heat at a WBGT above 80 F. Since tests show that the AH-1G ventilating system cannot maintain WBGT below 90 F in hot, sunny environments, an air conditioner is obviously required for effective pilot performance in this aircraft. (Author)

A70-31882 Sleep patterns of an airline pilot operating world-wide east-west routes. Anthony N. Nicholson (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aerospace Medicine,* vol. 41, June 1970, p. 626-632. 21 refs.

The sleep patterns of an airline pilot operating long haul east-west routes have been observed over a period of eighteen months. The normal sleep pattern was modified by irregular duty periods and by adaptation to time zone change. It is considered that sleep disturbance rather than sleep deprivation is the main problem in such aircrew. The physiological significance of the sleep patterns experienced during route flying is not understood, but it would appear possible that complex adjustments of intrasleep cycles and short periods of sleep (naps) may provide an adequate sleep pattern. (Author)

A70-31883 Renal hemodynamic response of unanesthetized dogs to negative acceleration. John E. Chimoskey (U.S. Naval Material Command, Naval Air Development Center, Johnsville, Pa.). *Aerospace Medicine,* vol. 41, June 1970, p. 633-637. 15 refs.

Study in which trained, unanesthetized dogs were exposed to negative centrifugal accelerations up to -3 G(z). Renal arterial pressure and inferior vena cava pressure at kidney level were measured through indwelling catheters. Renal blood flow velocity was measured by a Doppler flowmeter. The flow signal was telemetered, and the pressure signals were transferred by slip rings from the centrifuge. About ten days after the sensing devices were implanted under pentobarbital anesthesia, the experiments began, for which the dogs were unanesthetized. Renal blood flow velocity decreased in proportion to the magnitude of -G(z). The minimum flow velocity was significantly lower during -3 G(z) than it was during -1 and -2 G(z). By the end of the 27- to 30-sec periods of constant -G(z), flow velocity recovered significantly from the minimum values. The lowest mean arterial-venous pressure gradient, 129 plus or minus 7 (S.E.) mm Hg, recorded during -3 G(z), did not differ significantly from the mean preacceleration value. Calculated intrarenal resistance to blood flow increased. Flow velocity reductions on a given day were frequently smaller after the first acceleration. (Author)

A70-31884 # Beryllium sulfate effect on vascular volumes. Emmanuel L. Mosser and Dale A. Clark (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 640-643. 14 refs.

Measurement of volumes of plasma by the albumin I(131) technic for three weeks in control and BeSO4 injected rabbits. Beryllium sulfate doses were 4.45 micromoles/kg (three rabbits) or 6.67 micromoles/kg (seven rabbits). Hematocrits, albumin, and total protein were measured, and red cell volumes were calculated. In controls mean plasma volume decreased for 12 days, then increased to near normal levels on day 17. In beryllium-injected animals, mean plasma volumes changed oppositely. In beryllium-treated rabbits, mean hematocrits declined for 12 days, then rose toward normal, but in controls the mean hematocrit remained unchanged. Compared with controls, BeSO4, 6.67 micromoles/kg, had no specific effect on albumin levels or red cell mass, but did increase globulin levels and plasma volume between 7 and 14 days after injection. (Author)

A70-31885 # Effects of pitch and Coriolis illusions upon adjustment of pitch angle. R. L. Cramer and J. W. Wolfe (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 644-646.

Simulated takeoff causes an illusion of exaggerated nose up attitude, which ordinarily interferes with the proper adjustment of pitch. However, the operator is able to overcome this illusion and to pitch to a desired angle even without recourse to instruments or visual reference if he is given a 'fix' on straight and level prior to his actions. (Author)

A70-31886 Hand-eye coordination in altered gravitational fields. Malcolm Martin Cohen (U.S. Naval Material Command, Naval Air Development Center, Johnsville, Pa.). *Aerospace Medicine,* vol. 41, June 1970, p. 647-649. 6 refs. Navy-supported research.

Study in which samples of hand-eye coordination were obtained while each of eight subjects was exposed to accelerative forces of 1.0, 1.5, and 2.0 G(z) in the Naval Air Development Center Human Centrifuge. Systematic changes in coordination were observed as a function of the G(z) conditions employed. In the 2.0 G(z) environment, subjects initially reached below, and then above, a mirror viewed target. In the 1.5 G(z) environment, subjects tended to reach above the target throughout the exposure session. In the 1.0 G(z) environment (natural terrestrial conditions), there were no significant changes in coordination. The data suggest that the relationship between intended motor outputs and their proprioceptive-kinaesthetic consequences provides adequate information for rapid behavioral compensation to altered accelerative forces. Further, vestibular and/or sensory-tonic factors are implicated in bringing about changes in the apparent elevation of targets viewed under increased accelerative forces. (Author)

A70-31887 * Susceptibility to acute motion sickness in blind persons. Ashton Graybiel (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Pensacola, Fla.). *Aerospace Medicine,* vol. 41, June 1970, p. 650-653. 14 refs. NASA-sponsored research.

A group of twelve persons selected only on the basis of their visual defects were exposed to stressful Coriolis accelerations under standardized conditions. All demonstrated differences in susceptibility to acute motion sickness that bore no relation to their rank order of visual deprivation. Insofar as comparison with a group of normal subjects was made possible, no significant differences in susceptibility were demonstrable. It was concluded that vision is not an essential but rather a secondary etiologic factor in the genesis of motion sickness. This is not incompatible with the fact that symptoms characteristic of motion sickness may be visually induced in the absence of 'motion.' (Author)

A70-31888 Predicting the career naval pilot and flight officer. George M. Rickus, Jr., Richard F. Booth, and Rosalie K. Ambler (U.S. Naval Aviation Medical Center, Aerospace Medical In-

stitute, Pensacola, Fla.). *Aerospace Medicine,* vol. 41, June 1970, p. 666-668.

This paper investigates the retention of naval pilots and flight officers beyond their initial obligated tour of duty. Actual retention rates are established and the predictability of career pilots and flight officers, based on their training performance, is discussed. The records of naval pilots and flight officers who entered training in calendar years 1958-1963 were examined. The retention rate of men entering the aviation pilot training program as commissioned officers was high, but for men entering as aviation officer candidates it was low. The retention rate of men entering the flight officer training program was low when the increasing need for experienced flight officers is considered. The multiple regression analysis revealed the moderating effect of procurement source and the need for better prediction of the career-noncareer criterion. (Author)

A70-31889 # Silent myocardial infarction in USAF flyers detected solely by annual required electrocardiograms. Timothy N. Caris (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 669-671. 15 refs. USAF-sponsored research.

The attack rate for unrecognized myocardial infarction detected solely by the annual electrocardiogram in USAF flyers from 36 to 50 years of age is presented. It ranges from 1 to 2 per 1000 each year from 40 to 50 years of age. The majority of myocardial infarctions detected under these circumstances in a flying population are apparently completely asymptomatic as can be determined by detailed retrospective history-taking. Although the annual electrocardiogram is an established valuable tool in the detection of latent coronary heart disease that presents a distinct hazard to flying safety, the need for even more sensitive detectors is emphasized. (Author)

A70-31890 Motion sickness in USAF flying personnel. R. S. Ryback, R. E. Rudd, G. J. Matz, and C. L. Jennings (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 672-677. 8 refs.

Forty-nine cases summarizing the experience with motion sickness in rated personnel evaluated at the USAF School of Aerospace Medicine from 1962-1969 are reviewed. Typically, the individual referred for evaluation is a young navigator or pilot who is found to have a strong previous history of motion sickness and increased sensitivity to Coriolis stimulation. Factors present in the past history, along with laboratory examinations, help to determine whether the etiology is primarily organic or psychiatric. Laboratory examinations included audiogram, electroencephalogram, tilt table, caloric tests, Coriolis stimulation, centrifuge run, F-100 ride, and blood indices. Psychologic testing was performed in 16 cases, and all patients were given psychiatric interviews. The aircraft the patient was current in at the time of referral, his rating by command, rating code, flying hours, recommended disposition and final disposition are reported. (Author)

A70-31891 Evaluation of the sympatho-adrenals activity in pilots by determination of urinary catecholamines during supersonic flight. R. Debijadji, L. Perovic, and V. Varagic (Institute of Aviation Medicine, Zemun, Yugoslavia). *Aerospace Medicine,* vol. 41, June 1970, p. 677-679. 17 refs.

Adrenaline and noradrenaline output in urine was estimated in supersonic pilots divided in the groups A, B, and C, during the flight at different altitudes and speeds. Significantly increased excretion of adrenaline (P less than .001) during flight is most probably due to the emotional stress of the pilots. The excreted amount of adrenaline during flying stress suggests that the pilots in group A and B reacted by the law 'all or nothing.' The repeated flight of the pilots in group C has shown to lead to adaptation of the sympathoadrenal system to the flying stressors. (Author)

A70-31892 Experience with a physiologically-based formula for determining rest periods on long-distance air travel. L. E. Buley (International Civil Aviation Organization, Montreal, Canada). *(International Congress of Aerospace Medicine, 18th, Amsterdam, Netherlands, Sept. 15-18, 1969.) Aerospace Medicine,* vol. 41, June 1970, p. 680-683. 5 refs.

Discussion of the use of a formula, based on significant, easily-quantifiable stress factors, for assigning rest periods on long-distance air travel to staff members of the International Civil Aviation Organization (ICAO). The qualitative and quantitative rationale of the formula is described and ICAO's experience with it, in terms of efficiency and wellbeing of traveling staff and of administrative acceptability, is reviewed. Other organizations which have shown an interest in applying it to their diverse needs are mentioned. G.R.

A70-31893 Lateralization of hearing loss and vestibular nystagmus in test pilots. A. Bruner (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.) and T. W. Norris (Lovelace Clinic, Albuquerque, N. Mex.). *Aerospace Medicine,* vol. 41, June 1970, p. 684-687. 10 refs. NIH Grant No. FR-05531-04.

Bekesy hearing thresholds, and spontaneous and caloric nystagmus were recorded in 53 healthy test pilots. Significant correlations were obtained between interaural differences in high frequency hearing thresholds and the extent to which caloric nystagmus beat more strongly in one direction than the other (Directional Preponderance, DP). The direction of spontaneous nystagmus, when present, and DP were toward the worse hearing ear for pilots exhibiting interaural threshold differences, in contrast to the more typical findings for 17 unilateral sensorineural loss patients whose DP was away from the worse hearing ear. Normal hearing patients showed no hearing-vestibular relations, while '31 acoustic trauma patients gave results similar to the pilots. The lateralization of hearing loss and DP among high frequency hearing loss subjects appears to be a central phenomenon and may represent a normal predisposition to asymmetry which may or may not be augmented by noise. (Author)

A70-31894 Radiation plotting guide to space mission planning and in-flight assessment. John E. Pickering (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aerospace Medicine,* vol. 41, June 1970, p. 688, 689.

Planners, mission directors, and program directors may benefit from a radiation nomogram as an aid to decision points and contingency planning. Such a plotter is intended to display general radiobiologic effects with respect to dose, time of onset, and shielding factors scaled to current space vehicles. It may find use concurrent with instrument readings and on-board crew assessment of their physical condition and status as a visualization of the radiation syndrome, thus precluding untimely or unwarranted decisions. (Author)

A70-31917 Study of the curves of flow for a fluid obeying the Casson's equation - Application to blood (Etude des courbes d'écoulement pour un fluide obéissant à l'équation de Casson - Application au sang). J. F. Stoltz, F. Streiff, and A. Larcan (Nancy, Université, Nancy, France). *Journal de Mécanique,* vol. 9, Mar. 1970, p. 155-164. 18 refs. In French. Research supported by the Direction des Recherches et Moyens d'Essais.

Study of the pressure-flow relation for a fluid in a cylindrical tube obeying the Casson's equation, with particular reference to human blood. Using a capillary viscometer, the results obtained for human blood are compared to theoretical curves. The results are in good agreement with the experiment. O.H.

A70-31919 Blood flowmeter using the Doppler effect with pulsed ultrasonic emission. A - Description of the Apparatus - Results (Vélocimètre sanguin par effet Doppler à émission ultra-sonore pulsée. A - Description de l'appareil - Résultats). P. Peronneau, J. Hinglais, M. Pellet (CNRS, Centre d'Etudes des Techniques Chirurgicales, Paris, France), and F. Léger (Compagnie Générale d'Electricité de Paris, Marcoussis, Essonne, France). *L'Onde Electrique,* vol. 50,

May 1970, p. 369-384. 32 refs. In French. Research supported by the Délégation Générale à la Recherche Scientifique et Technique.

Description and applications of a Doppler-effect ultrasonic flowmeter using a unique transducer which is alternately a transmitter and a receiver. It makes possible the exact definition of the level of zero velocity, identification of the direction of flow, and the choice, by a purely electronic process, of the measurement volume in a fluid vein (distance and width). It also makes it possible to draw mean velocity and instantaneous velocity profiles without interference with the flow, and to study velocity profile changes during the cardiac cycle. F.R.L.

A70-31920 Blood flowmeter using the Doppler effect with pulsed ultrasonic emission. B - Numerical treatment of velocity information (Vélocimètre sanguin par effet Doppler à émission ultra-sonore pulsée. B - Traitement numérique des informations de vitesse). P. Y. Schwartz (CNET, Issy-les-Moulineaux, Hauts-de-Seine, France). *L'Onde Electrique,* vol. 50, May 1970, p. 385-389. In French.

Discussion of the numerical treatment of velocity information obtained from the previously described Doppler-effect ultrasonic flowmeter developed by Peronneau et al. (1970). The treatment requires operations of a statistical character, and an interpretation of the form of the received signals. On account of the large number of measurements to be treated, the interpretation of results fully justifies the use of an automatic analysis system. F.R.L.

A70-31921 Phase shift ultrasonic flowmeter - Application to blood flow (Débitmètre ultrasonore à déphasage - Application au débit sanguin). J. P. Girard (CNRS, Institut de Génie Biologique et Médical, Nancy, France). *L'Onde Electrique,* vol. 50, May 1970, p. 390-394. 11 refs. In French.

Description of an ultrasonic flowmeter which, without switching, measures the difference of transit time of two waves of slightly different frequency which propagate in the opposite direction in the blood vessel. The transit time difference, proportional to the blood flow, is converted into a phase difference between two low frequency voltages. F.R.L.

A70-31922 Data system for measurement of cardiac volumes by fast biplane cineangiography (Système informatique pour la mesure des volumes cardiaques par cinéangiographie biplane rapide). Ph. Brun (Institut National de la Santé et de la Recherche Médicale, Gréteil, Val-de-Marne, France), E. Niay (Compagnie Générale de Radiologie, France), and R. Sigelle. *L'Onde Electrique,* vol. 50, May 1970, p. 395-399. 16 refs. In French.

Description of a system for obtaining a sampling rate in the neighborhood of 100 measurements/sec, a rate which is necessary to measure cardiac volumes. The system consists of three parts: data acquisition, data reduction, and information treatment. The system makes it possible to develop a research program centered on the study of the mechanical phenomena of cardiac activity in man. F.R.L.

A70-31923 Physiological examination of the healthy subject (Explorations physiologiques chez le sujet bien portant). J. C. Chignon, H. Stephan, J. Leclercq (Institut National des Sports, Paris, France), and K. Bretz (Institut National Hongrois du Sport, Budapest, Hungary). *L'Onde Electrique,* vol. 50, May 1970, p. 445-449. 10 refs. In French.

Discussion of the physiological examination of healthy subjects which, during work or athletic effort, is quite different from that practiced on an unhealthy subject. The repose situation cannot be considered as 'normal.' Transmission of data by telemetry is desirable, because it conforms more closely to real physiological situations. The physiological problems set by technical constraints can be more easily solved by introduction of new methods of communication between the subject and the physiologist. F.R.L.

A70-31924 Amplifiers for electrocardiology and electroencephalography (Amplificateurs pour l'électrocardiologie et l'électroencéphalographie). M. Sauvanet (SGS-France, S.A., Paris, France). *L'Onde Electrique,* vol. 50, May 1970, p. 468-474. In French.

Discussion of amplifiers for cardiology and encephalography, which must transmit very low frequencies while at the same time rejecting differential dc potentials from probe contact imbalance. One solution consists of using, prior to filtering, dc preamplifiers of small gain (less than 60). A more elaborate solution is also outlined, where a selective feedback and clamping circuits in the amplifier make a voltage gain of 1000 possible. F.R.L.

A70-31925 # Fundamental gas laws in aviational medicine (Osnovnye gazovye zakony v aviatsionnoi meditsine). L. D. Olovianishnikov. Moscow, Tsentral'nyi Institut Usovershenstvovaniia Vrachei, 1969. 56 p. 30 refs. In Russian.

The basic laws characterizing the gaseous state of matter are explained for the benefit of flight surgeons in order to facilitate a proper approach to the pathology arising from the effects of reduced inspired partial oxygen pressure and barometric pressure variations. A systematic account is given of the kinetic theory of gases, and the dependence of gas volume on pressure is outlined. Topics treated include the effects of temperature, the Gay-Lussac's law, gas mixtures, Dalton's law, gas diffusion, and solubility of gases in liquids. T.M.

A70-31934 Studies on mechanical impedance of the human skull - Preliminary report. E. S. Gurdjian, V. R. Hodgson, and L. M. Thomas (Wayne State University, Detroit, Mich.). *Journal of Biomechanics,* vol. 3, May 1970, p. 239-247. 10 refs.

The steady state vibration response of the human cadaver head across a frequency range including its first three modes of vibration has been studied. Important first and third modes were found near 300 Hz (antiresonance) and 900 Hz (resonance), respectively. Below 200 Hz the skull moved relatively as a rigid body. In the antiresonant mode, maximum mechanical impedance (force/velocity) was found to occur, with acceleration amplification on the occiput greater than frontal input acceleration by a factor of 3. In the resonance mode minimal mechanical impedance occurs in which only that part of the head adjacent to the driven point is moving under the action of a vibratory force. It is hypothesised that long duration impacts (t more than 0.005 sec) produce predominantly rigid body motion because the frequency spectrum of the pulse is too low to excite the lowest natural frequency of the skull. Consequently the driving force produces primarily acceleration of the head. Shorter duration pulses, particularly those with short rise time, have a broader frequency spectrum which can excite skull modes, thereby augmenting or modifying the skull flexure patterns produced by the force. It is not yet understood in what proportions these factors influence head injury, but impact head accelerations have been recorded opposite the blow for short duration impacts (t less than 0.004 sec) that do not correlate with rigid body acceleration (a = force/head wt.) sometimes being greater by a factor of 2. (Author)

A70-31935 Mechanical and morphological aspects of experimental overload and fatigue in bone. A. Chamay (Clinique Universitaire d'Orthopédie; Hôpital Cantonal, Geneva, Switzerland). *Journal of Biomechanics,* vol. 3, May 1970, p. 263-270. 25 refs.

The author reports the results of experiments in which long bone fatigue is produced in 30 pairs of dog ulnas by applying opposing forces at both extremities thereby causing a strain. On a force-deformation curve the force axis indicates a zone of load, an intermediate zone of fatigue and a zone of overload; the deformation axis shows an elastic zone and a plastic zone. These zones are defined in the text. The fatigue test in the load zone does not indicate either weakening of the bone or histological signs of fatigue. The fatigue test in the intermediate zone is accompanied by a progressive bone deformation, a diminution of resistance and microscopic lesions of fatigue. The fatigue test in the load zone with brief applications of

overload produces the same histological lesions. These lesions, which are slip lines and microfissures striating the compressed cortex, are the cause of progressive bone weakness and of stress fractures. (Author)

A70-31936 Flow through a converging-diverging tube and its implications in occlusive vascular disease. I - Theoretical development. John H. Forrester (Tennessee, University, Knoxville, Tenn.) and Donald F. Young (Iowa State University of Science and Technology, Ames, Iowa). *Journal of Biomechanics,* vol. 3, May 1970, p. 297-305. 13 refs. Research supported by the Iowa State University of Science and Technology.

Approximate solution for flow through a converging-diverging tube using a mathematical model for a mild stenosis. Velocity profiles, pressures, and wall shearing stresses along the tube are determined from this solution. The critical Reynolds number required for separation, and the extent of the separated region are also determined. Z.W.

A70-31937 Flow through a converging-diverging tube and its implications in occlusive vascular disease. II - Theoretical and experimental results and their implications. John H. Forrester (Tennessee, University, Knoxville, Tenn.) and Donald F. Young (Iowa State University of Science and Technology, Ames, Iowa). *Journal of Biomechanics,* vol. 3, May 1970, p. 307-316. 12 refs. Research supported by the Iowa State University of Science and Technology.

Experimental study of the flow characteristics through a converging-diverging plastic tube for determining the separation and reattachment points, and the pressure drop across the entire stenosis. Water and blood were used in the experiment. Data were obtained for these fluids for Reynolds numbers up to approximately 1000. The experimental results obtained for the water and blood did not differ greatly, but in general only fair agreement was found between the experimental and theoretical results. Some speculations are made on the implications of this flow in occlusive vascular disease. Z.W.

A70-31938 Wave propagation through a Newtonian fluid contained within a thick-walled viscoelastic tube - The influence of wall compressibility. Robert H. Cox (Pennsylvania, University, Philadelphia, Pa.). *Journal of Biomechanics,* vol. 3, May 1970, p. 317-335. 21 refs. PHS Grant No. HE-07762; Contract No. Nonr-551(54).

A previously developed model of wave propagation in a thick-walled incompressible tube is extended to include wall compressibility. The motion of the fluid is assumed to be described by the linearized form of the Navier-Stokes equations. The motion of the wall is described by the equations of classical elasticity theory. The frequency variation of the modulus of rigidity is described by a three parameter relaxation-type model. The Poisson ratio is assumed to be a real parameter. The solutions of the equations of motion are restricted to axisymmetric, long waves. Boundary conditions are used describing the continuity of stress and velocity components in the fluid and the tube. From these boundary conditions, a set of six simultaneous equations in six unknown constants has been obtained. This set of equations has been solved numerically using a digital computer and the propagation constant and hydraulic fluid impedance determined as a function of frequency and system parameters. For constant values of the modulus of rigidity, a decrease in the Poisson ratio causes an increase in the hydraulic fluid impedance, the fluid resistance and the fluid inductance. A decrease in the Poisson ratio decreases the phase velocity of the two roots of the frequency equation. A decrease in the Poisson ratio decreases the transmission per wavelength of the first root but increases that of the second root. The effect of wall compressibility on propagation characteristics is as important as that of the wall viscoelasticity, but the influence of the former on fluid impedance is much greater than that of the latter. (Author)

A70-31939 Comparative study of arterial transmission velocity. George S. Malindzak, Jr. (Wake Forest University, Winston-Salem; North Carolina Heart Association, Raleigh, N.C.) and Jesse H. Meredith (Wake Forest University, Winston-Salem, N.C.). *Journal of Biomechanics,* vol. 3, May 1970, p. 337-350. 22 refs. Research supported by the North Carolina Heart Association and the Forsyth County Heart Association; NIH Grants No. FR-147; No. HE-8663.

For the purpose of determining the arterial transmission velocity experiments were performed on anesthetized mongrel dogs by recording arterial pressure measured simultaneously at two positions along the axis of the abdominal aorta. Four independent methods: pulse wave velocity (PWV), apparent phase velocity (APV), 'true' phase velocity (TPV), and correlation propagation velocity (CPV) were used for comparison and for the future purpose of providing a reliable index with which to relate and to compare changes of elastic constants of the arterial wall with arterial disease. Of these four velocity determinations, the PWV proved to be the least reliable. The relationship between the APV and TPV suggests the experimental differences may be related to arterial reflections. On the other hand, the CPV, as measured by the cross correlation technique, was less subject to beat-to-beat variations than was the PWV, in actual determination; although the CPV is a much easier method and a more consistent measure of the arterial pressure pulse transmission velocity. In these studies, the apparent terminal vascular impedance of the arterial transmission line appears to match the apparent characteristic impedance of the large arteries. (Author)

A70-31940 Errors in the measurement of hydraulic input impedance. Nicolaas Westerhof and Abraham Noordergraaf (Pennsylvania, University, Philadelphia, Pa.). *Journal of Biomechanics,* vol. 3, May 1970, p. 351-356. 14 refs. PHS Grant No. HE-10330-03.

It is shown that significant errors may be made in obtaining the input impedance of an arterial bed when pressure and flow are not measured at the same site. These errors manifest themselves mainly in the phase of the input impedance. The sign of the phase errors depends on whether flow is measured proximal or distal to pressure. The deviation in the absolute value is generally in the same direction for both cases. If the apparent wave velocity in the region between the pressure and flow transducers as well as their distance are measured, the phase error can be corrected easily. By means of a model of the systemic arterial tree the errors in the input impedance of the systemic arterial tree are quantified. At 10 Hz these errors may be in the order of 30 deg in the phase of the input impedance. The effect of applying the correction for phase is illustrated. The correction procedure used here can be successfully applied to avoid this difficulty in the future. This correction resolves most of the differences in the phase of the input impedance as reported by various investigators. (Author)

A70-31941 Arterial viscoelasticity: A generalized model - Effect on input impedance and wave travel in the systematic tree. Nicolaas Westerhof and Abraham Noordergraaf (Pennsylvania, University, Philadelphia, Pa.). *Journal of Biomechanics,* vol. 3, May 1970, p. 357-379. 46 refs. PHS Grant No. HE 10330-03.

In the first part of this paper most of the reported results concerning measurements of the viscoelastic properties of the systemic arterial wall are discussed. The various mechanical models of the vessel wall that have been proposed and which usually account for a special aspect of viscoelastic properties are reviewed critically. From these discussions a new mathematical model for the wall properties emerges. It accounts in quantitative terms for the frequency dependence of the Young modulus, stress-relaxation, creep, and hysteresis. Hence this new description, which is in terms of the complex Young modulus, covers all the known aspects of the viscoelastic wall properties. In the second part of this paper the complex Young modulus is incorporated in a model of the systematic arterial tree for the purpose of studying the effect of the viscous properties of the wall. Wave travel and input impedances are given for the case of a purely elastic wall and for the case of a

realistic viscoelastic wall; the differences are compared. Addition of the viscous wall properties proves to have a significant effect on input impedance and wave travel. (Author)

A70-32000 * **Ammonia incorporation in Hydrogenomonas eutropha.** A. A. Joseph and Robert L. Wixom (Missouri, University, Columbia, Mo.). *Biochimica et Biophysica Acta,* vol. 201, 1970, p. 295-299. 24 refs. Research supported by the University of Missouri; Grant No. NGR-26-003-023.

Exploration of the enzyme responsible for ammonia incorporation in the chemolithotroph, Hydrogenomonas eutropha. During the investigation, glutamate dehydrogenase (NADP-specific) activity was found in cell-free extracts. The optimal pH for this activity was pH 8.0 in phosphate buffer. The reduction of NADP(+) in the assay was specific with L-glutamate. Thus, NADP-specific, L-glutamate dehydrogenase is the main known enzyme responsible for ammonia incorporation into amino acids of Hydrogenomonas eutropha. M.V.E.

A70-32014 # **Spectral dependence of retinal damage produced by intense light sources.** M. A. Mainster, T. J. White, and R. G. Allen (Technology, Inc., San Antonio, Tex.). *Optical Society of America, Journal,* vol. 60, June 1970, p. 848-855. 6 refs. DASA-supported research; Contract No. AF 41(609)-68-C-0023.

Retinal-temperature increases produced by circularly symmetric exposures to electromagnetic radiation between 400 and 1200 nm were calculated for a wide range of image sizes. Temporal, axial, and radial temperature distributions are described. Constant and exponentially decreasing source strengths are considered. Solutions of the heat-conduction equation are expressed in terms of both retinal irradiance and the total power entering the eye. Application of solutions to the prediction of thresholds for retinal damage is discussed, and excellent agreement is noted between theoretical predictions and experimental observations of the spectral dependence of chorioretinal damage thresholds. (Author)

A70-32015 **Objective method of measuring the relative spectral-luminosity curve in man.** D. Regan (Keele, University, Keele, Staffs., England). *Optical Society of America, Journal,* vol. 60, June 1970, p. 856-859. 11 refs. Research supported by the Medical Research Council.

Steady-state evoked potentials were recorded from the human scalp and subjected to Fourier analysis during the psychophysical procedure of heterochromatic flicker photometry. The amplitudes of harmonic components whose frequencies fell in the range of 45-55 cps showed a clear minimum. This minimum coincided with the point of minimum subjective flicker. This agreement did not generally hold either for harmonic components in the range of 13-22 cps nor for the peak-to-peak amplitude of the averaged evoked potential. Relative spectral-sensitivity curves derived both from psychophysical and evoked-potential data agreed within 0.07 log units (18%). The objective method described is considerably more precise, and is less affected by evoked-potential variability, than previous methods that used evoked-potential amplitude to measure spectral sensitivity. A complete spectral-sensitivity curve can be obtained in two sessions of 2.5 hr each, and the procedure could probably be shortened significantly. (Author)

A70-32016 **Flicker sensitivity and apparent brightness as a function of surround luminance.** Lewis O. Harvey, Jr. (MIT, Cambridge, Mass.). *Optical Society of America, Journal,* vol. 60, June 1970, p. 860-864. 24 refs.

Both brightness matching and sensitivity to sinusoidal flicker were measured for different contrasts using a 30 min test field surrounded by a 6 deg annulus. Test fields that produced 10,000-, 3000-, 1000-, 300-, 100-, and 30-td retinal illuminance were used. Matched brightness of the test field remained constant as surround luminance was increased from zero, then fell rapidly when the luminance of the surround was one tenth that of the test field. Flicker sensitivity followed a different function: It began to increase when the surround had one hundredth the luminance of the test field, reached a peak at one third, and then fell rapidly. The sensitivity enhancement was independent of flicker frequency. The results are attributed to spatial interactions in the visual system. (Author)

A70-32211 # **Physiological and psychological deficiencies of the airline flight attendant induced by the employment environment.** Dwight Dedmon (Air Line Stewards and Stewardesses Association, Chicago, Ill.). In: Flight Safety Foundation, Annual International Air Safety Seminar, 22nd, Montreux, Switzerland, October 27-31, 1969, Proceedings. (A70-32206 15-02) Arlington, Va., Flight Safety Foundation, Inc., 1969. 20 p. 10 refs.

Discussion of fatigue and other effects of aircraft environment on the physical and mental state of airline flight attendants, noting a lack of general recognition of this problem. The various factors contributing to fatigue during systematic prolonged cruises, especially in women, are identified. Suggestions are made to remedy their effects. V.Z.

A70-32226 # **The operational aspects.** G. H. Dhenin (RAF, London, England). In: Flight Safety Foundation, Annual International Air Safety Seminar, 22nd, Montreux, Switzerland, October 27-31, 1969, Proceedings. (A70-32206 15-02) Arlington, Va., Flight Safety Foundation, Inc., 1969. 3 p.

Discussion of accident prevention by identifying and removing factors or situations likely to reduce attention of the pilot. The fatigue inducers and high level of awareness needed from the pilot are examined. The retrograde steps in the operation of civil aircraft including the progressive reduction of the crew and assumption by the pilots of more and more of the navigation, communication, and mechanical duties, are pointed out. The need for a combined approach to air safety problems from the side of designers, operators, psychologists, and physiologists is stressed. Z.W.

A70-32227 # **Application of lessons learned in the space program to air transport safety.** Toby Freedman (North American Rockwell Corp., Aerospace and Systems Group, El Segundo, Calif.). In: Flight Safety Foundation, Annual International Air Safety Seminar, 22nd, Montreux, Switzerland, October 27-31, 1969, Proceedings. (A70-32206 15-02) Arlington, Va., Flight Safety Foundation, Inc., 1969. 15 p.

Survey of the contributions obtained from the scientific and technological achievements of space programs to the air transport safety. Topics discussed include (1) new approach to the accident investigation, (2) development of a special air transport safety system similar to that used in the space programs, (3) use of new advanced technology in materials and their application to aircraft design, and (4) new concepts for an emergency evacuation of transport aircraft following survivable accidents. Z.W.

A70-32228 # **Human factors in airline incidents.** G. C. Wansbeek (KLM - Royal Dutch Airlines, Schiphol Airport, Netherlands). In: Flight Safety Foundation, Annual International Air Safety Seminar, 22nd, Montreux, Switzerland, October 27-31, 1969, Proceedings. (A70-32206 15-02) Arlington, Va., Flight Safety Foundation, Inc., 1969. 4 p.

Analysis of the 110 cases of aircraft accidents taking into consideration the involvement of human factors. It is found that from 110 cases investigated in 13 years, 42 contained criticism on one or more members of the cockpit crew. As two major factors contributing to aircraft accidents, overconfidence and insufficient care are pointed out. Z.W.

A70-32308 # **The mechanical properties of the diploë layer in the human skull.** J. W. Melvin, P. M. Fuller, and I. T. Barodawala (Michigan, University, Ann Arbor, Mich.). *Society for Experimental Stress Analysis, Spring Meeting, Huntsville, Ala., May 19-22, 1970,*

Paper. 28 p. NIH Contract No. PH-43-67-1136.

The shear and compressive properties of the porous diploë layer of human skull bone have been measured at static and dynamic strain rates. The properties are shown to be highly dependent on the structure of the diploë layer and similar failure modes in shear and compression suggest a relationship between shear and compressive strengths. (Author)

A70-32311 # **Measurements of mass diffusivity of gases in plasma and reaction velocity constant in bloods.** M. Nomura, Wen-Jei Yang (Michigan, University, Ann Arbor, Mich.), I. Tanasawa, R. Echigo, and D. R. Wotton. *Society for Experimental Stress Analysis, Spring Meeting, Huntsville, Ala., May 19-22, 1970, Paper.* 25 p. 17 refs. NIH Grant No. I ROI HE-12708.

A method is developed to determine the mass diffusivity of gases in plasma and the reaction velocity constant with hemoglobin in intact red cell suspensions in human and dog blood. Oxygen, nitrogen and carbon dioxide are used. A small gas bubble is injected into a flask containing plasma or blood degased by the use of a vacuum pump. The instantaneous bubble size is measured at certain time intervals until the bubble is completely dissolved in the liquid. Both the mass diffusivity and the reaction velocity constant are calculated from the solution of the mass transfer equation for the diffusion of a gas from a bubble into a liquid, using the initial size and measured life time of the bubble as input data or the slope of the radius-time curves during the moment immediately following injection. Results are compared and agree well with some existing values. (Author)

A70-32312 # **Experimental study of air bubbles in a simulated cardiopulmonary bypass system with flow constriction.** Wen-Jei Yang (Michigan, University, Ann Arbor, Mich.), I. Tanasawa, D. R. Wotton, and D. W. Clark. *Society for Experimental Stress Analysis, Spring Meeting, Huntsville, Ala., May 19-22, 1970, Paper.* 20 p. Research supported by the Michigan Heart Association and NIH.

An experimental study is performed to examine the breaking of an air bubble in the flow passage of a simulated cardiopulmonary bypass system by means of a flow constriction. The purpose of the study is to discover a geometry of the flow constriction which is efficient in breaking air bubbles while providing the least resistance of the flow of blood, i.e., to develop a new device for the oxygenation of the blood in extracorporeal circulation. Both plasma and water are used in the study. The use of plasma is to simulate the principal transport properties of the human blood and enable direct visualization of bubbles. Water is used for comparison with plasma to determine the influence of fluid properties on the breaking of bubbles. Several different shapes of flow constriction are tested. It is observed that as a result of rapid changes in the liquid pressure and bubble shape, an air bubble breaks into many bubbles at downstream from the flow constriction. The results are quantatively expressed by the number of baby bubbles versus the flow rate. It is disclosed that the flask-shape constriction is efficient in breaking air bubbles while providing ideal passage for the flow of blood. The number of baby bubbles is found to increase with an increase in the fluid viscosity. (Author)

A70-32327 # **Load actions on the human femur in walking, and some resultant stresses.** John P. Paul (Strathclyde, University, Glasgow, Scotland). *Society for Experimental Stress Analysis, Spring Meeting, Huntsville, Ala., May 19-22, 1970, Paper.* 24 p. 20 refs.

From experimental measurements of ground to foot force actions and limb configurations, resultant load actions at junctions of leg segments can be calculated. From a knowledge of the phasic activity of muscles and their anatomical location, the tension in relevant muscles and ligaments may be inferred, and the joint forces obtained. From the measured geometry of the femur, calculations are made of the stresses on the basis of simplifying assumptions of material disposition and behavior. (Author)

A70-32328 # **A semiexperimental method of stress analysis for the human intervertebral disc.** Lars Sonnerup (Chalmers Tekniska Högskola, Göteborg, Sweden). *Society for Experimental Stress Analysis, Spring Meeting, Huntsville, Ala., May 19-22, 1970, Paper.* 17 p. 5 refs.

The intervertebral disk is a heavily loaded component of the human body. In the lumbar region, in vivo measurements by Nachemson (1966, 1970) show compressive loads in the range of 1000-3000 Newton under normal living conditions. Analysis of stress in intervertebral disks is thus a relevant biomechanical problem that has been studied experimentally and from a clinical point of view by Nachemson (1960, 1963, 1966, 1970). Galante (1967) investigated tensile properties of the lumbar annulus fibrosus. Nachemson found the state of stress in the nucleus pulposus to be hydrostatic, and Galante's investigation revealed a considerable inhomogeneity of the material in the annulus fibrosus. In this paper the effect of material inhomogeneity on the distribution of tangential and radial stress through annulus fibrosus is studied theoretically on the basis of previous experimental findings and a complementary experimental investigation of the lateral pressure distribution through the disk. The results of the theoretical analysis show that inhomogeneity influences the distribution of tangential stress considerably, whereas only heavy lateral pressure gradients disturb this same stress distribution to any significant extent. (Author)

A70-32454 **Eye movements affect the perception of apparent (beta) movement.** James R. Pomerantz (Bell Telephone Laboratories, Inc., Holmdel, N.J.). *Psychonomic Science,* vol. 19, May 25, 1970, p. 193, 194. 10 refs.

Test of the hypothesis that eye movements determine the type of movement seen with a display in which the apparent direction of illusory movement is ambiguous. When subjects viewed a display of this kind, they saw movement most often in the direction in which they were instructed to move their eyes. After altering the display in an attempt to reduce its ambiguity, directional eye movements still proved decisive in determining perceived direction. It was concluded that, although eye movements are not necessary for the perception of this movement illusion, they can affect its appearance substantially. M.V.E.

A70-32455 **The effect of different psychophysical methods on visual orientation during tilt.** N. J. Wade (Monash University, Clayton, Victoria, Australia). *Psychonomic Science,* vol. 19, May 25, 1970, p. 201-203. 14 refs.

The visual vertical with 30 deg right head tilt was determined by three psychophysical procedures: the methods of adjustment with and without bracketing and a modified up-and-down (staircase) method. The visual vertical was on the opposite side of the gravitational vertical to tilt (E-effect) under all conditions. However, the E-effect measured by the up-and-down method was significantly larger than the combined average of the two methods of adjustment. The methods of adjustment with and without bracketing yielded approximately the same means for the visual vertical when averaged over starting positions, but differed significantly in the linear trends taken over starting positions. A greater error of anticipation resulted when bracketing was not allowed. (Author)

A70-32456 **Eye movements and perceptual error - A developmental study.** Evans Mandes (Virginia, University, Fairfax, Va.). *Psychonomic Science,* vol. 19, May 25, 1970, p. 237-239. 11 refs. NIH-supported research.

This study is concerned with the direction of eye movements during the occurrence of perceptual error. The hypothesis is that there is a positive relationship between eye-movement directionality and location of a stimulus in a particular field, and that this relationship holds for children and adults. One test of this hypothesis is that perceptual errors are associated partially with errors in eye movements themselves. Postexposural eye movements were studied in a sample of 24 7-year-old children and 36 adults. The stimuli

comprised families of geometric figures; members of a family differed from each other only on one side (distinguishing feature). These figures were presented tachistoscopically in four orientations, the distinguishing feature appearing randomly at the top, bottom, left, and right of the figure. Multiple-choice arrays were presented in four orientations. The results are consistent with the proposal that errors in the perception of the distinguishing feature are associated with initial eye movements to the opposite field of the distinguishing feature. (Author)

A70-32471 Total excitation of the isolated human heart. Dirk Durrer, R. Th. van Dam, G. E. Freud, M. J. Janse, F. L. Meijler, and R. C. Arzbaecher (Amsterdam, University, Amsterdam, Netherlands). *Circulation,* vol. 41, June 1970, p. 899-912. 23 refs. Research supported by the Nederlandse Organisatie voor Zuiver Wetenschappelijk Onderzoek.

Studies performed on seven isolated human hearts for the purpose of obtaining information concerning the time course and instantaneous distribution of the excitatory process of the normal human heart. These hearts were taken from seven individuals who died from various cerebral conditions, but who had no history of cardiac disease. Measurements were made from as many as 870 intramural terminals. In the isolated human hearts, three endocardial areas were synchronously excited 0 to 5 msec after the start of the left ventricular activity potential. These areas increased rapidly in size during the next 5 to 10 msec and became confluent in 15 to 20 msec. The epicardial excitation pattern reflected the movements of the intramural excitation wave. Conduction velocity was determined in one heart by an appropriate stimulation technic. Atrial excitation, explored in two hearts, spread more or less according to concentric isochronic lines. Control studies, carried out on five canine hearts, disclosed that the pattern of ventricular excitation did not change after isolation and perfusion. However, total excitation was completed earlier in the isolated heart, and conduction velocity increased. Mapping illustrations are presented. M.V.E.

A70-32531 Liver function and blood flow at high altitude. K. Ramsøe, S. Jarnum, R. Preisig, J. Tauber, N. Tygstrup, and H. Westergaard (University Hospital, Copenhagen, Denmark; University Hospital, Berne, Switzerland). *Journal of Applied Physiology,* vol. 28, June 1970, p. 725-727. 21 refs. Research supported by the Danish State Research Foundation and the Swiss National Foundation.

Bromsulfophthalein transport maximum and storage capacity, galactose elimination capacity, and galactose clearance were determined in nine subjects at sea level and during a week's stay at high altitude (3,450 m). Bromsulfophthalein transport maximum and storage capacity and galactose elimination capacity were unchanged, whereas the galactose blood clearance rose significantly from 1,400 to 1,900 ml/min. This indicates that the functional capacity of the liver is not affected by hypoxemia of this degree and duration and that the hepatic blood flow is increased. (Author)

A70-32532 Degradation of albumin and IgG at high altitude. H. Westergaard, S. Jarnum, R. Preisig, K. Ramsøe, J. Tauber, and N. Tygstrup (University Hospital, Copenhagen, Denmark; University Hospital, Berne, Switzerland). *Journal of Applied Physiology,* vol. 28, June 1970, p. 728-732. 26 refs. Research supported by the Danish State Research Foundation and the Swiss National Foundation.

Study of the albumin and IgG degradation made in seven healthy subjects at sea level and at an altitude of 3,450 m to evaluate the effect of high altitude exposure on the hepatic function in normal man. The experimental procedure is described, and the results are tabulated and displayed graphically. The results indicate that the hematocrit rose, the plasma volume decreased, and the serum concentrations of albumin and IgG remained unchanged during the stay at high altitude. Albumin degradation was unchanged. A shift of albumin from intravascular to extravascular compartments took place. IgG degradation, however, rose significantly (by 19%) at high altitude; this effect is unexplained. O.H.

A70-32533 Effects of hypoxia and acetazolamide on color sensitivity zones in the visual field. John L. Kobrick (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Journal of Applied Physiology,* vol. 28, June 1970, p. 741-747. 28 refs.

Effects of exposure to a series of hypoxic atmospheres (0, 13,000, 15,000, 17,000 ft equivalent elevations) on the size and shape of visual fields for red, green, and blue stimulus detection were studied. Twenty-four human subjects were tested, half of whom received acetazolamide and the other half equivalent placebo tablets. Complete monocular field plots were obtained by conventional perimetry techniques for each eye at each elevation for each color at luminances of both 9.3 and 0.72 ft-L, and for exposure durations of 0.5 and 3.5 hr. Significant effects were shown for hypoxia levels, exposure duration, and stimulus luminance; furthermore, acetazolamide reduced hypoxic decrements generated in the placebo group. In general, constrictions in visual field size were directly related to hypoxic severity and exposure duration, particularly at lower stimulus luminance. Relative sensitivity losses correctly followed predictions based on the Purkinje law of color luminance detectability, in that red sensitivity was earliest and most severely affected under hypoxia. (Author)

A70-32534 Renal responses to various rates of exercise. William A. Kachadorian and Robert E. Johnson (Illinois, University, Urbana, Ill.). *Journal of Applied Physiology,* vol. 28, June 1970, p. 748-752. 25 refs.

Measurements were made of endogenous creatinine clearance, urine volume, and the excretion of solutes, acid, formed elements, and protein in five healthy men who ran on two different occasions for 1 hr on a horizontal motor-driven treadmill at speeds of 8.0 and 10.5 km/hr and walked once at 5.6 km/hr. Changes from rest values for creatinine clearance and urinary volume were positive during the mildest exercise and thereafter proportionately negative with increasing exercise intensity. With respect to rest, urinary acidity decreased during the mildest exercise and thereafter increased. Changes in urine osmolarity from rest tended to be maximal at 8.0 km/hr, whereas changes in free-water clearance were minimal at the same rate of exercise. We conclude that several aspects of renal function may be affected differentially by exercise, mild exercise sometimes increasing a function, severe exercise decreasing it. Studies involving renal function should take these effects into account. (Author)

A70-32535 Elicitation of heart rate and blood pressure increase on muscle contraction. Ulla Freyschuss (Karolinska Sjukhuset, Stockholm, Sweden). *Journal of Applied Physiology,* vol. 28, June 1970, p. 758-761. 18 refs. Research supported by the Förenade Liv Insurance Co.

Study of the parasympathetic and sympathetic nervous outflows adjusting the initial cardiovascular response to muscular contraction in healthy individuals. In 10 healthy males the cardiovascular effects accompanying voluntary, isometric muscle contractions were studied before and after an intravenous injection of atropine or phentolamine and after a dose of both drugs. Heart rate, aortic and right atrial pressures, developed muscular tension, myopotentials, and respiratory movements were recorded. Muscle activation elicited increments of heart rate and aortic pressures. Atropinization inhibited the heart rate acceleration whereas a pressure rise was maintained. After phentolamine the heart rate increase was unchanged but the pressure elevation was diminished. The combined dose markedly reduced the heat rate blood pressure response. It is concluded that the heart rate increase during a voluntary muscle contraction was initiated by a release from vagal tone. The pressure rise can be ascribed both to a heart rate acceleration and to an effect on the systemic vascular resistance mediated by the sympathetic

nervous system. The instantaneous onset of the circulatory response seems to preclude a humoral mechanism. Changes in intrathoraic and right atrial pressures were not a prerequisite of the cardiovascular effects. O.H.

A70-32536 Effect of prolonged centrifugation on tissue carbohydrate in fasted rats. M. H. Harrison (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Journal of Applied Physiology,* vol. 28, June 1970, p. 771-774. 13 refs.

The exposure of starved female rats to 4-G radial acceleration for 0.25-4 hr has resulted in increases in blood glucose, and decreases in muscle glycogen levels. An initial small depletion of liver glycogen stores was followed by a considerably greater deposition. Coincidence of peak responses suggests a common control system. However, it appears that epinephrine alone will not satisfactorily explain the observations made and therefore the classical interpretation of the carbohydrate response to stress may represent an oversimplification of the control system involved. The contribution of rotation alone to the tissue carbohydrate response to 4-G radial acceleration has been examined. It is concluded that the glucose and glycogen changes observed cannot be attributed entirely to the G load. (Author)

A70-32537 Simultaneous measurement of plasma volume and cell mass in polycythemia of high altitude. Celestino Sánchez, César Merino, and Manuel Figallo (Universidad Peruana, Lima, Peru). *Journal of Applied Physiology,* vol. 28, June 1970, p. 775-778. 15 refs. NIH Grant No. RG-8576.

Investigation of the values of plasma and red cell volumes estimated by the direct and simultaneous method in a group of natives living at high altitude. In 13 healthy natives permanently living at an altitude of 4,330 m above sea level, a simultaneous measurement of the red cell and plasma volumes was performed using the 51Cr and the Evans' blue dye techniques, respectively. A mean value of 51.7 plus or minus 16.63 ml/kg body weight for the red cell volume, and a mean value of 33.4 plus or minus 9.44 ml/kg body weight for plasma volume were found. The fall in plasma volume in the majority of cases had an inverse relationship with the hematocrit value, resembling the polycythemia seen in congenital heart disease. O.H.

A70-32538 Ventilation and arterial blood gas changes induced by pursed lips breathing. Robert E. Mueller, Thomas L. Petty, and Giles F. Filley (Colorado, University, Denver, Colo.). *Journal of Applied Physiology,* vol. 28, June 1970, p. 784-789. 13 refs. Research supported by the U.S. Department of Health, Education, and Welfare and PHS; NIH Grant No. FR-00404-01; Contract No. DA-49-193-MD-2227.

Study of the effects of pursed lips breathing (PLB) on ventilation and blood gas exchange during rest and exercise in patients with a chronic airway obstruction. Ventilation and gas exchange changes induced by PLB were determined during rest and exercise in 12 subjects with a chronic airway obstruction. Seven claimed symptom relief from PLB; five denied relief. The use of a specially designed face mask permitted the subjects to expire through pursed lips in their customary manner. Symptom relief was related to physiologic changes induced by PLB by comparing results in subjects deriving symptom benefit from PLB with those who denied relief. The results are tabulated and discussed. It is concluded that PLB is a more effective pattern of respiration, but that it probably does not decrease the work of breathing. The source of symptom benefit from PLB may relate to decreased airway collapse with the resultant enlarged tidal ventilation volume and slowed respiration rate. O.H.

A70-32539 Ventilatory responses of awake normal goats during acute and chronic hypoxia. Allan H. Mines and Søren C. Sørensen (California, University, San Francisco, Calif.). *Journal of Applied Physiology,* vol. 28, June 1970, p. 826-831. 13 refs. NIH Grants No. GM-09262; No. HE-06285.

Study of the ventilatory response to CO2 in normal goats during acute (1 hr), subacute (5-6 hr), and chronic (55 days) hypoxia. Ventilatory responses were measured in seven normal goats to acute hypoxia and acute hyperoxia. Then hyperoxic responses were measured on two of these goats during 5-6 hr of hypoxia, and later during 55 days of altitude exposure (3,800 m). The CO2 response curves obtained in these measurements which characterize the normal goat's ventilatory regulation during acute and chronic hypoxia, are plotted graphically and discussed. O.H.

A70-32548 * Transient color sensitivity of the Hill reaction during the disintegration of chloroplasts. G. Harnischfeger and H. Gaffron (Florida State University, Tallahassee, Fla.). *Planta,* vol. 89, 1969, p. 385-388. Grant No. NGR-10-004-018.

Systematic investigation of the saturation rate for the Hill reaction in red and blue light. During the disintegration of isolated chloroplasts, the declining capacity for evolving oxygen in the light becomes temporarily color sensitive. The decline of Hill reaction rates follows a different time course if measured in either blue (from 380 to 500 nm) or red light (greater than 600 nm). Later, when only one-third or less of the original maximal capacity of the particular preparation is left, the rates of oxygen evolution in red or blue light become the same again. (Author)

A70-32568 Nonlinearities in human postural control system. Gyan C. Agarwal (Illinois, University, Chicago, Ill.) and Gerald L. Gottlieb (Presbyterian-St. Lukes Hospital, Chicago, Ill.). In: Institute of Electrical and Electronics Engineers, Annual Southwestern Conference and Exhibition, 22nd, Dallas, Tex., April 22-24, 1970, Technical Papers. (A70-32551 15-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 142-146. 7 refs.

The dynamics of the postural control system is examined using a gross mechanical disturbance, a tendon jerk input, and by an electrically evoked reflex. A strong influence of the initial conditions on the response of the system is observed in all three cases. Most of the input-output relations are inherently nonlinear in nature. (Author)

A70-32570 Nystagmus computation by analog technics. F. A. Brogan (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). In: Institute of Electrical and Electronics Engineers, Annual Southwestern Conference and Exhibition, 22nd, Dallas, Tex., April 22-24, 1970, Technical Papers. (A70-32551 15-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 152-156. 8 refs.

A complete system is described for on-line reduction of nystagmic data during vestibular bithermal caloric testing. The total eye movement in one direction for each 5-second interval is plotted in degrees by an X-Y recorder. A different symbol is used for each test condition. The operator does not have to be familiar with the computer system once it is set up since all controls to the computer are automatic. Control room operation is limited to adjustment of the gain of the raw data recorder for a calibrated eye movement and the changing of symbols on the X-Y point print plotter after each stimulation. A standard analog computer can be used for processing the data, or a special computer may be constructed. (Author)

A70-32571 Foundations of bilinear compartmented physiological systems. W. D. Smith and R. R. Mohler (Oklahoma, University, Norman, Okla.). In: Institute of Electrical and Electronics Engineers, Annual Southwestern Conference and Exhibition, 22nd, Dallas, Tex., April 22-24, 1970, Technical Papers. (A70-32551 15-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 157-160. 21 refs. NSF Grant No. GK-17866.

Compartmentation in the study of physiological systems is reviewed and compared with other modeling techniques. Then, characteristics of an ideal compartmented system are examined. Specifically, the general biological property of homeostasis is related to this

system, and mathematical and physiological conditions and approximations necessary to modeling with this system are presented. Also, past theoretical analysis of compartmented systems, including tracer methods, is discussed. Compartmented physiological systems which can be modeled as bilinear control systems are then studied. Restrictions imposed by these bilinear models on the nature of allowable transport, storage, and control mechanisms are considered, and specific physiological processes are shown to satisfy these restrictions. Also, bilinear approximations to nonlinear processes are discussed along with examples of known bilinear compartmented physiological systems. (Author)

A70-32629 The human element in system development. Alan D. Swain (Sandia Laboratories, Albuquerque, N. Mex.). In: Institute of Electrical and Electronics Engineers, Annual Symposium on Reliability, Los Angeles, Calif., February 3-5, 1970, Proceedings. (A70-32626 15-15) Symposium co-sponsored by the Institute of Environmental Sciences, the American Society for Nondestructive Testing, and the American Society for Quality Control. New York, Institute of Electrical and Electronics Engineers, Inc. (Annals of Assurance Sciences. Volume 3, No. 1), 1970, p. 20-28. 18 refs. AEC-supported research.

Description of the program and procedures indicating the type of approach necessary to fully consider the human element in system development. It is shown that appropriate consideration of the human element in all stages of system development is necessary to achieve optimum tradeoffs among system reliability, cost, and other system criteria. Formal planning for this consideration can reduce the tendency to allocate system functions to automatic equipment when a more effective allocation would make greater use of manual means. Formal consideration of the human element includes the application of human factors technology to increase human reliability in a system. Where possible, human reliability analyses should be performed to obtain estimates of human error rates for inclusion in system reliability studies and to evaluate recommended design changes. O.H.

A70-32636 Man as a part of the design environment. J. W. Christopher (Chrysler Corp., Space Div., New Orleans, La.). In: Institute of Electrical and Electronics Engineers, Annual Symposium on Reliability, Los Angeles, Calif., February 3-5, 1970, Proceedings. (A70-32626 15-15) Symposium co-sponsored by the Institute of Environmental Sciences, the American Society for Nondestructive Testing, and the American Society for Quality Control. New York, Institute of Electrical and Electronics Engineers, Inc. (Annals of Assurance Sciences. Volume 3, No. 1), 1970, p. 114-119.

Discussion of the concept of including workmen as one of the environmental variables that must be considered in any design. It is shown that in designing space systems hardware not only traditional environmental criteria, consisting of a set of constraints under which a design must not only survive but function with an acceptable degree of reliability, but also the man environment must be taken into account. The design is not complete unless the designer assumes responsibility for the survival of his product as it interfaces with workmen during fabrication, assembly, test and use. A design which fails to survive predictable encounters with men is just as unsatisfactory as the design which fails under predicted traditional criteria. The man is therefore a valid design environment. Reports, analyses and corrective actions should therefore be humanized. In order to humanize workman-problem-reporting during the manufacturing and testing spacecraft components, the introduction of a Human Factors Report is suggested. O.H.

A70-32664 Characteristic traits of semiconductor failures. W. J. Lytle and Owen J. McAteer (Westinghouse Defense and Space Centre, Baltimore, Md.). In: Institute of Electrical and Electronics Engineers, Annual Symposium on Reliability, Los Angeles, Calif., February 3-5, 1970, Proceedings. (A70-32626 15-15) Symposium co-sponsored by the Institute of Environmental Sciences, the American Society for Nondestructive Testing, and the American Society for Quality Control. New York, Institute of Electrical and Electronics Engineers, Inc. (Annals of Assurance Sciences. Volume 3, No. 1), 1970, p. 386-393.

Discussion of the relative importance of visual microscopic data as it pertains to recognizing the characteristic traits of semiconductor failure. The characteristic appearance of each failure reveals data concerning the direction of current, magnitude of voltage applied, temperature excursion of the microsurface or substrate, and the approximate duration of the transient. Examples of circuit failure analysis are given for both standard and unusual cases. In one experience described, and unusual multiple melt of interconnect predicted a high voltage surge of nanowatt proportion. Later, this failure was duplicated in the laboratory and was traced to a circuit malfunction with a resultant modification in the circuit design. It is demonstrated that the characteristics of the device failure define the external influence which caused the overstress. T.M.

A70-32671 * Nature of the inactivation of the isocitrate dehydrogenase from an obligate halophile. Jerry S. Hubbard and Alan B. Miller (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Bacteriology,* vol. 102, June 1970, p. 677-681. 9 refs.

Study of the nature of the inactivation of the nicotinamide adenide dinucleotide phosphate (NADP)-specific isocitrate dehydrogenase (ICDH) at low NaCl levels. It is shown that this ICDH is rapidly inactivated by removal of NaCl which causes an unfolding of the protein. The conformational changes associated with the inactivation and reactivation of the protein are discussed in detail. O.H.

A70-32676 Physicochemical methods of obtaining formaldehyde for carbohydrate synthesis in life support systems. M. A. Lobanova and Iu. E. Siniak. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 11-20.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 417-425. 27 refs. Translation.

Brief review of the literature covering physicochemical methods of synthesizing formaldehyde. Procedures of formaldehyde synthesis under ground-based conditions have been developed at different degrees; therefore, it is difficult to give preference to any of them on the basis of weight or power characteristics. However, high priority should be given to the following methods of the formaldehyde synthesis: from CO and hydrogen under the influence of electric discharges; from methanol obtained through the synthesis of carbon dioxide and hydrogen; from methanol obtained through methane chlorination; and by methane oxidation in the presence of nitrogen oxides. (Author)

A70-32677 Effect of synthetic carbohydrates on growth and toxin formation of Clostridium perfringens type A. G. F. Shemanova. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 21-24.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 426-429. 9 refs. Translation.

Investigation of the effect of synthetic carbohydrates on the growth and toxin formation of type A Cl. perfringens. The observed growth rate of bacterial mass and the amounts of protein eliminated into the ambient liquid indicate that synthetic carbohydrates cause an insignificant inhibition of the life processes. M.V.E.

A70-32678 Effect of changes in composition of the atmosphere on resistance to low temperatures. I. P. Shcherbachev. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 29-32.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 434-436. 9 refs. Translation.

A 4-hour exposure of white mice to atmospheres with an increased content of carbon dioxide (5-7%), oxygen (35-40%) or both gases brought about a decrease of their rectal temperature. Carbon dioxide produced the highest hypothermal effect while oxygen induced the lowest. During the subsequent exposure to low temperatures (-25 and-50 deg C), the animals pre-exposed to a hypercapnic atmosphere showed the lowest rate of the rectal

temperature decrease and their death occurred at lower rectal temperatures as compared to control animals. It is suggested that increased carbon dioxide concentrations in the atmosphere may elevate the tolerance of mice to low temperatures. (Author)

A70-32679 Proliferative activity of the bone marrow in dogs after chronic gamma-ray irradiation. T. M. Zukhbaia. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 32-35.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 437-439. 8 refs. Translation.

The mitotic activity and chromosome aberrations in the bone marrow of dogs exposed to a chronic gamma-irradiation at doses of 25, 75 and 150 r per year were studied. No noticeable changes in the proliferative activity were found. An increase of chromosome aberrations was seen in the animals irradiated with doses of 75 and 150 r/year. (Author)

A70-32680 Effect of rate of decompression on altitude tolerance in rats. A. V. Sergienko. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 36-41.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 440-444. 10 refs. Translation.

Experimental study of the effect of various decompression rates on the altitude tolerance of white rats in a pressure chamber. A distinct relationship between the decompression rates and changes in the animal tolerance to acute hypoxia is noted. It is concluded that the decompression rate is of independent biological significance in hypoxia tolerance: with an increase in the decompression rate the altitude ceiling increases and the period of maintained activity progressively decreases. In the case of slowly increasing hypoxia the basic effect is on the cardiovascular, respiratory, circulatory, and thermal control systems, while in the case of rapidly increasing hypoxia the main influence is on the central nervous system. A.B.K.

A70-32682 Basic principles of planning of acceleration training. V. I. Stepantsov and A. V. Eremin. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 47-54.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 451-456. 7 refs. Translation.

Experiments were performed with 37 animals (dogs) and 22 test subjects. In animal experiments the efficiency of three schedules was exaluated as judged by variations in maximally tolerable accelerations as well as by physiological, morphological and histochemical changes in the body. In human experiments the efficiency of two schedules was assessed. The schedules differed in the number of rotations, intervals between them and level of the accomplishment of the main principles of training. Our studies have resulted in the development of basic requirements that should underlie rational schedules of training of animals and humans in order to increase their tolerance to transverse accelerations. (Author)

A70-32683 Effect of a diet containing fragmented algal cells on composition of the intestinal microflora. V. M. Shilov, N. N. Liz'ko, V. I. Fofanov, and N. S. Kliushkina. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 54-57.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 457-459. Translation.

The paper surveys the studies of the enteric microflora of animals and human beings who were fed with diets containing different protein sources. In animals the casein-containing diet resulted in a decrease of the concentration of lactobacilli while the diet containing proteins of unicellular algae led to an increase of the amount of sporiferous anaerobic bacteria. These changes may be associated with the protein properties. In men the diets containing proteins of unicellular algae produced a decrease of the concentration of bifidobacteria and lactobacilli. Our results show that large quantities of the biomass obtained through the current method of theatment cannot be recommended for human nutrition. Further studies should be aimed at developing improved methods to separate the substance of unicellular algae and, consequently, to produce readily assimilated protein products. (Author)

A70-32684 Space diets for flights lasting up to one month. V. P. Bychkov and P. P. Ivanov. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 58-62.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 460-463. Translation.

Testing of space diets demonstrated that in the environments with energy costs of 34 Cal/kg of body weight the mean daily requirements of man for nutrients and water, as calculated per the assimilable portion, were: proteins—1.5 g, fats—1.2 g, carbohydrates—4.1 g and water—28 g per kg of body weight. Our investigations showed that metabolic parameters varied within the limits that induced no abnormalities in the health condition of the test subjects. (Author)

A70-32685 Effect of electrical stimulation of lower limb muscles in raising orthostatic tolerance. B. B. Egorov, V. S. Georgievskii, V. M. Mikhailov, V. I. Kii, I. P. Semeniutin, E. K. Kazimirov, Iu. V. Davidenko, and L. I. Fat'ianova. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 62-65.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 464-466. Translation.

The cardiovascular reaction of 9 healthy male test subjects to a passive orthostatic test was studied. Every test subject was exposed to the test twice: a control test and a test accompanied by the muscle electrostimulation. The application of controlled muscular contractions increased the orthostatic tolerance which was confirmed by subjective feelings of the subjects and by an objective decrease of the absolute value of the heart rate and by an increment of the pulse rate in the erect position. (Author)

A70-32686 Alveolar ventilation and pulmonary blood flow during the action of negative pressure on the lower part of the body. A. M. Genin, V. G. Voloshin, V. I. Sokolkov, and M. A. Tikhonov. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 66-70.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 467-470. 14 refs. Translation.

Results of experiments performed on 11 healthy male test subjects within the age range from 21 to 40 years, who were exposed to lower-body negative pressure (to -80 mm Hg). According to their physiological reactions, the test subjects were divided into those resistant and nonresistant to the exposure. Due to the pooling of a portion of the circulating blood in the lower body and a decrease in the venous return, the arterioalveolar difference in carbon dioxide partial pressure increased, the physiological and alveolar dead space increased, and the number of ventilated but nonperfused alveoli rose. These changes were more pronounced in the test subjects who appeared nonresistant to the lower-body negative pressure. The study of the alveolar carbon dioxide partial pressure dynamics may be of prognostic significance in evaluating the health state of test subjects. The progressive reduction of the alveolar carbon dioxide partial pressure is indicative of increasing circulatory disturbances. (Author)

A70-32687 Method of long-term recording of bioelectrical activity of ventral and dorsal spinal cord roots in dogs. S. A. Skuratova and V. S. Oganov. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 71-73.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 471-473. 10 refs. Translation.

Development of a method of chronic implantation of electrodes in the anterior and posterior roots of the spinal cords of dogs for the purpose of recording the bioelectric activity under various conditions of operation of the sensomotor apparatus. The proposed method is recommended for use in prolonged chronic experiments on dogs with restricted motor activity and in other model experiments. The interelectrode resistance on one and the same pair of operating electrodes after a period of up to four months is found to remain essentially unchanged, while the resistance on different pairs of electrodes amounts to 20 to 100 kohms. A.B.K.

A70-32688 Dynamics of excretion of 5-hydroxyindoleacetic acid by rats during prolonged hypokinesia. Z. S. Dolgun and S. P. Novikova. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec.

1969, p. 74, 75.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 474. Translation.

Study of the effect of prolonged motor activity restriction on the dynamics of elimination of 5-oxyindoleacetic acid in rat urine. On the basis of experiments with rats in so-called 'hypokinetic' cages, it is found that during hypokinesia the dynamics of elimination of 5-oxyindoleacetic acid undergo changes indicating the occurrence of certain shifts in the serotonin metabolism. A.B.K.

A70-32689 Effect of hypokinesia on conditioned-reflex activity of albino rats. L. N. Khruleva. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 75, 76.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 475, 476. 6 refs. Translation.

Study of the state of the higher central nervous system of white rats during a 30-day period of hypokinesia followed by a period in which aftereffects were manifested. On the basis of an analysis of the data obtained from this study, it is shown that a 30-day period of hypokinesia causes considerable shifts in the organism, which indicate the disruption of vitally important functions and require a long time for recovery. A.B.K.

A70-32690 Effect of short exposure to an atmosphere with increased CO2 concentration on man. V. S. Moskalenko. (*Kosmicheskaia Biologiia i Meditsina,* vol. 3, Nov.-Dec. 1969, p. 77, 78.) *Environmental Space Sciences,* vol. 3, Nov.-Dec. 1969, p. 477, 478. Translation.

Study of the effect of a two-hour exposure to an above-normal concentration of carbon dioxide on the organism of a man performing light physical labor. On the basis of the results obtained from this study, it is concluded that a two-hour exposure to a gas mixture containing up to 4% carbon dioxide is entirely tolerable to a healthy man in a state of rest or performing light labor. A.B.K.

A70-32740 Biomechanics of a man in a reference-free position - Weightlessness. V. I. Stepantsov and A. V. Eremin. (*Kosmicheskie Issledovaniia,* vol. 7, Nov.-Dec. 1969, p. 925-930.) *Cosmic Research,* vol. 7, Nov.-Dec. 1969, p. 829-833. Translation.

Determination of the average moments of inertia of a body and individual parts of it relative to various axes for a man with a height of 168 to 170 cm and a weight of 70 to 75 kg. The values of these moments of inertia are used to calculate the ratios between the moments of inertia of individual parts of the body relative to various axes, thus making it possible to estimate, choose, recommend, and justify the most favorable and most easily coordinated methods of turning (orienting) a man in an unsupported position relative to the longitudinal (course), transverse (pitch), and front-to-rear (roll) axes of the body exclusively by his own muscular forces, without resorting to technical means. A.B.K.

A70-32741 Pathomorphological and histochemical changes in the organs of tortoises carried on board the spacecraft Zond 5. N. A. Gaidamakin, G. P. Parfenov, V. G. Petrukhin, V. V. Antinov, P. P. Saksonov, and A. V. Smirnova. (*Kosmicheskie Issledovaniia,* vol. 7, Nov.-Dec. 1969, p. 931-939.) *Cosmic Research,* vol. 7, Nov.-Dec. 1969, p. 834-841. 6 refs. Translation.

Study of the pathomorphological changes occurring in tortoises during a trip around the moon and back while deprived of food. A number of changes of atrophic nature were noted in the subjects—namely, a decrease in the thickness of the intestinal walls, in the diameter of the seminal ducts, and in the volume of liver and kidney cells. The number of cells in the embryonic epithelium of the testes decreased, the mitotic activity of the epithelium of the intestinal mucosa and of the hemopoietic tissue of the spleen was suppressed, and lipofuscin accumulated in the organs. The enzyme activity of the tissue cells was modified. A comparison of the changes occurring in these animals with those occurring in control animals showed that the main structural alterations in the tortoises were caused by hunger and only to a lesser extent by space flight factors. A.B.K.

A70-32820 A physical model for muscular behavior. Julia T. Apter (Presbyterian-St. Luke's Hospital, Chicago, Ill.) and William W. Graessley (Northwestern University, Evanston, Ill.). *Biophysical Journal,* vol. 10, June 1970, p. 539-555. 22 refs. PHS Grants No. GM-14659; No. HE-05808; No. CA-06475.

A model for muscular behavior has been developed by a generalization of the laws governing the viscoelastic behavior of polymeric materials. The model simulates events thought to take place during stretch, loading, and stimulation of muscle, whether smooth or striated. The equations of motion were solved with an analogue computer for several types of perturbation, and stress, strain, and strain-rate curves were generated. Model parameters were selected by fitting experimental stress-relaxation data. The resulting equations predicted the frequency dependence of dynamic modulus and phase angle within experimental error. With appropriate boundary conditions and suitable values for model parameters, the computed results also closely resembled experimental curves of contraction velocity vs. time, isometric tension development vs. time, force-velocity curves, and temperature-tension relationships. These results call attention to the relationship between the behavior of various kinds of muscle and open the way for quantifying muscular behavior in general. (Author)

A70-32831 * Volume-conducted potentials in response to auditory stimuli as detected by averaging in the cat. Don L. Jewett (Yale University, New Haven, Conn.; California, University, San Francisco, Calif.). *Electroencephalography and Clinical Neurophysiology,* vol. 28, June 1970, p. 609-618. 26 refs. Grant No. NGR-05-009-083.

This study followed unpublished experiments by Wolf, Chimienti, and Galambos, in which electrical responses to auditory clicks in unanesthetized cats were found in widely separated brain areas, many of which were not related directly to the auditory system. These electrical potentials, recorded by an averaging computer, had too short a latency to be accounted for by known neuronal pathways. In the research reported here, some of these responses were found in anesthetized animals together with other responses with even shorter latencies. It is shown that early responses are the result of volume-conducted spread of potentials from generators in the vicinity of the classical auditory pathways. The findings have implications for studies that recover a signal buried in noise since, as in this case, the source of a potential may be surprisingly distant from the recording electrode. A preliminary account of this work has been published (Jewett, 1969). (Author)

A70-32834 Structural basis for cardiac function. J. A. Armour and W. C. Randall (Loyola University, Hines, Ill.). *American Journal of Physiology,* vol. 218, June 1970, p. 1517-1523. 32 refs. NIH Grants No. HE-08682; No. GM-999.

In nine species of mammals, anatomic evaluation of fresh specimens demonstrated that the ventricles of the heart are grossly structured as a continuum of muscle strands. These strands originate and insert into a basal fibrous skeleton consisting of four interconnected, triangular accumulations of fibrous tissue surrounding the aortic valve. They undergo a slow right-angular directional change as they course from the epicardium to the endocardium. Vertically directed strands of the endocardium and the papillary muscles originate from these innermost strands, the latter playing an important role in the formation of inflow and outflow tracts within the left ventricle. Right ventricular sinus musculature is anatomically similar to that of the left, but the conus strands run more nearly parallel to form a potentially separate cylindrical chamber at the base of the pulmonary artery. Incisions following the direction of the muscle strands do not grossly alter cardiac function, whereas cutting across the strands seriously interferes with normal activity. It is concluded that anatomic considerations are of paramount importance in determining the specific effectiveness of each individual portion of the ventricles in performing its particular function. (Author)

A70-32835 * Hematology of sea-level and high-altitude native Sonoran deer mice. Charles F. Sawin (California, University, Berkeley, Calif.). *American Journal of Physiology,* vol. 218, June

1970, p. 1701-1703. 13 refs. Grants No. NGR-05-003-018; No. NGL-05-003-024; Contract No. Nonr-3656(22).

Hematological data were compiled for male and female Sonoran deer mice native to sea level (94 m) and high altitude (3,800 m). Erythrocyte concentrations, hemoglobin concentrations, and packed cell volumes (PCV) were higher in high-altitude mice than in sea-level mice. Plasma sodium, potassium, and chloride ion concentrations were measured. Hemoglobin electrophoresis demonstrated two components present in both high-altitude and sea-level mice, with the exception that two of six high-altitude male mice studied exhibited only one component. No correlation was found between the quantity of minor hemoglobin component present and the oxygen affinity (P sub 50) of the particular blood hemoglobin. (Author)

A70-32836 Effects of hypoxia on mechanics of cardiac contraction. J. V. Tyberg, L. A. Yeatman, W. W. Parmley, C. W. Urschel, and E. H. Sonnenblick (Peter Bent Brigham Hospital, Boston, Mass.). *American Journal of Physiology,* vol. 218, June 1970, p. 1780-1788. 26 refs. Research supported by the American Heart Association and PHS.

The mechanical performance of isolated cat papillary muscles has been studied during 60-min periods of hypoxia (95% N2-5% CO2; oxygen partial pressure = 15 mm Hg), and during subsequent recovery after reoxygenation. During hypoxia developed force fell to 20 plus or minus 3% of control whereas time-to-peak tension (TTP) and the rate of relaxation, i.e., the time for isometric tension to fall to 50% of its peak (RT sub 1/2), both declined by 40%. Upon reoxygenation, a characteristic pattern of recovery ensued. After 2 min, tension development had recovered to 60 plus or minus 5% of control, whereas TTP and RT sub 1/2 were prolonged to 137 plus or minus 6% and 208 plus or minus 8%, respectively. Even after only 2-4 min hypoxia, this pattern of prolonged relaxation became evident during the reoxygenation phase. After 60 min of recovery, there was almost a complete return to control values. During early hypoxia the calculated maximum velocity of shortening (V sub max) was maintained, whereas force development declined. With continued hypoxia, V sub max was reduced to 46 plus or minus 7% of control. During reoxygenation, force development recovered sooner than V sub max. It is suggested that these transient changes during early hypoxia and recovery relate to differential alterations in the intensity and duration of the active state. (Author)

A70-32837 Effect of autonomic drugs on contractures of cardiac muscle. Emil Bozler and Houston R. Baker (Ohio State University, Columbus, Ohio). *American Journal of Physiology,* vol. 218, June 1970, p. 1795-1800. 30 refs. PHS Grant No. AM-0257-011.

Autonomic drugs enhanced or inhibited contractures of cardiac muscle of the frog under certain conditions. During contractures induced by high-Ca Ringer solution epinephrine caused relaxation, acetylcholine a further rise in tension. However, in solutions containing not only a high concentration of Ca but also of K, the effect of the drugs was reversed. Acetylcholine caused relaxation also during contractures induced by Ringer solution after washing in Ca-free solutions. The effects of epinephrine were blocked by the beta-adrenergic blocking agent, propranolol, those of acetylcholine by atropine. These results can be explained by assuming that the drugs used increase or decrease the influx of Ca. The reversal in the effect of epinephrine due to an increase in K indicates that Ca influx is diminished by epinephrine at a normal, increased at a lowered, membrane potential. The last of these conclusions agrees with the results of recent electrophysiological studies and supports the hypothesis that the inotropic action of the drug is due to an increase in Ca influx during the phase of the action potential in which the membrane potential is very low. (Author)

A70-32844 A distributed-lumped parameter model of mass transfer in the respiratory system. Harold R. Warner and Richard C. Seagrave (Iowa State University of Science and Technology, Ames, Iowa). *Chemical Engineering Progress, Symposium Series,* no. 99, 1970, p. 12-21. 19 refs.

A distributed-lumped parameter model has been developed to investigate the effects of impeded mass transfer and blood-gas maldistribution in the human respiratory system. Specific attention is devoted to pulmonary capillary mass transfer dynamics. The model is used to simulate successfully observable physiological behavior while remaining amenable to analog computer solution. The effects of varying diffusing capacity on the transient longitudinal concentration profiles of oxygen and carbon dioxide in the pulmonary capillaries are demonstrated. The results are in good agreement with available data and with the results of more complicated digital computer models. (Author)

A70-32845 Hybrid simulation - Oxygen transport in the microcirculation. Duane F. Bruley (Clemson University, Clemson, S.C.) and Melvin H. Knisely (South Carolina, Medical College, Charleston, S.C.). *Chemical Engineering Progress, Symposium Series,* no. 99, 1970, p. 22-32. 18 refs. PHS Grants No. 5-R01 NB-06957-02; No. HE-04176; No. HE-07714.

Description of a hybrid computer simulation of a theoretical model representing the steady state release, diffusion, and consumption of oxygen in a capillary-tissue system. The mathematical formulation consists of a nonlinear, second-order, partial differential equation in the capillary coupled with a linear, second-order, ordinary differential equation in the tissue. Although the physiological model could be used to represent many organs, the physical and chemical parameters used are for human brain gray matter. The simulation illustrates a practical, economical, faster than real time solution of a complex, small-time constant system. Benefits resulting from the study of a basic anatomical unit, such as the capillary-tissue arrangement, might include a deeper insight into the physiological process, the development of experimental programs for determining important physical and chemical parameters, and the possible use of predictive calculations for clinically oriented open- and closed-loop control designs. M.V.E.

A70-32846 Estimation of the rate constants for the oxygen-hemoglobin reaction within intact red cells. Marvin Fleischman (Cincinnati, University, Cincinnati, Ohio) and Daniel Hershey (Louisville, University, Louisville, Ky.). *Chemical Engineering Progress, Symposium Series,* no. 99, 1970, p. 77-84. 20 refs.

Use of experimental in vitro data on whole blood in the solutions to the differential equations describing the intracellular oxygen transport for obtaining values of the rate constants for the oxygen-hemoglobin reaction. Previous determinations of these quantities in intact red cells have not been made. Rather it was assumed that the rate constants had the same values in the red cell as in homogeneous, well-mixed, hemoglobin solution. The values obtained for the oxygen-hemoglobin reaction are approximations that should be considered as order of magnitude estimates. An unsuccessful attempt was made to account for the intermediate reactions between oxygen and hemoglobin by applying the steady state approximation to the kinetics of the reactions. Further attempts should be made to incorporate the intermediate reactions into the kinetics model making as few assumptions as possible. However, progress along these lines is dependent upon prior development of methods for identifying the intermediates and accurately determining the intermediate rate constants. M.V.E.

A70-32847 Diffusion of organic solutes in stagnant plasma and red cell suspensions. C. K. Colton, K. A. Smith, E. W. Merrill (MIT, Cambridge, Mass.), and J. M. Reece (California, University, Berkeley, Calif.). *Chemical Engineering Progress, Symposium Series,* no. 99, 1970, p. 85-100. 87 refs. NIH Grant No. PH-43-66-491.

Diffusion of organic solutes in plasma and red cell suspensions is investigated analytically and experimentally. Models are developed within the framework of existing theories for transport in heterogeneous media. Data obtained in a transient experiment with the microcapillary technique show (1) that solute binding by proteins significantly affects diffusion in plasma, and (2) that the red cells

may be modeled as a nearly impermeable suspended phase. Criteria for the existence of near-equilibrium between red cells and the suspending medium are proposed. (Author)

A70-32848 Diffusion of oxygen in solutions of blood proteins. Thomas K. Goldstick (Northwestern University, Evanston, Ill.) and Irving Fatt (California, University, Berkeley, Calif.). *Chemical Engineering Progress, Symposium Series,* no. 99, 1970, p. 101-113. 50 refs. NIH Grant No. HE-06796; No. GM-15418.

The diffusion coefficient of dissolved oxygen was determined, using an unsteady state method, in aqueous solutions of potassium chloride, bovine serum albumin, and human oxyhemoglobin over the complete concentration range. A Clark type of polarographic oxygen electrode monitored the oxygen partial pressure at the bottom of a layer of liquid after the partial pressure was changed at the top. Mathematical analysis of the resulting transient data gave the oxygen diffusion coefficient directly, without requiring a value for the oxygen solubility or any empirical constant. Auxiliary polarographic techniques were developed to measure the oxygen consumption rate and combining capacity. Results indicate that the oxygen diffusion coefficients at 25 deg C in water, albumin solutions of the total protein concentration in plasma, and hemoglobin solutions of the concentration in the red blood cell are 2.13, 1.80, and 0.76 times .00001 sq cm/sec, respectively. (Author)

A70-32851 # Influence of sodium oxybutyrate on the oxidation processes in brain tissue during hypoxia (Vliianie oksibutirata natriia na okislitel'nye protsessy v mazgovoi tkani pri gipoksii). N. B. Vysotskaia, V. V. Zakusov, R. U. Ostrovskaia, and Z. N. Chumina (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR). *Biulleten' Eksperimental'noi Biologii i Meditsiny,* vol. 35, Apr. 1970, p. 70-72. 5 refs. In Russian.

Experimental investigation of the possibility of using sodium oxybutyrate to prevent the depressed respiration of brain tissues which is characteristic for hypoxia. Tests conducted with mice demonstrated the capability of sodium oxybutyrate to increase the intensity of oxidation processes in brain tissues under normal conditions, and to prevent the depressed respiration under hypoxia conditions. In this context, sodium oxybutyrate differs from typical narcotic and tranquilizing media. Neither Nembutal nor Aminazine reduced the depressed respiration under hypoxia. T.M.

A70-32868 # Investigation of the intercentral relations in the human cerebral cortex by the method of electroencephalogram cross correlation (Issledovanie mezhtsentral'nykh otnoshenii v kore golovnogo mozga cheloveka metodom krosskorreliatsii elektroentsefalogrammy). V. S. Rusinov, O. M. Grindel', and G. N. Boldyreva (Akademiia Nauk SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii; Akademiia Meditsinskikh Nauk SSSR, Institut Neirokhirurgii, Moscow, USSR). *Zhurnal Vysshei Nervnoi Deiatel'nosti,* vol. 20, Mar.-Apr. 1970, p. 280-292. 34 refs. In Russian.

Brief survey of original research using cross correlations of electrical activity in the cerebral cortex of healthy human subjects in a state of relative repose and during afferent stimulation. Subjects with focal damage of the cerebral cortex were also studied. Data obtained by correlation analysis of different EEG rhythms indicate that healthy humans exhibit characteristic intercentral relations which are reflected in the electrical activity and which ensure the joint operation of different cortical regions necessary for normal behavior of the cerebral cortex. The presence of several simultaneously existing cyclic processes with different parameters is discovered; this signifies the participation of different brain structures in these cycles. Mathematical analysis of EEG data can be used to localize damaged areas and to determine their pathological effects on other regions of the brain. T.M.

A70-32869 # Physiological mechanisms of human adaptation to time intervals (O fiziologicheskikh mekhanizmakh prisposobleniia cheloveka k vremennym intervalam). A. S. Dmitriev (Bashkirskii Gosudarstvennyi Universitet, Ufa, USSR). *Zhurnal Vysshei Nervnoi Deiatel'nosti,* vol. 20, Mar.-Apr. 1970, p. 293-302. 64 refs. In Russian.

Survey of the current state of knowledge concerning the mechanisms governing human and animal adaptation and responses to time intervals and temporal cycles of activity. Two stages or levels of temporal adaptation are recognized; one is termed the primary-signal stage corresponding to the directly experienced level (common to humans and animals), while the other is a secondary-signal stage which is typically human and allows conscious evaluation of time-related changes and their significance in a wider context. Primary-signal mechanisms are examined both in connection with circadian rhythms and much shorter intervals (5 to 30 min). Conditioned reflexes are discussed in terms of physiological factors which play a role in their formation, and the participation of secondary-signal mechanisms is considered. T.M.

A70-32870 # Problem of the reflection of speech signals in the nervous system (Problema otrazheniia rechevykh signalov v nervnoi sisteme). L. I. Chistovich (Akademiia Nauk SSSR, Institut Fiziologii, Leningrad, USSR) and I. I. Leiman (Akademiia Nauk SSSR, Institut Filosofii, Leningrad, USSR). *Zhurnal Vysshei Nervnoi Deiatel'nosti,* vol. 20, Mar.-Apr. 1970, p. 413-421. 24 refs. In Russian.

Outline of the theoretical fundamentals (definition of the problem, a priori assumptions, and terminology) underlying studies of speech signal perception. The objective is designated as the construction of a functional perception model which ensures the conversion of a set of signals into a set of phonetic patterns. It is assumed that the model has a multilevel structure and that each level reduces the information about the signal. Possible methods of gaining knowledge about different units of the model are considered for the initial processing unit, the index recognition unit, and the phonetic interpretation unit. Methods based on observations of behavioral effects are analyzed, and experimental results are given from studies of parameters utilized by the hearing apparatus to characterize the speech signal. T.M.

A70-32871 # Function of the auditory system during integrative (conditioned reflex) activity of the brain (Funktsiia slukhovoi sistemy pri integrativnoi /uslovnoreflektornoi/ deiatel'nosti mozga). U. G. Gasanov (Akademiia Nauk SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR). *Zhurnal Vysshei Nervnoi Deiatel'nosti,* vol. 20, Mar.-Apr. 1970, p. 422-430. 56 refs. In Russian.

Description of experiments conducted on cats with positive and inhibitory conditioned eyelid reflexes in response to noise bursts of different durations (up to 7 msec). For a positive signal, the thresholds of the evoked responses diminished in the auditory cortex, the posterior colliculi, the medial geniculate body, and the cochlear nucleus. The creation of an inhibitory reflex did not change the attained level of sensitivity, with the exception of the auditory cortex where a further reduction of the evoked response threshold took place. The cochlea did not exhibit any changes of the threshold index either for positive or inhibitory signals. Positive and inhibitory noise signals were accompanied by specific changes in the configuration of the cortical evoked response. T.M.

A70-32872 # Problem of the perception of and subthreshold reaction to unrecognized stimuli (Problema vospriiatiia i podporogovykh reaktsii na neopoznavaemye stimuly). E. A. Kostandov (Tsentral'nyi Nauchno-Issledovatel'skii Institut Sudebnoi Psikhiatrii, Moscow, USSR). *Zhurnal Vysshei Nervnoi Deiatel'nosti,* vol. 20, Mar.-Apr. 1970, p. 441-449. 52 refs. In Russian.

Survey of currently available information about factors affecting the perception threshold in novel and rapidly changing circumstances. The role of training to recognize the stimuli signals is discussed, together with the physiological mechanism for reducing the signal recognition threshold. Effects of emotional factors on the perception process are considered in terms of emotional excitation of

the posterior hypothalamus and the reticular formation stem. The perception of emotional stimuli is discussed, and attention is given to automatic protective measures against emotional stress. The presence of subthreshold (subsensory) reactions to different stimuli is examined. T.M.

A70-32891 # Control devices for regional hypotonia and for the emergency centralization of blood circulation (Ustroistva dlia upravleniia regionarnoi gipotoniei i avariinoi tsentralizatsii krovoobrashcheniia). I. N. Bibileishvili (Tbilisskii Gosudarstvennyi Institut Usovershenstvovaniia Vrachei, Tiflis, Georgian SSR). *Akademiia Nauk Gruzinskoi SSR, Soobshcheniia,* vol. 57, Feb. 1970, p. 433-436. In Russian.

Description of the designs and operation of two devices for controlling regional hypotonia with or without blood circulation centralization, in emergency cases. The devices consist of an inflatable balloon, an extracorporeal shunt, an electromagnetic valve, a manometer and a circuit stopping the blood flow in the abdominal section of the aorta and arresting hemorrhages in caudal sections of the trunk. The devices were designed to facilitate abdominal surgeries and to control metrorrhagia. V.Z.

A70-32892 # Effect of partial removal of the cerebellum on delayed visual and auditory reactions (Vliianie chastichnogo udaleniia mozzhechka na zritel'nye i slukhovye otsrochennye reaktsii). Ts. G. Suknidze (Akademiia Nauk Gruzinskoi SSR, Institut Fiziologii, Tiflis, Georgian SSR). *Akademiia Nauk Gruzinskoi SSR, Soobshcheniia,* vol. 57, Feb. 1970, p. 449-451. 8 refs. In Russian.

Study of the visual and auditory reactions to alimentary stimuli in a group of 5 dogs prior to and after the extirpation of lob, simplex, folia, tuber vermis and pyramis from their cerebellum. The effect of this operation on the memory of the dogs is discussed, indicating a complete recovery of their reflexes within a month. V.Z.

A70-32900 # Common antigens shared by human blood serum and human erythrocyte stroma. L. Nakov and T. Evrev (Vissh Meditsinski Institut, Sofia, Bulgaria). *Bolgarskaia Akademiia Nauk, Doklady,* vol. 23, no. 3, 1970, p. 335-338. 5 refs.

Attempt to establish whether antigens shared by human blood serum and the proteins of the erythrocyte stroma exist. Experimental results show that the antisera do not show blood group specificity and the common antigens, shared also by the serum, have no relationship with the blood group antigens. F.R.L.

A70-32990 * Eukaryotes versus prokaryotes - An estimate of evolutionary distance. P. J. McLaughlin and M. O. Dayhoff (National Biomedical Research Foundation, Silver Spring, Md.). *Science,* vol. 168, June 19, 1970, p. 1469-1471. 14 refs. NASA-supported research; NIH Grant No. GM-08710.

The divergence of nucleated organisms and bacteria was 2.6 times more remote in evolution than the divergences of the nucleated organisms into separate kingdoms, as evidenced by genetic changes in cytochrome c and transfer RNA. The development of the genetic code through the differentiation of transfer RNA's for different amino acids was still more remote in evolution. The overall rates of transfer RNA evolution in bacteria and nucleated organisms were comparable. (Author)

A70-33026 * Physical principles of biological membranes; Proceedings of the Conference, University of Miami, Coral Gables, Fla., December 18-20, 1968. Conference supported by NASA, Grant No. NGL-10-007-010. Edited by F. M. Snell (New York, State University, Buffalo, N.Y.), J. J. Wolken (Carnegie-Mellon University, Pittsburgh, Pa.), G. J. Iverson (Miami, University, Coral Gables, Fla.), and J. Lam (National Research Council, Ottawa, Canada). New York, Gordon and Breach, Science Publishers, Inc., 1970. 442 p. $27.50.

Contents:

Introduction. F. Snell (New York, State University, Buffalo, N.Y.), p. v.

Dielectric properties of living membranes. K. S. Cole (National Institutes of Health, Bethesda, Md.), p. 1-16.

Optical and electrophysiological evidence for conformational changes in membrane macromolecules during nerve excitation. I. Tasaki, W. Barry, and L. Carnay (National Institute of Mental Health, Washington, D.C.), p. 17-34.

Theory of nerve excitation as a cooperative cation exchange in a two-dimensional lattice. G. Adam (München, Universität, Munich, West Germany), p. 35-67.

A non-linear term in the ion transport across membranes. R. Schlögl (Max-Planck Institut für Biophysik, Frankfurt am Main, West Germany), p. 69-77.

Ion distribution equilibria in bulk phases and the ion transport properties of bilayer membranes produced by neutral macrocyclic antibiotics. G. Eisenman (California, University, Los Angeles, Calif.), S. M. Ciani (Genova, Università, Genoa, Italy), and G. Szabo, p. 79-135.

Possible mechanisms of ion transit. L. Onsager (Yale University, New Haven, Conn.), p. 137-141.

Physical principles in monolayer and membrane permeation. M. Blank and J. S. Britten (Columbia University, New York, N.Y.), p. 143-163.

Current rectification and action potentials across thin lipid membranes. D. R. Kalkwarf (Battelle Memorial Institute, Richland, Wash.), D. L. Frasco, and W. H. Brattain (Whitman College, Walla Walla, Wash.), p. 165-174.

Dispersion forces and stability of lipid bilayers. S. Ohki (New York, State University, Buffalo, N.Y.), p. 175-225.

Ion transport across lipid bilayer membranes. P. Läuger (Konstanz, Universität, Konstanz, West Germany), p. 227-241.

Role of water structure in various membrane systems. W. Drost-Hansen (Miami, University, Miami, Fla.), p. 243-258. 21 refs. (See A70-33027 16-04)

Structural and functional properties of bacterial cell membranes. M. R. J. Salton (New York University, New York, N.Y.), p. 259-286.

Structure of the mitochondrial cristael membrane. D. E. Green and G. Vanderkooi (Wisconsin, University, Madison, Wis.), p. 287-313.

Conformational basis of energy transductions in biological membranes. D. E. Green (Wisconsin, University, Madison, Wis.) and R. A. Harris, p. 315-344.

Contrasting protein architectures of plasma and mitochondrial membranes. D. F. H. Wallach (Massachusetts General Hospital, Boston, Mass.), A. S. Gordon, J. M. Graham, and B. R. Fernbach, p. 345-363.

Cell and photoreceptor membranes. J. J. Wolken (Carnegie-Mellon University, Pittsburgh, Pa.), p. 365-382. 33 refs. (See A70-33028 16-04)

The indication of a light induced electrical field by pigments incorporated in chloroplast membranes. W. Junge, H. M. Emrich, and H. T. Witt (Berlin, Technische Universität, Berlin, West Germany), p. 383-396.

Concept of the reactive site in biological transport. H. N. Christensen (Michigan, University, Ann Arbor, Mich.), p. 397-416.

Membrane-like properties in microsystems assembled from synthetic protein-like polymer. S. W. Fox, R. J. McCauley, P. O'B. Montgomery, T. Fukushima, K. Harada, and C. R. Windsor (Miami, University, Coral Gables, Fla.; Texas, University, Dallas, Tex.), p. 417-432. 13 refs. (See A70-33029 16-04)

List of participants, p. 433-435.

A70-33027 * Role of water structure in various membrane systems. W. Drost-Hansen (Miami, University, Miami, Fla.). In: Physical principles of biological membranes; Proceedings of the Conference, University of Miami, Coral Gables, Fla., December 18-20, 1968. (A70-33026 16-04) Conference supported by NASA, Grant No. NGL-10-007-010. Edited by F. M. Snell, J. J. Wolken, G. J. Iverson, and J. Lam. New York, Gordon and Breach, Science

Publishers, Inc., 1970, p. 243-255; Discussion, Morris Rockstein (Miami, University, Coral Gables, Fla.), Ichiji Tasaki (National Institutes of Health, Bethesda, Md.), Jauch, and Thorhaug, p. 256-258. 21 refs. Grant No. NGL-10-007-010.

The role of water structure in membrane systems is discussed and evidence is presented which shows that water near interfaces is different from bulk water. It is concluded that the interface produces, at least in some cases, a stabilization of structured units of water, capable of undergoing higher-order phase transitions. Thermal anomalies in vicinal water and in membrane systems are discussed and the biological implications of these anomalies are examined. G.R.

A70-33028 * Cell and photoreceptor membranes. Jerome J. Wolken (Carnegie-Mellon University, Pittsburgh, Pa.). In: Physical principles of biological membranes; Proceedings of the Conference, University of Miami, Coral Gables, Fla., December 18-20, 1968. (A70-33026 16-04) Conference supported by NASA, Grant No. NGL-10-007-010. Edited by F. M. Snell, J. J. Wolken, G. J. Iverson, and J. Lam. New York, Gordon and Breach, Science Publishers, Inc., 1970, p. 365-382. 33 refs. Grant No. NGR-39-002-011.

Discussion of the structural relationship between cellular membranes and the structure of photoreceptors. The basic structure of the cell membrane and of cytoplasmic organelles is briefly considered. The photoreceptors in plant cells are discussed and a schematized molecular network in or on the lamellae of the chloroplast is shown. The photoreceptors in animal cells are retinal rods and cones of the eye for vision. A structural molecular model for the vertebrate retinal rods is discussed. G.R.

A70-33029 * Membrane-like properties in microsystems assembled from synthetic protein-like polymer. Sidney W. Fox, Robert J. McCauley, Philip O'B. Montgomery, Takeshi Fukushima, Kaoru Harada, and Charles R. Windsor (Miami, University, Coral Gables, Fla.; Texas, University, Dallas, Tex.). In: Physical principles of biological membranes; Proceedings of the Conference, University of Miami, Coral Gables, Fla., December 18-20, 1968. (A70-33026 16-04) Conference supported by NASA, Grant No. NGL-10-007-010. Edited by F. M. Snell, J. J. Wolken, G. J. Iverson, and J. Lam. New York, Gordon and Breach, Science Publishers, Inc., 1970, p. 417-430; Discussion, George Eisenman (California, University, Los Angeles, Calif.) and H. N. Christensen (Michigan, University, Ann Arbor, Mich.), p. 431, 432. 13 refs. Grant No. NGR-10-007-008; Contract No. NAS 9-8101.

Study of the properties and the composition of proteinoids and proteinoid microparticulate systems. The protein-like polymers are obtained by simply heating mixtures of amino acids. The microsystems are made by adding water to the polymers. Catalytic activities found in thermal proteinoids are considered and the properties which these substances have in common with contemporary proteins are listed. Size and ultra-structure of the synthetic materials are discussed and aspects of selective retention are shown. G.R.

A70-33060 * Initiation of DNA replication in Bacillus subtilis. II. Hiroshi Yoshikawa (California University, Berkeley, Calif.). *Journal of Molecular Biology*, vol. 47, 1970, p. 403-417. 27 refs. Research supported by the American Cancer Society; Grant No. NGR-05-003-020.

Discussion of an experimental study of the linkage between the termini of parent strands and the origin of daughter strands of DNA in Bacillus subtilis. The occurrence of a semi-conservative replication, without premature reinitiation, was observed when 5-bromodeoxyuridine was added to thyamine-requiring Bacillus subtilis spore after 3 h germination in a thymineless medium. It was also found that pulse-labeled strands were end-to-end hybrids of heavy 5-bromodeoxyuridine-labeled strands linked to the termini of light parent strands. The mechanism of initiation and reinitiation of DNA replication is discussed. V.Z.

A70-33091 * Gas-phase stabilities of bicyclic cations. Fred Kaplan, Paul Cross, and Richard Prinstein (Cincinnati, University, Cincinnati, Ohio). *American Chemical Society, Journal*, vol. 92, 1970, p. 1445, 1446. 12 refs. NSF Grant No. GP-4924-X; Grant No. NGL-05-020-250.

Discussion of the relative stabilities of sets of protonated bicyclic olefins and ketones free of solvation effects. Limits on heats of formation in the gas phase are established by observing and identifying ion-molecule reactions. The results are tabulated, and the presence of (nonclassical) delocalization in the norbornyl cation is established. M.V.E.

A70-33093 * Life in earth extreme environments - A study of cryobiotic potentialities. S. M. Siegel, Thomas Speitel, and Roy Stoecker (Hawaii, University, Honolulu, Hawaii). *(Society for Cryobiology, Annual Meeting, 6th, Symposium on the Relationship to Extraterrestrial Life of Biochemical Events at Low Temperature, Buffalo, N.Y., Aug. 5, 1969.) Cryobiology*, vol. 6, no. 3, 1969, p. 160-181. 82 refs. Contract No. NASw-767; Grant No. NGR-12-001-042.

Study of cryobiotic potentialities on earth, intended as a brief introduction to the colder places on this planet and the life forms that inhabit them. Two areas of major relevance to the general problem of life at low temperatures - i.e., the cryobiotic environments of the earth, and the general patterns of physiological response to temperature - are first considered. The achievements of experimental cryobiology dealing with mechanisms of cryotolerance, such as survival and growth of organisms, metabolism and enzymes, are then discussed. It is shown that the actual temperature limits are quite narrow for complex organisms - in the range of 0 deg C or somewhat below. Organizationally simpler forms may or may not have extended capabilities - a matter of weighing genetic capabilities against severity of environment. Resistance in some active, growing organisms can permit growth at -30 to -40 deg C. Such capabilities are associated with modified aqueous media, such as salts or alcohols in the laboratory and salts in nature. Water analogs such as ammonia are included as options. Metabolic systems and components may have superior capabilities compared to cells or complex organisms; they show that active extreme low temperature life is still possible in principle. It is demonstrated that it is not cold per se that limits life, but the phase change of the medium itself, insofar as it threatens cellular organization in the most 'crystallizable' cell in the system. O.H.

A70-33096 * Daily rhythm in the accumulation of brain catecholamines synthesized from circulating H3-tyrosine. Michael J. Zigmond and Richard J. Wurtman (MIT, Cambridge, Mass.). *Journal of Pharmacology and Experimental Therapeutics*, vol. 172, no. 2, 1970, p. 416-422. 26 refs. PHS Grant No. AM-11709; Grant No. NGR-22-009-272.

Measurement of the accumulation of H3-catecholamines in the brain of rats given i.p. H3-tyrosine (H3-TYR). In animals injected at the same time of day, brain H3-TYR reached a peak within 10 minutes of injection and remained at this level for at least 120 minutes. Brain H3-catecholamine content was highest 60 minutes after injection. The accumulation of H3-catecholamine was significantly higher in the middle of the light period than in the dark period when correction was made for fluctuations in the specific activity of tyrosine. M.V.E.

A70-33098 * The effect of ionizing radiation on the molecular biology of escherichia coli. Ernest C. Pollard (Pennsylvania State University, University Park, Pa.). In: Current topics in radiation research. Volume 6. Edited by M. Ebert and A. Howard. Amsterdam, North-Holland Publishing Co., 1970, p. 51-127. 100 refs. AEC Contract No. AT (30-1)-2804; Grant No. NGR-39-009-008.

Description of recent work regarding the action of ionizing radiation on living cells, giving an adequate background of those aspects of the work that are necessary to understand recent

experiments, but concentrating on the new material. The physical action of ionizing radiation is considered, and the statistics of damage to cells (the critical target idea) are discussed. Attention is given to the molecular biology of bacteria, and comparison with mammalian cells is made. Experiments on colony-forming ability, the observation of single cells after radiation, peroxides and effects of irradiated medium, and ionizing radiation and DNA degradation are studied. Ionizing radiation and DNA synthesis, respiration, and transcription and translation are treated. The effects of the decay of incorporated radioactivity, and mutations are considered. F.R.L.

A70-33099 * **The effect of high-gradient, high-strength magnetic fields on the early embryonic development of frogs.** Peter W. Neurath (New England Medical Center Hospitals, Boston, Mass.). In: Biological effects of magnetic fields. Volume 2. Edited by M. F. Barnothy. New York, Plenum Press, 1969, p. 177-187. 11 refs. Grant No. NGR-22-021-002.

Test of the hypothesis that the effect of magnetic fields on the early development of an organism should affect particularly those cellular components of the organism which have a paramagnetic susceptibility larger than the rest of the tissue. In investigating magnetic-field effects on the early embryonic development of frogs, a special effort was accordingly made to detect connections between observed growth abnormalities and peculiar ferritin motions within the embryo, such as ferritin concentration gradients within cells. Ferritin, a protein complex of iron, is the molecule used in animals for storing the iron that goes into the early making of hemoglobin. It contains as much as 20% of iron by weight and is relatively paramagnetic. The investigation results brought no substantiation of the ferritin hypothesis, though the embryonic development was affected in a highly significant manner. An alternate hypothesis and further experiments are suggested. M.V.E.

A70-33110 **Primary myocardial disease - Clinical, hemodynamic and angiocardiographic correlates in fifty patients.** Robert I. Hamby, Pablo Catangay, Orlando Apiado, and Abdul Hafiz Khan (Long Island Jewish Medical Center, New Hyde Park; Long Island Jewish Medical Center, Jamaica, N.Y.). *American Journal of Cardiology,* vol. 25, June 1970, p. 625-634. 44 refs.

Description of clinical observations and hemodynamic and angiocardiographic studies of primary myocardial disease made in a group of 50 adult patients, with particular view to left ventricular volume and wall changes. The experimental methods used are reviewed, and the results are statistically analyzed, tabulated and displayed graphically. A discussion is presented which is connected with clinical and hemodynamic features of primary myocardial disease in general, left ventricular volume and wall thickness, left ventricular diastolic pressure, and left ventricular hypertropy vs dilatation. It is suggested that primary myocardial disease is characterized by an early latent asymptomatic stage followed by a symptomatic hypertropic stage which progresses to an irreversible stage of dilatation. O.H.

A70-33111 **Radiotelemetry of phasic right ventricular blood velocity in man.** Alberto Benchimol, Stephen Tio, and John L. Gartlan (Good Samaritan Hospital, Phoenix, Ariz.). *American Journal of Cardiology,* vol. 25, June 1970, p. 649-654. 12 refs.

Study of the wave form of the phasic right ventricular blood velocity in normal subjects, and the influence of respiration, rhythm disturbances and the Valsalva maneuver on the right ventricular blood velocity in normal subjects and in patients with cardiac dysfunctions. A radiotelemetry technique using a Doppler ultrasonic catheter-flowmeter telemetry system was adopted in these examinations which seems to be valuable in the study of right ventricular dynamics in a variety of conditions. O.H.

A70-33133 **Design considerations for CRT symbol generators.** E. L. Wallace (Westinghouse Defense and Space Center, Baltimore, Md.). In: Electro-Optical Systems Design Conference, 1st, New York, N.Y., September 16-18, 1969, Proceedings. (A70-33126 16-14) Edited by K. A. Kopetzky. Chicago, Industrial and Scientific Conference Management, Inc., 1970, p. 60-70. 19 refs.

Description of the design of symbol generators providing electrical signals for 'writing' symbols on a cathode ray tube, and used as a means for displaying data at high speeds for the input/output computer terminals. The symbol generator is first considered in terms of the electrooptical constraints imposed by the human operator. The effects of cathode ray tube phosphors, symbol refresh rates, symbol sizes and spacing, and ambient illustration and viewing angles on the required 'readability' by the operator, are then discussed. O.H.

A70-33261 # **Mechanism of transmission of hormonal stimuli from the posterior hypothalamus to the cerebral cortex (O mekhanizmakh peredachi gormonal'nykh vozdeistvii s zadnego gipotalamusa na koru golovnogo mozga).** M. G. Amiragova and M. A. Berlina (Akademiia Meditsinskikh Nauk SSSR, Institut Normal'noi i Patologicheskoi Fiziologii, Moscow, USSR). *Akademiia Nauk SSSR, Doklady,* vol. 191, Apr. 11, 1970, p. 1186-1188. 6 refs. In Russian.

Experimental investigation showing that the dorsomedial nucleus of the thalamus is the principal switching point of stimuli, associated with the introduction of thyroxin into the posterior hypothalamic nucleus, to the cortex. It is found that deactivation of the adrenergic structures of the dorsomedial nucleus of the thalamus leads to suppression of conditioned reflex activity. V.P.

A70-33262 # **Neurophysiological characteristic of the lemniscus neurons of the posterior ventral nucleus of the thalamus (Neirofiziologicheskaia kharakteristika lemniskovykh neironov zadnego ventral'nogo iadra talamusa).** V. S. Kobozev (Akademiia Meditsinskikh Nauk SSSR, Institut Normal'noi i Patologicheskoi Fiziologii, Moscow, USSR). *Akademiia Nauk SSSR, Doklady,* vol. 191, Apr. 11, 1970, p. 1189-1192. 7 refs. In Russian.

Experimental investigation showing that in the switching nucleus of the thalamus there exist functionally different types of neurons which receive signals directly from the lemniscus system. The actual switching cells are brevilatent neurons having direct cortical projections into the somatosensory cortical zones. V.P.

A70-33263 **Anthropotechnics in vehicle control (Anthropotechnik in der Fahrzeugführung).** R. Bernotat (Forschungsinstitut für Anthropotechnik, Meckenheim, West Germany). *Ergonomics,* vol. 13, May 1970, p. 353-377. 12 refs. In German.

Study of the guidance and control of dynamic systems by man in the light of anthropotechnics. Following an introduction of the concept of anthropotechnics which has found acceptance in Germany, two simultaneous approaches to man-machine systems optimization are treated. The basic scheme of vehicle guidance and control is then presented. The progress of automation in aircraft is traced from attitude and speed control to steering and navigation. Particular attention is given to dynamic adaptation and, in the first place, to the justification as well as the limitation for treating the human as a 'linear regulator.' In a review of the optimization of information display, the utilization of human flexibility is shown to require specific display modes. Illustrations are given of the differences between vehicle guidance and static work places, The significance of the display reference system for detection of movements, the effects of rotating display and control coordinates against each other, and the advantage of predictive displays are discussed. The impending introduction of electronic displays and computing facilities into vehicles is pointed out. The temporal characteristics of machines is simulated in hybrid computers, and reactions to variable displays, movements in the cockpit, and changes in simulated external environment are studied. In conclusion, a survey of measurement scales used in anthropotechnics are given. It is pointed out that, due to the complexity of the problems involved, only theoretical solutions are available, and optimization proceeds meanwhile mainly by experimental approach. O.H.

A70-33291 * Effect of manganese deficiency on fluorescence in algae adapted to hydrogen. Erich Kessler (Florida State University, Tallahassee, Fla.). In: Progress in photosynthesis research. Volume 2. Edited by Helmut Metzner. Tübingen, Institut für chemische Pflanzenphysiologie, 1969, p. 938-942. 28 refs. Grant No. NGR-10-004-018.

Analysis of chlorophyll fluorescence in normal and manganese-deficient hydrogen-adapted Ankistrodesmus braunii to determine the underlying electron transport mechanism. Diagrams are plotted to compare the intensities of steady-state fluorescence in normal and experimental plants. The chlorophyll content is determined in manganese-deficient Chlorella fusca and Chlorella vulgaris algae. A scheme is proposed for photosynthetic electron transport in these algae. V.Z.

A70-33322 On respiratory system parameter estimation. J. S. Meditch (Boeing Scientific Research Laboratories, Seattle, Wash.) and P. J. Stoll (California, University, Davis, Calif.). In: American Automatic Control Council, Joint Automatic Control Conference, 11th, Georgia Institute of Technology, Atlanta, Ga., June 22-26, 1970, Preprints of Technical Papers. (A70-33301 16-10) New York, American Society of Mechanical Engineers, 1970, p. 383-390. 21 refs. Research supported by Boeing Co.

In the estimation of physiological parameters, visual fitting of experimental data has the obvious drawback that a given 'best-fit curve' is not equally satisfying to every observer. In this paper, iterative, weighted, nonlinear least-squares parameter estimation is applied to estimate the parameters of a portion of the human respiratory control system. In particular, the subsystem examined is that relating tidal volume to alveolar CO2 fraction. It is modeled by a transfer function which involves five parameters: two gain constants, two time constants, and a pure time delay, and is of the same form as that determined in an earlier study involving a visual fit. The estimation is based on sinusoidal steady-state magnitude and phase data for two human subjects. The details of the numerical procedure are discussed and possible extensions are indicated. Values of the parameters changed slightly, but not insignificantly compared with those previously obtained using visual fitting. Implications of the results are discussed in terms of the contributions, to the total ventilatory response, of individual variations of CO2 in brain arterial blood and cerebrospinal fluid. (Author)

A70-33323 Experimental investigation of the sampling hypothesis in the human motor control system. Gyan C. Agarwal (Illinois, University, Chicago, Ill.) and Gerald L. Gottlieb (Presbyterian-St. Luke's Hospital, Chicago, Ill.). In: American Automatic Control Council, Joint Automatic Control Conference, 11th, Georgia Institute of Technology, Atlanta, Ga., June 22-26, 1970, Preprints of Technical Papers. (A70-33301 16-10) New York, American Society of Mechanical Engineers, 1970, p. 391-399. 27 refs.

Some results of a physiological investigation of the sampling hypothesis in normal human subjects are presented in this paper. The hypothesis of a proprioceptively open loop system at the initiation of voluntary effort is not supported by the data. No discontinuity in the monosynaptic pathway (primary afferent fibers from the spindles to alpha motoneuron) is observed in random step tracking under isometric conditions. This would indicate that the sampling hypothesis at the alpha motoneuron as proposed by Navas and Stark is not valid. The sampling behavior in the human motor system must be of central origin. (Author)

A70-33340 A discrete stochastic optimal control model of the human operator. H. M. Paskin (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: American Automatic Control Council, Joint Automatic Control Conference, 11th, Georgia Institute of Technology, Atlanta, Ga., June 22-26, 1970, Preprints of Technical Papers. (A70-33301 16-10) New York, American Society of Mechanical Engineers, 1970, p. 640, 641. 7 refs.

A discrete stochastic optimal control model of the human operator is developed for the single-loop compensatory/pursuit tracking situation. The model generates signals corresponding to those in the physical closed-loop tracking situation. There is one primary model parameter which is varied to match model-experimental normalized root-mean-squared tracking error at a bandwidth of 1.0 rad/sec for an input which approximates a rectangular spectra. With this parameter fixed, the model then predicts normalized tracking error and power spectra of control loop signals across a range of input bandwidths of 0.5 to 2.0 rad/sec. The model is applied to simple first and second order controlled elements in both compensatory and pursuit display situations. A comparison between model and experimental normalized tracking error and power spectral density data confirms the model capability of matching and predicting operator performance with sufficient correlation to warrant its application as a tool in manual vehicular control system design. (Author)

A70-33341 Paper pilot - An application of pilot models to VTOL flying qualities evaluation. Ronald O. Anderson and James D. Dillow (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: American Automatic Control Council, Joint Automatic Control Conference, 11th, Georgia Institute of Technology, Atlanta, Ga., June 22-26, 1970, Preprints of Technical Papers. (A70-33301 16-10) New York, American Society of Mechanical Engineers, 1970, p. 643, 644. 9 refs.

Description of a new optimal, fixed-form, pilot model computer program dubbed the 'Paper Pilot,' developed as part of an Air Force Flight Dynamics Laboratory in-house program to draft a joint AF-Navy-Army flying qualities specification for V/TOL aircraft. The mathematical model used to develop the program is outlined, and a specific application of the program to the VTOL longitudinal control hover task is described. The results for the hover task provided by this method are shown to be excellent and indicate that the same approach can be successful in diverse applications. O.H.

A70-33459 Human factors requirements for electronic displays - Effects of S/N and TV lines-over-target. S. H. Levine, R. A. Jauer, and D. R. Kozlowski (McDonnell Aircraft Co., St. Louis, Mo.). In: NAECON '70; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 18-20, 1970, Proceedings. (A70-33426 16-14) Dayton, Ohio, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 247-252. 5 refs.

This study was performed as part of a McDonnell Aircraft Company Reconnaissance Laboratory program to determine the observer requirements for effective utilization of electronic reconnaissance displays. Twelve subjects viewed a high-fidelity reconnaissance TV display which simulated real time operations. Images having an average of 6, 9 and 11 TV lines-over-target successively appeared at S/N ratios of 4, 8, 16, 32, 64 and 100 to 1. The observer located discrete targets with one of three levels of response certainty; detection, recognition, or identification. Performance was measured in terms of correct responses and false alarms. Overall, as the S/N ratio and the TV lines-over-target increase and response certainty decreases, the number of correct responses goes up. False alarms remain constant for S/N ratios greater than 8:1 and TV lines-over-target, and go down with increases in response certainty. These data show that the most effective way to improve performance, increasing the number of correct responses while reducing or maintaining false alarms, is to increase the number of TV lines-over-target or the S/N ratio. An analysis of the display characteristics showed that resolvable lines over-target, a compound variable derived from the number of TV lines-over-target and display resolution as a function of the S/N ratio, had a high correlation with correct responses, accounting for 66% of the variance. Design criteria including display specification, performance prediction and tradeoffs between display resolution and scale can be derived from these data. (Author)

A70-33460 **A biologically derived model for image classification utilizing Walsh functions.** J. W. Carl (USAF, Air University, Wright-Patterson AFB, Ohio). In: NAECON '70; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 18-20, 1970, Proceedings. (A70-33426 16-14) Dayton, Ohio, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 253-259. 28 refs.

An image classification model based on cross-correlation and discrete Walsh-Fourier techniques is presented, and shown to have biological relevance. A review of some known properties of Walsh functions, and a discussion of sequency filtering are included. A computer simulation of the model (using hand-written capital letters as images) and the results obtained from the simulation are described. The conclusion is reached that discrete Walsh-Fourier transforms can be filtered to facilitate reliable automatic classification of alphabetic characters, and the conjecture is supported that other images may be similarly classified. (Author)

A70-33461 **A correlation of human and machine pattern discrimination.** Frank A. Maher (Bunker-Ramo Corp., Oak Brook, Ill.). In: NAECON '70; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 18-20, 1970, Proceedings. (A70-33426 16-14) Dayton, Ohio, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 260-264. 7 refs.

An initial attempt at validating a model for pattern information processing was undertaken. A pattern discrimination task involving 10 animal forms was performed by a computer simulation of the model and by a group of 46 human subjects. The degree of relationship between machine and human outputs was determined using statistical correlation methods. A Pearson correlation coefficient of .961 was calculated, supporting the validity of the model. The potential for using the model as a source for developing a metric for dealing with pattern information was discussed. Research directions for further model validation, as well as the metric development, were suggested. (Author)

A70-33463 **A discrete stochastic optimal control model of the human operator.** H. M. Paskin (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: NAECON '70; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 18-20, 1970, Proceedings. (A70-33426 16-14) Dayton, Ohio, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 270-276. 10 refs.

Development of a discrete stochastic optimal control model of the human operator for the single-loop compensatory/pursuit tracking situation. The model generates signals corresponding to those in the physical closed-loop tracking situation. There is one primary model parameter which is varied to match model-experimental normalized root-mean-squared tracking error at a bandwidth of 1.0 rad/sec for an input which approximates a rectangular spectra. With this parameter fixed, the model then predicts normalized tracking error and power spectra of control-loop signals across a range of input bandwidths of 0.5 to 2.0 rad/sec. The model is applied to simple first- and second-order controlled elements in both compensatory and pursuit display situations. A comparison between model and experimental normalized tracking error and power spectral density data confirms the model capability of matching and predicting operator performance with sufficient correlation to warrant its application as a tool in manual vehicular control system design. (Author)

A70-33515 # **Assessing the life support systems of the Ben Franklin submarine.** F. J. Abeles (Grumman Aerospace Corp., Bethpage, N.Y.). *American Society of Mechanical Engineers, Design Engineering Conference and Show, Chicago, Ill., May 11-14, 1970, Paper 70-DE-60.* 8 p. Members, $1.00; nonmembers, $2.00.

With a successful completion of the Gulf Stream Drift Mission, the Ben Franklin has more than proven itself. During this mission, a six-man crew was sustained for a little more than 30 days by a system that was quite unique in many respects. The system: (1) relied on natural convection for atmosphere control; (2) consumed essentially no electrical energy; (3) cost under $45,000 including expendables; (4) could have performed for 60 days, with minor modifications. (Author)

A70-33660 **Feedback analysis of learning and performance in steering and tracking behavior.** Karl U. Smith and Vernon Putz (Wisconsin, University, Madison, Wis.). *Journal of Applied Psychology,* vol. 54, June 1970, p. 239-247. 8 refs. Research supported by the Social and Rehabilitation Administration and NSF.

This experiment tested the assumption that steering and tracking behavior are interrelated in terms of the extent of self-produced stimulation involved in the two tasks. Steering was defined as involving maximal, and stimulus tracking as involving minimal levels of movement-regulated sensory information. Three tasks - that is, steering, as governed by breath-produced target movement, stimulus tracking, and a hand-yoked target control task - were compared under conditions in which the difficulty of the steering and stimulus tracking tasks were exactly equated. Results showed that steering performance was more accurate and learned more rapidly than stimulus tracking. Oscillograph records of all aspects of performance indicated that the two tasks differed psychophysiologically in terms of how the self-timed respiratory activities and the external manual-visual responses were continuously and dynamically interrelated to control visual input. The results thus suggest that the modes and conditions of feedback control of dynamic sensory input not only determine accuracy of performance and rate of learning: they also define how internally timed organic functions are integrated to determine learning in motor skills and other activities. (Author)

A70-33661 **Effects of altered display-control relationships on information processing from a visual display.** J. Richard Simon and John L. Craft (Iowa, University, Iowa City, Iowa). *Journal of Applied Psychology,* vol. 54, June 1970, p. 253-257. 6 refs.

This study was concerned with differential effects of five types of spatial incompatibility on reaction time (RT) to a visual display. Four display lights and four response buttons were arranged to form squares. The Ss reacted to the onset of a light by pressing the appropriate button. After performing a block of compatible trials (pressing the button in the position corresponding to the light), Ss responded again while thinking of the display panel as being reversed (top to bottom, left to right, or both) or rotated (90 deg clockwise or 90 deg counterclockwise). While all of the display manipulations produced significant slowing in RT, the 90 deg clockwise rotation caused the most difficulty. Apparently, this difficulty was related to the specific display-control relationship generated by the clockwise display rotation. (Author)

A70-33662 **Effects of feedback delay on eye-hand synchronism in steering behavior.** Patrick Coleman, Connie Ruff, and Karl U. Smith (Wisconsin, University, Madison, Wis.). *Journal of Applied Psychology,* vol. 54, June 1970, p. 271-277. 10 refs. Research supported by the Social and Rehabilitation Administration and NSF.

Real-time computer methods of controlling feedback factors in eye tracking were used to compare accuracy in tracking environmentally generated and hand-generated visual targets in steering behavior. Feedback delays of 0.1 and 0.2 sec between hand and target movement produced a time lag of eye motion with respect to the hand-produced target action. Results confirmed the assumption that steering and stimulus tracking represent different modes of response and are subject to different conditions of delay and displacement of action feedback of body movements. The main effect of feedback delays on eye tracking in steering was to restrict

the normal capability of the eye to predict the course of self-generated stimulus movements by reducing the interval of time between hand action and eye response beyond the magnitude of the actual delay interval. (Author)

A70-33664 Some persistent myths about military electronics maintenance. Nicholas A. Bond (Sacramento State College, Sacramento, Calif.). *Human Factors,* vol. 12, June 1970, p. 241-252. 15 refs.

This paper considers several propositions that are widely held among people concerned with the maintainability of complex equipments in a military environment. It appears that these propositions are often dubious and represent unrealistic views of hardware and human performance conditions. Finally, it is proposed that these propositions, or 'myths,' can be countered, not through 'selling maintainability' but via a strategy of education and involvement. (Author)

A70-33665 The field maintenance interface between human engineering and maintainability engineering. John E. Robinson, Jr., Walter E. Deutsch, and James G. Rogers (Hughes Aircraft Co., Fullerton, Calif.). *Human Factors,* vol. 12, June 1970, p. 253-259. 5 refs.

Field maintenance actions reported in a deployed air defense system were reviewed to determine and quantify (1) the nature of operator and maintainer influences on system malfunctions, and (2) the nature of man-machine problems being encountered by system personnel in actual diagnosis and repair activities. Maintenance events described in 213 problem reports from the field were categorized according to three probable sources of malfunction: primarily human, combination human and equipment, and primarily equipment. Human involvement in system malfunctions was clearly established in 25% of the events reported. Additional information contained in 21 documents analyzing system maintenance was examined. The nature of human influence on system malfunction is described by examples of 'unfortunate' field maintenance, 'ordinary' field maintenance, and troubleshooting deficiencies. The nature of reported man-machine problems highlighted the fact that human engineering participation in establishing maintainability design requirements can serve to make equipment that will be suitable to the presence and actions of human users. (Author)

A70-33666 # An evaluation of experimental how-malfunctioned codes. Nilss M. Aume and Donald A. Topmiller (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio). *Human Factors,* vol. 12, June 1970, p. 261-269. 6 refs.

In three learning-recall studies, the existing coding procedure by which Air Force maintenance technicians record and describe equipment malfunctions was compared to four experimental codes. The four three-symbol experimental codes included all numeric symbols, all alphabetical symbols, alphanumeric symbols, and a mnemonic code that had a high association value with the corresponding descriptor statements. Performance using the five experimental conditions was evaluated in three separate studies: first, under short-term recall, second, under paired-associate learning, and third, under long-term recall. All experiments demonstrated superior performance with the mnemonic code condition. The mnemonic codes produced approximately one-half the average error rate for short-term recall, were twice as easily learned, and achieved nearly half the error rate for long-term recall when compared to the existing coding technique. (Author)

A70-33667 # The status of maintainability models - A critical review. Russell L. Smith and Ronald A. Westland (Integrated Sciences Corp., Santa Monica, Calif.), and Billy M. Crawford (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). *Human Factors,* vol. 12, June 1970, p. 271-283. 76 refs. Contract No. AF 33(615)-69-C-1396.

Significant milestones in the development of maintainability assessment techniques are summarized. Maintainability models are critically reviewed in terms of general utility, ease of application, validity, and use of human engineering data. The capability of each model to be employed during various points in the system development cycle is evaluated with special consideration given to availability of model input data. Examples of potential model approaches are included. Survey results show continuing progress toward the potential development of efficient maintainability modeling techniques. However, increased effort is required to ensure the development of effective systems and to reduce maintenance costs. Emphasis is given to requirements for additional effort in (1) maintainability modeling early in the design process, (2) model validation, and (3) development of timely, valid input data. (Author)

A70-33668 # Human strength - Terminology, measurement, and interpretation of data. K. H. Eberhard Kroemer (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio). *Human Factors,* vol. 12, June 1970, p. 297-313. 76 refs.

Application of strength data to human engineering problems is often hampered by ambiguities of both terminology and data. This paper attempts to point out some of the problems. After defining 'strength' and clarifying related terms, mechanical, physiological, and statistical implications of strength testing are discussed. It becomes obvious that strength data are fully relevant to human engineering problems only if the operator must exert maximal static muscle force; if submaximal forces are required, the applicability of strength data is very limited. Research is needed to establish relations between human static force capacity and the abilities to perform maximal or submaximal dynamic work. At present there is little evidence that static force data accurately predict dynamic performance. (Author)

A70-33669 Maximizing human power output by suitable selection of motion cycle and load. J. Y. Harrison (New South Wales, University, Sydney, Australia). *Human Factors,* vol. 12, June 1970, p. 315-329. 18 refs.

In this paper various factors affecting human power output are discussed, including the mechanical properties of muscle, the geometry of the input motion and the kinematics of the input motion. A multipurpose ergometer, designed and built to take account of these factors is described. Two basic motions are possible on the ergometer: cycling and rowing. The rowing motions may be made with any combination of seat and feet either sliding or fixed. In the rowing motions, during a single to and fro cycle, prescribed variations in velocity of the input links can be forced on a subject. Experimental work, which is described, showed that there are considerable differences in the effectiveness of the various ways of working, and that one in particular, a modified rowing motion, allowed the production of greater average amounts of power for periods up to two minutes than have so far been recorded and published (to the author's knowledge). (Author)

A70-33670 Discrete tracking performance with limited velocity resolution. James G. Rogers (Hughes Aircraft Co., Fullerton, Calif.). *Human Factors,* vol. 12, June 1970, p. 331-339. 10 refs.

Advances in the design of radar data processing and display systems have resulted in certain nonlinearities in the response of the displayed cursor to a manual input. This paper examines the effects upon target acquisition time, in a simulated air defense environment, of (1) a low-velocity 'dead zone' for which no cursor movement occurs, and (2) quantization of control velocity into a small number of discrete cursor velocities. Resulting decrements in acquisition latencies are given as functions of tracking distance and direction. A rolling ball control is used. (Author)

A70-33675 Consideration of the training of line pilots at Montpellier and St-Yan (A propos de la formation des pilotes de ligne à Montpellier et St-Yan). Roger Coroli. *Secrétariat Général à*

l'Aviation Civile, Revue, June 15, 1970, p. 10-57. In French.

Review of the training program for airline pilots as carried out at Montpellier and St-Yan. The basic requirements for entering the program are a degree in basic mathematics and a good knowledge of English. Potential line pilots are recruited competitively, and their training is under the sole control of the Ecole Nationale de l'Aviation Civile, although most pilots will have served with the Armée de l'Air. An airline pilot's license requires 1200 hours of actual flight under varied conditions. In addition to actual flying training, work is carried out at St-Yan and Montpellier on sophisticated simulators.

F.R.L.

A70-33689 Differential effects of threat-induced stress on tracking performance. Bengt Bergstroem (Institute of Military Psychology, Stockholm, Sweden). *Perceptual and Motor Skills,* vol. 30, June 1970, p. 811-820. 6 refs. Research supported by the Swedish Armed Forces.

Tracking performance in position, rate, and acceleration control systems was studied experimentally under short-term psychological stress induced by electric shocks. 30 army conscripts were divided into 3 matched groups which trained 1, 3, and 13 hr on the tracking tasks. It was hypothesized that performance decrements under stress would be greater for the more complex and less well learned tasks. The results showed significant tracking impairment of roughly the same order of magnitude for the three systems and learning levels, thus the hypotheses were rejected. Plots of heart rate against performance indicated a linear relation, which was interpreted as a partial confirmation of the activation theory. Adaptation to stress was rapid. (Author)

A70-33696 # The effect of varied electrical stimulation in the rostromedial hypothalamus upon thermogenesis of juvenile rats (Über die Wirkung variierter elektrischer Reizung im rostromedialen Hypothalamus auf die Thermogenese juveniler Ratten). P. Bartsch (Berlin, Humboldt-Universität, Berlin, East Germany) and H. Choinowski. *Acta Biologica et Medica Germanica,* vol. 24, no. 3, 1970, p. 277-287. 27 refs. In German.

Study of the effect of electrical stimulation of the Area praeoptica medialis and adjacent cerebral structures in juvenile rats. The tests were conducted in a hypothermic and in a hyperthermic group of rats. The animals were stimulated by 4, 8, 12, 16 and 20 alternating impulses/sec. Parameters of response studied included the dynamic behavior of oxygen uptake during and following a 10 min period of stimulation, and the behavior of rectal and skin temperature above back and belly, which were used to calculate the controlled heat transfer at the trunk. G.R.

A70-33697 # The integrating influence of mediorostral hypothalamic structures upon temperature regulation of the juvenile rat (Zur integraviten Funktion mediorostraler Hypothalamusstrukturen auf die Temperaturregulation der juvenilen Ratte). *Acta Biologica et Medica Germanica,* vol. 24, no. 3, 1970, p. 289-300. 23 refs. In German.

Study of the integrating influence of mediorostral hypothalamic structures upon temperature regulation of the juvenile rat on the basis of tests involving the stimulation of the Area praeoptica medialis of ten juvenile albino rats through implanted electrodes. Twelve alternating impulses/sec were applied (0.3 mA, 70 msec), under gradual warming up (+ 2 deg C/hr at regular intervals for 10 min). The animals were allowed to recover for 20 min. Criteria of response included oxygen uptake, rectal temperature and heat transfer at the abdominal wall. G.R.

A70-33707 Astronaut maneuvering research vehicle. J. Robert Tewell (Martin Marietta Corp., Denver, Colo.). In: Technology today and tomorrow; Canaveral Council of Technical Societies, Space Congress, 7th, Cocoa Beach, Fla., April 22-24, 1970, Proceedings. Volume 1. (A70-33701 16-30) Edited by T. H. Hanrahan. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1970, p. 1-81 to 1-88.

The astronaut maneuvering research vehicle (AMRV) for use in the Skylab Experiment M509, astronaut maneuvering equipment, is described. The AMRV enables investigation of several maneuvering devices and mobility techniques. The AMRV consists of two maneuvering unit configurations; a hand held maneuvering unit (HHMU) which provides manually oriented variable thrust control and an automatically stabilized maneuvering unit (ASMU) which provides fixed thrusters and three selectable attitude control and stabilization modes. (Author)

A70-33709 * Off-duty concepts for long duration space missions. Edward W. Karnes, Leonard A. Loudis, J. Dirby Thomas (Martin Marietta Corp., Denver, Colo.), and Thomas Spiritoso (Temple University, Philadelphia, Pa.). In: Technology today and tomorrow; Canaveral Council of Technical Societies, Space Congress, 7th, Cocoa Beach, Fla., April 22-24, 1970, Proceedings. Volume 1. (A70-33701 16-30) Edited by T. H. Hanrahan. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1970, p. 4-15 to 4-27. Contract No. NAS 8-24000.

Leisure time preferences were surveyed in three populations which are potential sources of future spacecrew candidates: test pilots, military pilots and aerospace engineers and scientists. A questionnaire designed to provide rating scale measures of preferences for various types of spacecraft recreational equipment items, leisure time activity categories, content within activity categories, and various kinds of snack items was administered to the samples from the three populations. The results indicated that leisure time preferences in the three populations were quite similar. Representative spacecraft off-duty concepts for long duration space missions and possible engineering constraints are discussed. (Author)

A70-33948 * # Thermal behavior of biological media. John C. Chato and Bruce A. Hertig (Illinois, University, Urbana, Ill.). *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 5th, Los Angeles, Calif., June 29-July 1, 1970, Paper 70-813.* 10 p. 34 refs. Members, $1.00; nonmembers, $1.50. Grant No. NGR-14-005-103.

This paper deals with some of the thermal problems related to living systems, particularly man, wherein maintenance of nearly constant internal temperature under widely varying conditions is essential. First, the physiology of temperature regulation is reviewed to present background for 'engineering models.' Second, steady state, distributed-parameter models are developed to describe energy transport phenomena occurring within the tissue and also between the skin surface and the immediate environment, such as cooling tubes in space suits. Third, models of transient behavior of the entire body are described. These are basically of the lumped-element type, with each element representing some arbitrary portion of the body.

(Author)

A70-33974 * Signal recognition as influenced by information feedback. T. A. Tanner, Jr., J. A. Rauk (NASA, Ames Research Center, Moffett Field, Calif.), and R. C. Atkinson (Stanford University, Stanford, Calif.). *Journal of Mathematical Psychology,* vol. 7, June 1970, p. 259-274. 9 refs.

Eight human observers were tested on a signal recognition task involving two tones of different amplitudes. The independent variables were (1) three binomial schedules for presenting the two signals, with parameter values 0.2, 0.5, and 0.8, and (2) four conditions varying the information given to an observer about the signal presentation schedules. The information that an observer was given about the presentation schedules markedly influenced hit and false alarm rates (the probabilities of reporting a loud signal when a loud and soft signal, respectively, occurred). The influence of the preceding trial's signal and response on hits and false alarms also varied as a function of both the presentation schedule and the information

given about the schedules. A mathematical model of signal recognition is shown to provide a fairly accurate account of the various conditions investigated. (Author)

A70-33991 * Human circadian circulatory rhythms during weightlessness in extraterrestrial flight or bedrest with and without exercise. Franz Halberg (Minnesota, University, Minneapolis, Minn.), Carlos Vallbona (Baylor University; Texas Institute for Rehabilitation and Research, Houston, Tex.), Lawrence F. Dietlein, John A. Rummel, Charles A. Berry (NASA, Manned Spacecraft Center, Houston, Tex.), Grover C. Pitts, and Sarah A. Nunneley (Ohio State University, Columbus, Ohio). *Space Life Sciences,* vol. 2, May 1970, p. 18-32. 32 refs. PHS Grants No. 5-K6-GM-13,981; No. FR-00254; Grant No. NGR-24-005-006; Contracts No. NAS 9-6162; No. NAS 2-1554; No. NAS 2-2738.

Detection of human circadian rhythms in heart rate and in the durations of electromechanical systole and of the entire cardiac cycle by an inferential statistical analysis, the cosinor method. These findings apply to men on earth in bed for several days, whether or not they intermittently perform isometric exercise. Rhythms also are demonstrated in men at a few hundred nautical miles from earth experiencing weightlessness for several days during extraterrestrial space flight; whether or not these circadian rhythms are 24-hour synchronized cannot be discussed with the data on hand. Such demonstrations of rhythm persistence in astronauts and cosmonauts underline the need for further work on mammals to define and to control those rhythmic factors affecting not only the longer-term scheduling of human activities in extraterrestrial space but also rhythmic behavior in health and disease on earth Given such background information, the long-term behavior of rhythms in organisms transferred to terrestrial, lunar, and eventually solar orbits remains a major challenge for research in extraterrestrial space. M.V.E.

A70-33992 * Multi-purpose monitoring of carbon dioxide in closed organism-environment systems. Maurice Stupfel (Centre de Recherches sur la Pollution Atmosphérique, Le Vésinet, Yvelines, France), Walter Nelson, Julia Halberg, and Franz Halberg (Minnesota, University, Minneapolis, Minn.). *Space Life Sciences,* vol. 2, May 1970, p. 33-39. 25 refs. PHS Grant No. 5-K6-GM-13,981; Grant No. NGR-24-005-006; Contracts No. NAS 2-2738; No. AF 29(600)-69-C-0011.

Carbon dioxide output monitoring from biosatellites and the analysis of such data by circadian rhythmometry can serve the double purpose of (1) documenting an interesting aspect of circadian system behavior in extraterrestrial space while (2) gauging at the same time an important function of the life support system. Groundwork here analyzed shows circadian CO2 output endpoints and an acrophase-map of other rhythmic variables in the mouse. (Author)

A70-33993 Basic studies on Hirudo medicinalis for a space experiment. I - Behavior of Hirudo medicinalis in natural environments. R. G. A. Lotz, M. E. A. Fuchs, and P. E. A. Moyat (Frankfurt, Universität, Frankfurt am Main, West Germany). *Space Life Sciences,* vol. 2, May 1970, p. 40-44. 9 refs.

Discussion of the preparations for a biological satellite experiment of one year duration proposed for studying the effects of long term weightlessness on metabolism and biological rhythms. The medical leech, Hirudo medicinalis, is to be used as the experimental animal. Accomplished and ongoing basic studies are described of the experimental animal's behavior under normal conditions and of numerous physiological parameters that must be known in order to evaluate the effects of space flight. Among such studies are recently conducted experiments to establish the techniques to be used for killing the microorganisms that are on the skin of the leech and those that are released from the internal organs of the leech. Such techniques will be used in the flight experiment to prevent the build-up of O2-consuming microorganisms. M.V.E.

A70-33994 Basic studies on Hirudo medicinalis for a space experiment. II - Behavior of Hirudo medicinalis in unnatural environments. R. G. A. Lotz and G. H. Bowman (Frankfurt, Universität, Frankfurt am Main, West Germany). *Space Life Sciences,* vol. 2, May 1970, p. 45-47.

Review of the basic studies conducted on the behavior of Hirudo medicinalis in unnatural environments in preparation for a long-term biological satellite experiment. Most of the environments selected were those that could arise in the course of the experiment in space and be properly simulated in the laboratory. Upper and/or lower endurable limits of temperature, humidity, O2 pressure, CO2 concentration, and calcium hydroxide concentration in water were determined, along with the effects of vibration, acceleration, and mechanical shock. Though tests conducted so far are not all inclusive, it is felt that the leech can survive the rigors of spaceflight without deleterious effects and that this animal is well suited for long term biological space experiments. M.V.E.

A70-33995 * Microbial contamination associated with the Apollo 6 spacecraft during final assembly and testing. John R. Puleo, N. D. Fields (U.S. Public Health Service, Spacecraft Bioassay Laboratory, Cape Kennedy, Fla.), B. Moore (Minnesota, University, Minneapolis, Minn.), and R. C. Graves (NASA, Manned Spacecraft Center, Houston, Tex.). *Space Life Sciences,* vol. 2, May 1970, p. 48-56. 8 refs.

The National Aeronautics and Space Administration (NASA) requires that microorganisms which could contaminate the surface of the moon as the result of lunar missions be enumerated and identified so that life forms in lunar materials returned to earth may be more easily recognized as being of native or terrestrial origin. Assessment of microbial contamination in the intramural environments used for the assembly and test of the manned lunar spacecraft (Apollo) was made using fallout strips and air samplers. Microbial contamination on the surfaces of Apollo Command and Lunar Modules was determined by use of the swab-rinse method. Preliminary results indicate that the levels of microbial contamination which accumulated on exposed stainless steel surfaces, as well as airborne microbial contamination in the high bay assembly areas, were similar to those encountered in the unmanned spacecraft assembly areas. However, higher levels of microbial contamination were detected on the Apollo spacecraft than on the unmanned lunar spacecraft. (Author)

A70-33996 * Biochemical and metabolic effects of a six-month exposure of small animals to a helium-oxygen atmosphere. Robert W. Hamilton, Jr., Janis D. Cohen, Gerald F. Doebbler, Lorenzo F. Exposito, John M. King, Kent H. Smith, and Heinz R. Schreiner (Ocean Systems, Inc., Tarrytown, N.Y.). *Space Life Sciences,* vol. 2, May 1970, p. 57-99. 56 refs. Contract No. NAS 2-3900.

Investigation of the physiological effects of long-duration exposure of higher animals to helium in a helium-oxygen atmosphere. Rats and mice were exposed for periods of up to six months and two successive generations of mice were raised in a ground-level chamber system filled with 80% helium and 20% oxygen at 24 C. A duplicate chamber for controls contained a comparable nitrogen-oxygen mixture, and in both the other environmental parameters were well controlled and nearly identical. Animals adapted to helium showed no greater increase in oxygen consumption when placed in helium-oxygen than did those raised in air. Growth rates were identical, but the helium mice consumed more food and water. Selected biochemical analyses were made on the parent and two successive generations of mice. These included blood indices; electrophoretically separated tissue protein pattern form liver, skeletal muscle, and cardiac muscle; quantitative determination of LDH, MDH, and G6PDH from the same tissues; serum insulin; and semiquantitative histochemical estimates of liver glycogen. No cases of statistically significant difference or consistent trends were seen between the experimental environmental groups. It is concluded that prolonged exposure to helium-oxygen, relative to air, does not produce detectable changes

in several key subcellular factors which might be altered by serious metabolic disturbances, and therefore the helium exposure is well tolerated. M.V.E.

A70-33997 The effect of positive pressure breathing on the cerebral circulation and the content of catecholamines in hypothalamus and adrenals. Aleksandar I. Radović, Jovan M. Davidović, and Vukosava S. Davidović (Institute of Aviation Medicine, Zemun, Yugoslavia). *Space Life Sciences,* vol. 2, May 1970, p. 100-108. 21 refs.

Arterial pressures in the Circle of Willis were measured in dogs subjected to positive pressure breathing. Catecholamines in hypothalamus and adrenals were measured in sacrificed animals. Pathologic changes in brain tissue were demonstrated. Pressure changes and catecholamine variations are discussed. (Author)

A70-33998 * Photoelectric device for recording of leaf movements (Research Note). T. W. Tibbitts, D. K. Alford (Wisconsin, University, Madison, Wis.), and T. Hoshizaki (California, University, Los Angeles, Calif.). *Space Life Sciences,* vol. 2, May 1970, p. 109-112. 6 refs. NASA-PHS-supported research.

Description of a photoelectric device that may have usefulness for sensing rhythmic leaf movements of plants in space experiments. The system provides an instantaneous record of the precise angular change in position of the leaf blade and avoids physical attachment of disturbance of the plant. This system has been utilized to record leaf movements for several weeks. The device is sufficiently sensitive to record small rapid oscillations by the leaf of only 2 deg angular movement. (Author)

A70-33999 A miniaturized pump oxygenator for evaluation of peripheral circulatory changes induced by long-term weightlessness in rats. V. P. Popovic, J. Horecky, and P. Popovic (Emory University, Atlanta, Ga.). *Space Life Sciences,* vol. 2, May 1970, p. 113-115.

Description of techniques for studying the effects of long-term weightlessness on the cardiovascular system in small laboratory animals. These techniques developed in the laboratory are to be employed in control experiments on earth and during actual spaceflights. The aorta and right ventricle of the animals are permanently cannulated permitting the use of direct methods for cardiovascular evaluations. It has been shown that the physiological and psychophysiological state of the cannulated animals is unchanged as compared to uncannulated animals. As a next step in complementing the necessary technique, a small membrane type heart-lung machine for white rats was developed. After cannulation, the animals are connected to the pump oxygenator. The extracorporal blood flow of rats during bypass is 70-80% of the total cardiac output. The survival of animals is 100% for 1-hr bypass. It is believed that this technique will permit proper evaluation and separation of changes induced by long-term weightlessness on peripheral circulation from changes induced upon the heart itself. M.V.E.

A70-34247 An asymptotic solution of a class of nonlinear wave equations - A model for the human torso under impulsive stress. J. D. Murray and A. B. Tayler (Oxford University, Oxford, England). *SIAM Journal on Applied Mathematics,* vol. 18, June 1970, p. 792-809. 11 refs. NSF Grant No. GK-2318.

Study of nonlinear wave motion taking into consideration a specific class of equations which is derived from a model for the effect on the human body of subjecting it to rapidly varying stress and velocity gradients along the spine. Accelerations occur in situations connected with parachute landings, manned launchings and pilot ejector systems. Second order nonlinear hyperbolic equations with given smooth initial data which give rise to discontinuous solutions are investigated. The effect of including a third order damping term is discussed. Two typical examples are given and general conclusions as to the possible avoidance of spinal damage in practical situations are made. G.R.

A70-34256 Hypoxia, ventilation, P sub CO2 and exercise. N. K. Bhattacharyya, D. J. C. Cunningham, R. C. Goode, M. G. Howson, and B. B. Lloyd (Oxford University, Oxford, England). *Respiration Physiology,* vol. 9, June 1970, p. 329-347. 50 refs. Research supported by the Department of National Health and Welfare of Canada.

Determination of the acid-base state of the blood, the carbon dioxide partial pressure and ventilation in 7 subjects during rest and mild exercise under hyperoxia and mild hypoxia. A large increase in ventilation is established under mild hypoxia during light exercise when the CO2 partial pressure is near the resting CO2 threshold. The relation between ventilation and CO2 partial pressure was steadily nonlinear in 4 subjects but was linear in the other 3 subjects. In the venous blood of all subjects there was no evidence of metabolic acidaemia but a tendency toward metabolic alkalaemia. V.Z.

A70-34257 Theoretical considerations on the response of lung tissue to the acceleration of gravity. Giorgio Brandi (McGill University, Montreal, Canada). *Respiration Physiology,* vol. 9, June 1970, p. 356-370. 12 refs. Research supported by the John A. Hartford Foundation and the Medical Research Council of Canada.

Discussion of the physical foundation of the contentions of Krueger et al. (1961) that the response of the lungs to acceleration is similar to that of a fluid and that lungs retain the same mean density during acceleration. The validity of the first contention is sustained by the fact that lungs are enclosed by the far more rigid chest wall so that 'shear' supporting forces may be in this case negligible as they are in fluids. The second contention is found theoretically untenable and is substituted by the assumption that the density of any horizontal layer of a lung is related to the corresponding recoil in the same fashion throughout the whole lung. V.Z.

A70-34315 # Biological aspects of long-term space flight. P. Molton (Queen Elizabeth College, London, England). *British Interplanetary Society, Journal,* vol. 23, July 1970, p. 515-526. 45 refs.

Hydrogenomonas and Chlorella life-support systems for spacecraft are compared and discussed in relation to human requirements and the type of equipment needed to maintain a stable and balanced food supply on long-duration space missions. Some disadvantages of purely chemical systems are indicated. None of the systems yet tried can provide complete regeneration or utilize solid human waste directly. A possible solution to the problem is the thermal destruction of solid wastes and the use of a series of specific microorganisms in continuous culture, providing flexibility and variety. Possible long-term metabolic effects of space flight on humans are indicated, particularly with regard to circadian rhythms. Possible use of deep hypothermia in space is discussed. (Author)

A70-34319 * Conversion of glucose-14C(UL) to 14CO2, 14C-glycogen, and 14C-fatty acids in the partially hepatectomized rat. E. D. Neville, K. S. Talarico, and D. D. Feller (NASA, Ames Research Center, Environmental Biology Div., Moffett Field, Calif.). *Society for Experimental Biology and Medicine, Proceedings,* vol. 134, June 1970, p. 372-379. 16 refs.

Study of the relative role of plasma free fatty acids and plasma glucose in contributing to the metabolic state and energy production in the two-thirds hepatectomized rat. An experiment is described in which partially hepatectomized rats and sham-operated controls were injected with glucose-14C(UL) to determine its conversion to 14CO2, 14C-glycogen, and 14C-fatty acids. The results are presented, discussed, and summarized. O.H.

A70-34320 * **The importance of dispensable amino acids for maximal growth in the rat.** Q. R. Rogers (California, University, Davis, Calif.), D. M-Y. Chen (MIT, Cambridge, Mass.), and A. E. Harper (Wisconsin, University, Madison, Wis.). *Society for Experimental Biology and Medicine, Proceedings,* vol. 134, June 1970, p. 517-522. 16 refs. Research supported by the National Livestock and Meat Board; Grant No. NsG-496; Contract No. AF 33(615)-2924.

Investigation of the requirements of the rat for the dispensable amino acids. A description is given of the experimental procedure carried out in rats which were fed a basal amino acid mixture, with different proportions of the dispensable amino acids in the mixture for each experiment. By analyzing the results, combinations of dietary amino acids which allow maximum growth in the rat when one or more of the dispensable amino acids is completely absent are presented. O.H.

A70-34346 # **Adaptation of man to cold environments - Ergonomic and medicomilitary aspects (L'adaptation de l'homme aux environnements froids - Aspects ergonomiques et médico-militaires).** R. Henane (Ministère des Armées, Service de Santé des Armées, Paris, France). *Revue des Corps de Santé des Armées,* vol. 11, Apr. 1970, p. 129-149. 24 refs. In French.

Analysis of mechanisms of adaptation to cold in humans, their induction by natural or artificial means, and the benefits which can be derived from them. The role of metabolic reactions and physical reactions of isolating type in protecting the human organism from extreme cold is discussed. The physiological bases of clothing protection are outlined, and the mechanism of cold acclimatization in man is explained. The problem of providing appropriate protection for troops in a given cold environment during a given mission is considered from the standpoint of ensuring maximum work efficiency of the troops. Methods of selecting personnel for service in cold regions and of determining their aptitude for such service are described, and some recommendations are made concerning the training and acclimatization of such personnel to conditions of extreme cold. A.B.K.

A70-34347 # **Disadaptation in fighter pilots (La désadaptation du pilote de chasse).** J.-C. Lachaud and P. Osouf (Ministère de l'Air, Centre Médical de Psychologie Clinique, Paris, France). *Revue des Corps de Santé des Armées,* vol. 11, Apr. 1970, p. 161-171. In French.

Outline of the symptomatic manifestations of disadaptation or 'demotivation' in fighter pilots, and study of the circumstances under which such manifestations occur. Manifestations of purely medical nature are considered, such as chronic fatigue, digestive disorders, and feelings of anxiety, as well as manifestations of professional nature, such as absenteeism, loss of efficiency, and proneness to accidents. Causes of such manifestations traceable to difficulties in the subject's professional or family life or due to advancing age are considered. An attempt is made to isolate the factors governing the motivation of fighter pilots and the processes of adaptation and disadaptation in such pilots. Some remarks are made concerning the detection of disadapted pilots and their classification according to degree of inaptness. A.B.K.

A70-34348 # **Current value of the vital capacity in biotypological examinations of young adults (Valeur actuelle de la capacité vitale dans l'examen biotypologique du jeune adulte).** J. Guillermand (Ministère des Armées, Hôpitaux des Armées, Paris, France). *Revue des Corps de Santé des Armées,* vol. 11, Apr. 1970, p. 191-216. 84 refs. In French.

Evaluation of measurements of vital capacity in young recruits as a means of studying the respiratory function. The equipment required for performing such measurements and the procedure employed are described, and certain factors entering into the interpretation of the resulting data are cited. Vital capacity functions determined theoretically by a large number of authors as a function of body height and weight are presented. The results of a study of correlations in a group of young recruits are summarized and evaluated. A.B.K.

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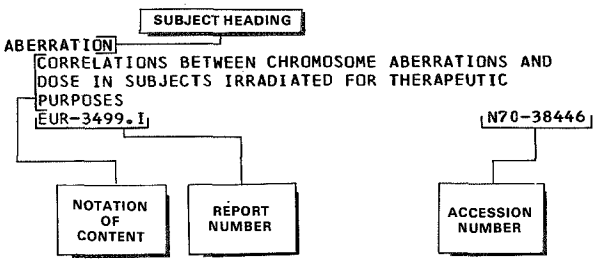

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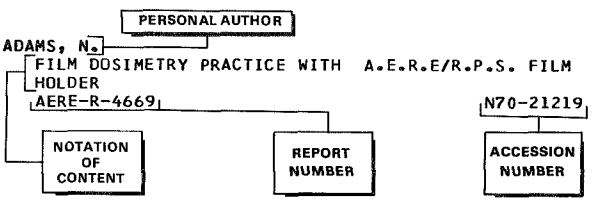

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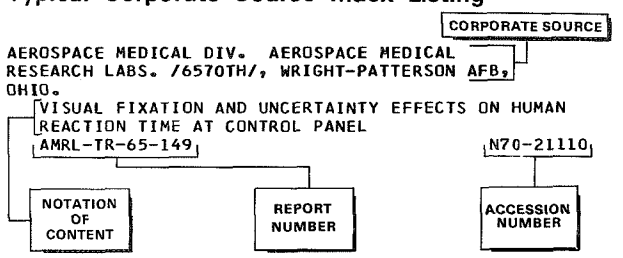

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