AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA Information System during March 1967

Scientific and Technical Information Division
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. APRIL 1967

INTRODUCTION

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 Aerospace Medicine and Biology Bibliography Project of the Library of Congress (LC), the American Institute of Aeronautics and Astronautics (AIAA), and NASA. 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. The contents of this issue are comprised of abstracts that were prepared by the three contributing organizations.

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

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c. LC entries identified by a number in the A67-80000 series.

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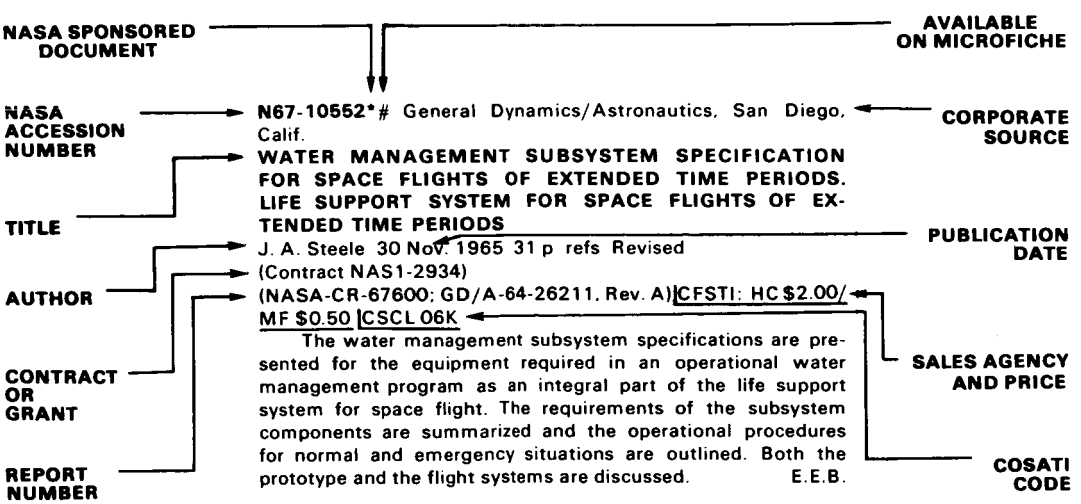

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AEROSPACE MEDICINE AND BIOLOGY

a continuing bibliography APRIL 1967

STAR ENTRIES

N67-14373# Library of Congress, Washington, D. C. Aerospace Technology Div.

HEMODYNAMIC INDICES DURING THE ACTION OF SUPER-HIGH FREQUENCY ELECTROMAGNETIC FIELDS

Surveys of Foreign Scientific and Technical Literature

Sheila Penners 5 Oct. 1966 8 p refs Transl. into ENGLISH from Gigiena Truda i Prof. Zabolevaniya (Moscow), no. 7, 1966 p 18–21

(ATD-66-123)

Hemodynamic indices as minute blood volume, peripheral resistance, average and actual arterial pressure, and the degree of tonic strain in the smooth muscle of various vessels were recorded using a mechanocardiograph in order to determine the effect of super high frequency radiation on the human cardiovascular system. Data obtained showed that exposure to SHF of considerable intensity not only causes pathological changes in the nervous system, but brings about deviations in the functional state of the circulatory system as well. In the clinical picture of patients with moderate and pronounced symptoms of SHF exposure, neurocirculatory disorders with a tendency to hypertension were dominant. Analysis of pulse-wave velocity in myogenic and elastic type vessels, of the elasticity modulus, and of the ratio between the elastic moduli of the two types of vessels indicated that the elasticity of the walls of myogenic type vessels increases during all stages of chronic exposure to SHF electromagnetic fields. Data on peripheral resistance showed increased resistance in the precapillary system, and EKG analysis revealed changes in intra-cardiac conductivity and sinus bradycardia, due apparently to disturbances in the extracardiac regulation of cardiac activity. Although a firm correlation between hemodynamic disorders and pathological deviations due to SHF exposure could not be established, changes in hemodynamic indices were found to occur much more frequently in subjects with moderate and pronounced symptoms of exposure. S.C.W.

N67-14375# Joint Publications Research Service, Washington, D. C.

PRINCIPLES OF CONTROL SCIENCES APPLIED TO FIELD OF BIOLOGY AND MEDICINE

5 Dec. 1966 35 p Transl. into ENGLISH from Nauka i Tekhn. (Riga), No. 8, Aug. 1966

(JPRS-38959; TT-66-35382) CFSTI: $2.00

CONTENTS:

N67-14376# Joint Publications Research Service, Washington, D. C.

FEEDBACK IN A COMMUNITY OF ORGANISMS

G. Sabardina *In its* Principles of Control Sci. Appl. to Field of Biol. and Med. 5 Dec. 1966 p 1–5 (See N67-14375 05-04) CFSTI: $2.00

A discussion of inherent problems associated with disturbing the life and development of symbiotic associations of plants and animals with their environment is presented. Emphasized is the importance of the self-regulating mechanism of living organisms which is realized with the help of feedback acting from the output to the input. The essence of this feedback includes the fact that part of the synthesized organic matter (in the form of droppings subject to the effect of microorganisms, and in the form of primordium of living plants) being converted into resources of one and the same community, insures it further life and development. The advantages of understanding such associations between living organisms and their environment are discussed in view of their importance to: (1) The formation of methods for controlling the development of biocoenosis which are based on an understanding of those mechanisms which may have a regulatory significance; (2) The determination of the fertility and productivity of forests, farm lands, and reserves of natural resources; and (3) The development of controlled methods for transplanting new plant forms and introducing new breeds of domestic animals into environments which are foreign to their native habitats. S.C.W.

N67-14377# Joint Publications Research Service, Washington, D. C.

MODERN MATHEMATICS AND BIOLOGY

L. Rastrigin *In its* Principles of Control Sci. Appl. to Field of Biol. and Med. 5 Dec. 1966 p 6–9 (See N67-14375 05-04) CFSTI: $2.00

Problems associated with the reluctance of biologists to adopt mathematical methods in biological theory and practice are discussed. Difficulties in the formalization of biological objects and the specificity of modern mathematics are considered the primary causes underlying the prejudice of biologists against modern mathematics. The applicability of divisions of modern mathematics which may be used by biologists such as the theory of adaptation, the probability theory, the extrapolation theory, and their divisions;

are discussed. It is concluded that modern mathematics has at its disposal resources which may be used by biologists and medical men. These resources are quite strong and effective and they cannot be neglected. Inadequate use of these divisions of modern mathematics by medicine and biology leads to intolerable expenditures of efforts and resources. On the other hand, biology needs a special mathematics which would be more adaptable to the description of the behavior of biological systems. Both problems may be solved only by timely symbiosis of mathematics and biology. This symbiosis at the present time must be considered the most progressive form of existence both of biology and mathematics. S.C.W.

N67-14378# Joint Publications Research Service, Washington, D. C.

USE OF LINEAR CORRELATION METHODS IN VARIOUS SCIENCES

I. Rabinovich *In its* Principles of Control Sci. Appl. to Field of Biol. and Med. 5 Dec. 1966 p 10–16 (See N67-14375 05-04) CFSTI: $2.00

The use of the method of least squares by mathematicians for determining the relationship between a set of given values based on data from observations is discussed. Emphasized is the need for nonmathematicians, such as animal breeders, to consider the question of probability when dealing with problems of cause and effect. It is further noted that in the problem of cause and effect it is impossible to rely on the correlation coefficient since in most cases the assumption of a so-called linear dependency between the variables drops out. The need for a better understanding of the principles, language, and limitations of mathematics by the nonmathematician is also emphasized. S.C.W.

N67-14379# Joint Publications Research Service, Washington, D. C.

EFFECTS OF CHEMICALS ON MENTAL PROCESSES DESCRIBED

I. Lapin and Yu. Nuller *In its* Principles of Control Sci. Appl. to Field of Biol. and Med. 5 Dec. 1966 p 17–27 (See N67-14375 05-04) CFSTI: $2.00

Problems related to testing the effect of new psychotropic drugs on human mental processes on the basis of studies of the emotional reactions of laboratory animals are discussed. It is surmised that although it is possible on the basis of psychopharmalogical tests to propose one effect or another of a new compound on the human mind, the final word belongs to research performed on the mentally ill. It is further noted that: (1) The positive effect of the medicine frequently depends not so much on its chemical effect as on the belief of the patient in it; that is, in the final analysis on factors of suggestion and autosuggestion; and (2) It is necessary to treat people not only with tablets but also with kind words, concern, attentiveness, and it is also necessary to win their confidence if a good medicine is to be effective. S.C.W.

N67-14381# Joint Publications Research Service, Washington, D. C.

ELECTRONIC AIDS FOR THE PHYSICIAN

M. L. Bykhovskiy et al 8 Dec. 1966 47 p refs Transl. into ENGLISH of the Book "Elektronnyye Pomoshchniki Vracha: Problemy Biologicheskoy Kibernetiki" Moscow, Znaniye Publishing House, 1966 p 1-43
(JPRS-30923; TT-66-35446) CFSTI: $2.00

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1. INTRODUCTION V. V. Parin p 1–3 (See N67-14382 05-04)

2. THE UNION OF CYBERNETICS AND BIOLOGY A. A. Malinovskiy p 4–11 (See N67-14383 05-04)

3. BIOCURRENTS IN THE SERVICE OF MEDICINE V. S. Gurfinkel p 12–18 (See N67-14384 05-04)

4. A MACHINE MAKES THE DIAGNOSIS M. L. Bykhovskiy p 19–24 (See N67-14385 05-04)

5. IS IT POSSIBLE TO SIMULATE CONSCIOUSNESS AND FEELING? A. G. Spirkin p 25–37 refs (See N67-14386 05-04)

N67-14382# Joint Publications Research Service, Washington, D. C.

INTRODUCTION

V. V. Parin *In its* Electron. Aids for the Physician 8 Dec. 1966 p 1–3 (See N67-14381 05-04) CFSTI: $2.00

Reasons are given for presenting the cybernetics approach to the study of vital processes. Also given is a discussion of what this approach has to offer the theory and practice of biology and medicine. Such areas as control in organisms, transient states, biological regulation, and process simulation are considered in discussing some general assumptions of physiological cybernetics. C.T.C.

N67-14383# Joint Publications Research Service, Washington, D. C.

THE UNION OF CYBERNETICS AND BIOLOGY

A. A. Malinovskiy *In its* Electron. Aids for the Physician 8 Dec. 1966 p 4–11 (See N67-14381 05-04) CFSTI: $2.00

A discussion is given of the role cybernetics plays in the study of biology. Emphasis is placed on the concept of direct communications and feedback in order to regulate the course of a process. Examples are given which show the significance of the corpuscular structure of systems of evolution. C.T.C.

N67-14384# Joint Publications Research Service, Washington, D. C.

BIOCURRENTS IN THE SERVICE OF MEDICINE

V. S. Gurfinkel *In its* Electron. Aids for the Physician 8 Dec. 1966 p 12–18 (See N67-14381 05-04) CFSTI: HC $2.00

Electrical phenomena in humans are discussed along with biopotential control systems and various apparatus using this phenomena. The operation of a prosthesis for the forearm is described in which the control unit is operated by biopotentials from amputated muscles. Other areas discussed include instruments controlled by biopotentials from the heart and apparatus for investigating consciousness during electrographic paroxysms in patients with epilepsy. C.T.C.

N67-14385# Joint Publications Research Service, Washington, D. C.

A MACHINE MAKES THE DIAGNOSIS

M. L. Bykhovskiy *In its* Electron. Aids for the Physician 8 Dec. 1966 p 19–24 (See N67-14381 05-04) CFSTI: $2.00

A computerized cybernetics method for diagnosis of a disease and presenting an optimum plan of action is discussed. The logical steps that the process utilizes are described along with the medical memory, processing of the information, and the self training processes. It is noted that the system is especially applicable to diagnosing congenital defects in the heart, mechanical jaundice, acquired heart defects, and certain infectious diseases. C.T.C.

N67-14386# Joint Publications Research Service, Washington, D. C.

IS IT POSSIBLE TO SIMULATE CONSCIOUSNESS AND FEELING?

A. G. Spirkin *In its* Electron. Aids for the Physician 8 Dec. 1966 p 25-37 refs (See N67-14381 05-04) CFSTI: $2.00

A philosophical approach is used in discussing the possibility of simulating consciousness and emotion. The principle of feedback in cybernetics is shown applicable, in that certain general laws inherent in animate organisms, organs, cells, communities of biological species, and society may be reproduced with technical devices. C.T.C.

N67-14397# Joint Publications Research Service, Washington, D.C.

ISOTOPES AND IONIZED RADIATION AS POWERFUL TOOLS OF SCIENTIFIC RESEARCH

Kiril Popov 5 Jan. 1967 4 p Transl. into ENGLISH from Zemedelsko Zname (Sofia), 4 Dec. 1966 p 2
(JPRS-39418; TT-67-30068)

A discussion is presented of the uses of isotopes and ionized radiation in the fields of biology, agriculture, and medicine. Various accomplishments are cited, and mention is given to the production facilities and laboratories conducting research. C.T.C.

N67-14399*# Oregon State Univ., Corvallis.

SYSTEMATIC DESCRIPTION OF BACTERIAL ISOLANTS FROM RIGOROUS ENVIRONMENTS

W. B. Bollen 30 Sep. 1966 6 p Prepared for JPL
(Contracts NAS7-100; JPL-950783)
(NASA-CR-80871) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Results are presented of ammonification and nitrification tests of desert soils. Ammonium liberated by hydrolysis and oxidation-reduction of added peptone after three days and five days incubation was used as an index of ammonifying power. It was found that all soils except one were active in this heterotraphic function, being comparable to representative agricultural soils. On incubation with ammonium sulfate for 30 days, only two soils showed a nitrifying power comparable to representative cultivated soils. C.T.C.

N67-14466*# Weizmann Inst. of Science, Rehovoth (Israel). Polymer Dept.

MECHANOCHEMISTRY

A. Katchalsky and A. Oplatka *In* Stanford Univ. Proc. of the 4th Intern. Congr. on Rheol., Pt. 1 1965 p 73-97 refs (See N67-14462 05-34) CFSTI: HC $7.00/MF $1.75
(Grant AF-EOAR-62-58)

Some general rules are reviewed for mechanochemical conversion (the transformation of mechanical into potential energy). A mathematical discussion is presented for the reversible conversion of chemical free energy into mechanical work. Equations are derived for elementary work cycles and the characterization of a mechanochemical field. Also discussed are: the change of chemical potential with length in a closed system, the enrichment of a fiber in equilibrium with an open bath, the conversion of chemical into mechanical energy during contraction in an equilibrium bath, the chemical melting and enrichment of contractile fibers, and mechanochemical rate processes. R.Ll.

N67-14468*# Osaka Univ. (Japan). Dept. of Biology.

RHEOLOGY OF CYTOPLASMIC STREAMING

Noburo Kamiya *In* Stanford Univ. Proc. of the 4th Intern. Congr. on Rheol., Pt. 1 1965 p 105-121 refs (See N67-14462 05-34) CFSTI: HC $7.00/MF $1.75

Descriptions were given of some basic features of rheological importance of the cytoplasmic streaming in the slime mold (Physarum polyoephalum), e.g., flow profile, spontaneous change in flow velocity, the motive force responsible for the flow and its rhythmic variation, the twisting habit of the slime mold strand, etc. Techniques applied by the author for studying each of these characteristics were also described in some detail. Author

N67-14558*# California Univ., Berkeley. Dept. of Nutritional Sciences.

BEHAVIOR OF *PEROGNATHUS* Semiannual Progress Report, 1 Jul.-31 Dec. 1966

31 Dec. 1966 6 p
(Grant NGR-05-003-118)
(NASA-CR-80893) CFSTI: HC $1.00/MF $0.50 CSCL 06C

The development of a pelleted diet consisting of sunflower meal and millet is described in relation to studying the nutritional requirements of two subspecies of Perognathus (Longimembris and Penicillatus)j A climatron is described, which was obtained to study breeding behavior by subjecting mice to seasonal changes they would experience in the field. Finally, in order to obtain baseline values for future studies, organ weights, carcass composition, and certain blood values of a group of P. penicillatus were determined. L.E.W.

N67-14561*# New York Medical Coll., N. Y.

PROCEEDINGS OF THE FOURTH INTERNATIONAL CONGRESS ON RHEOLOGY. PART 4: SYMPOSIUM ON BIORHEOLOGY

Alfred L. Copley, ed. New York, Interscience, 1965 656 p refs Congr. held at Brown Univ., Providence, 26-30 Aug. 1963
(Grant NsG-509)
(NASA-CR-80888) CFSTI: HC $9.55/MF $2.75 CSCL 06P

Symposium papers on laminar flow of biological fluids, cytoplasmic streaming, hemolysis, sap movement, hemorheology of pulsatile flow, blood flow in branching and tapered tubes, biorheological measurements and observations, hemorheology of redcell suspensions, medical biorheology, in vivo hemorheology in man and animals, biorheology of tissue materials, and blood clotting and low shear hemorheology are presented. For individual titles see N67-14562-N67-14608.

N67-14562*# New York Medical Coll., N. Y. Dept. of Physiology and Pharmacology.

OPENING ADDRESS ON THE VALIDITY OF CLASSICAL FLUID MECHANICS IN BIORHEOLOGY

Alfred L. Copley *In its* Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 3-10 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The Opening Address consists of three parts. The first part is a brief survey of the events pertaining to the organization of the symposium on biorheology. The second part refers to Heraclitus and other pre-Platonic thinkers, the founders of the natural sciences, and their insights into nature as related to modern rheology. In the third part, which deals with the topic of the address, phenomena, in which an apparent deviation of fluid mechanics exists, are mentioned to point out the complexity of the rheology of certain biological fluids in vivo and extra vivo. Examples are the plasmatic zone, free of red and white blood cells, in the living circulation and the observation that the apparent viscosity of blood systems in capillary viscometers can be altered by coating the glass surface with different substances. A possible explanation for the latter phenomenon could be the existence of slip along the wall, an assumption which is rejected in classical fluid mechanics. As an alternative explanation, it is surmised that no slip exists, if there is wall adherence in a closed system. However, wall adherence has only been established on the basis of an index of blood systems bordering air surfaces and traveling in a capillary tube. Author

N67-14563*# Uppsala Univ. (Sweden).
ARCHAIC HEMORHEOLOGY. THE EARLY HISTORICAL SIGNIFICANCE OF BLOOD SEDIMENTATION
Robin Fahraeus *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 11–17 refs (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

Pathology of the ancient Greeks was founded on observations of the blood. The contents of the venous system seemed to be a mixture of four fluids, which separated more or less when the mixture had left the warm body. One could thus distinguish the black bile, the yellow bile, the blood (in the limited sense of the word), and the phlegm. The properties of the last-named fluid had the greatest influence on the conception of diseases. In normal blood the phlegm was invisible but served as the connecting substance in the caked blood. In diseases, on the contrary, the phlegm formed a more or less thick layer at the top of the caked blood. This phenomenon was a consequence of increased blood sedimentation but was taken by the Greeks as proof that the phlegm had increased in amount, a change of the contents in the veins much more ominous, as the phlegm in contradistinction to the other three fluids had the property to congeal and make the contents of the vessels immovable. The fever was nature's means of counteracting this tendency. Venesection was considered by the physicians as the most effective way of reducing the predominance of phlegm. Author

N67-14564*# Royal Institution of Great Britain, London.
RESEARCH IN HEMORHEOLOGY, INTRODUCTORY LECTURE
K. Weissenberg *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 19–33 refs (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

Research in hemorheology can form an integral part of Einstein's concept of research in an all-embracing natural science. In that science one aims to fit experiment and theory to one another as closely as possible and over the widest possible range of conditions, while one takes fully into account the inevitable uncertainty and arbitrariness of all experimental data. The theory here eliminates the defects of the experimental data for wider and wider changes of materials, conditions, and modes of observation by way of the group theory of transformations and invariants, and thereby makes it possible to approach step by step to the ideal of obtaining a perfect fit between experiment and theory as between lock and key. Author

N67-14565*# Reading Univ. (England). National Inst. for Research in Dairying.
SOME ASPECTS OF RHEOLOGICAL THEORY AS APPLIED TO BIOLOGICAL SYSTEMS
G. W. Scott Blair *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 35–44 refs (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

Although the same fundamental mechanical laws apply to all rheological systems, certain treatments are more appropriate than others for studying biological phenomena. Following the parallel of rheology and thermodynamics, it is suggested that the new irreversible thermodynamics will be of special value for studying processes in vivo. Classical elasticity theory, though useful enough for a few structural materials such as bone, is hardly suited, even as extended by recent workers, to most biological systems. It is proposed that the mathematics of quantum theory, leading to a new type of invariant, concerned rather with processes than with properties, would be worth careful consideration. Author

N67-14566*# Institut Pasteur, Paris (France). Service de Biophysique.
CONGLOMERATION PROVOKED BY FLOW IN MACROMOLECULAR SOLUTIONS OF BIOLOGICAL ORIGIN [AGREGATION PROVOQUEE PAR L'ECOULEMENT DANS LES SOLUTIONS DE MACROMOLECULES D'ORIGINE BIOLOGIQUE]
M. Joly *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 45–68 refs In FRENCH (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

The general principles of aggregation kinetics in flow are reviewed, and the characteristic behavior of globular or ellipsoid particle suspensions is described. This behavior depends on the relative values of shearing velocity, initial particle size, and interaction energy. For a given system (sizes and interaction energies of particles of specific values), there are successive shearing velocities, and the flow effect on the dispersion of suspended particles is of a different type. Examples are given and it is shown that, despite the schematic character of the models used, there is satisfactory agreement between experimental results and theoretical expressions on the variation of average size of aggregates as a function of the shearing velocity. Some applications of the interaction energy are also included. Transl. by R.Ll.

N67-14567*# Nottingham Univ. (England).
AN APPLICATION OF PARTICLE FLUID MECHANICS TO BLOOD FLOW
R. L. Whitmore *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 69–82 refs (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

The observed fall in blood viscosity and erythrocyte concentration, when the diameter of a glass capillary down which the blood is flowing is decreased, is frequently attributed to the presence of a cell-free layer at the tube wall. Experiments show that under suitable conditions individual particles, flowing near a wall, may move away from it but when a mass of particles is present an opposing dispersive pressure is also developed. From published results on the flow of suspension of spheres in tubes the parameters indicating the conditions for spheres to leave the wall are derived. On applying them to data on the flow of blood in glass capillaries it is shown that normally the outwardly directed dispersive pressure is many times greater than the inward pressure developed by the erythrocytes. Thus the existence of a "plasmatic layer" at the wall of a capillary tube down which blood is flowing is unlikely, and the layer which is observed in vivo must be the product of some other interaction or force. Author

N67-14568*# McGill Univ., Montreal (Quebec). Dept. of Chemistry.
PHYSICAL ASPECTS OF THE FLOW OF BIOLOGICAL SUSPENSIONS THROUGH TUBES
H. L. Goldsmith and S. G. Mason *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 85–88 refs (See N67-14561 05-04) CFSTI: HC$9.55/MF$2.75

The steady laminar flow of liquid suspensions of rigid and deformable particles through rigid tubes has been investigated by direct observations of the particle motions through a travelling microscope. The phenomena studied in the first part of the work included the rotation of single small rigid spheres, rods, and discs; the radial migration of rigid and deformable spheres; and particle interactions in dilute and concentrated suspensions. The second part describes the flow and deformation of large liquid bubbles suspended in wetting liquids undergoing Poiseuille flow. Author

N67-14569*# Tokyo Metropolitan Univ. (Japan).
THEORETICAL CONSIDERATIONS ON THE FLOW OF BLOOD THROUGH A CAPILLARY
Syoten Oka *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 89–102 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Scott Blair has shown that an equation proposed by Casson for varnishes and which was later applied by Steiner to molten chocolate, gives excellent straight lines for bovine, rabbit, and human blood, on both glass and fibrin surfaces. Following this equation, straight lines are obtained when the square root of the shear rate is plotted against the square root of the shear stress. On the assumption that Casson's equation is applicable to blood, we treated theoretically the rheological behavior of blood flowing in a capillary. We have obtained both the velocity distribution across the capillary and the volume of flow in unit times as a function of pressure difference. The result was compared with the rheological behavior of a Bingham system and other non-Newtonian systems. Author

N67-14570*# Cartiera Vita Mayer E.C., Milan (Italy). Sezione Ricerche.
NECKLACE-LIKE FORMATIONS IN THE POISEUILLE FLOW OF A SUSPENSION OF SPHERES
Giorgio Segré *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 103–118 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Experiments on the rearrangement of spherical particles carried in a dilute suspension in Poiseuille flow are presented. The tendency of the particles to form regular groups (necklaces) aligned parallel to the tube axis is established and is analyzed photographically. It is shown that this tendency increases with the particle diameter, and that the observed distribution of groups agrees with an interpretation based on nearest neighbor hydrodynamic interaction. In the stable configurations the gap between the particles is a function of the number of particles in the group, independent of the particle diameter, and strongly correlated with the Reynolds number. A comparison with von Karman's theory on vortex systems is made, but no correlation results. Author

N67-14571*# Weizmann Inst. of Science, Rehovoth (Israel).
HYDRODYNAMIC INTERACTION BETWEEN PARTICLES IN SUSPENSION
A. Silberberg *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 119–124 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The importance of theoretical models for the understanding of biorheological phenomena was stressed, and the central position of the hydrodynamic interaction tensor in these considerations underscored. The use of this tensor for studies of the concentration dependence of specific viscosity was examined, and it could be shown that the Huggins coefficient for a class of models based on statistical assemblies of connected spheres should be identical with that of the hard sphere case. Deviations can be interpreted as due to specific interactions. Author

N67-14572*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanics.
A FORMULATION OF THE PROBLEM OF FLOW THROUGH TUBES
E. A. Fox and Edward Saibel *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 125–133 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The equations of motion of a general fluid in an extensible tube are put in a form suitable for calculating flow from quantities which may reasonably be measured. These are the cross-sectional area of the tube, its time derivative and the derivative along its length. From these quantities, information regarding the flow rate and the axial force can be obtained. The equations are developed in terms of net axial force and thus obviate a fluid constitutive equation. Before meaningful calculations can be made the constitutive relations in the wall must be determined by experiment *in vivo*. The equations lend themselves to such experiments. The equations developed include inertia and body forces and are suitable for calculations of flow in deformable tubes. Author

N67-14573*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
THE CASSON EQUATION AND RHEOLOGY OF BLOOD NEAR ZERO SHEAR
E. W. Merrill, W. G. Margetts, G. R. Cokelet, and E. R. Gilliland *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 135–143 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

As a continuation of previous studies this paper is concerned with assessing the relevance to blood rheology of the model upon which N. Casson derived the equation

$$\tau^{1/2} = S\gamma^{1/2} + b$$

where $S = [\eta_0/(1-H)^{a\alpha-1}]^{1/2}$; $b = [(a\beta)/(a\alpha-1)][(1-H)^{1-a\alpha/2} - 1]$; τ is the shear stress, γ the shear rate, η_0 the viscosity of suspending medium, H the volume fraction of dispersed particles, a the factor depending on average orientation of aggregate, and α,β the constants. On the one hand, the *form* of the equation serves well in correlating the low shear rate data on blood near and at zero shear. On the other hand, the model on which the equation is based does not allow for attraction between, or three-dimensional structural organization of, the rodlike aggregates (rouleaux). The applicability of the Casson equations to the rheology of human blood is discussed. Author

N67-14574*# Osaka Univ. (Japan). Dept. of Biology.
THE VISCOELASTICITY OF SLIME MOLD PROTOPLASM
Shigemi Abe *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 147–155 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

By analyzing a damped oscillation shown by the plasmodial strands, elasticity and viscosity values of the slime mold protoplasm were determined independently of each other. On the basis of the type of deformation caused by the application and release of a torque, it is found that rheological behavior of the same mold protoplasm can be well represented in terms of a four-element model. Each of these elasticity and viscosity values were determined.

When a torque was applied on a plasmodial strand repeatedly at short intervals, it was observed that the strain corresponding to each torque increased progressively indicating that the slime mold protoplasm is thixotropic in nature. Author

N67-14575*# Osaka Univ. (Japan). Dept. of Biology.
ROTATIONAL PROTOPLASMIC STREAMING IN *NITELLA* AND SOME PHYSICAL PROPERTIES OF THE ENDOPLASM
Noburo Kamiya and Kiyoko Kuroda *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 157–174 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

From the velocity distribution of rotational streaming in the *Nitella* cell is was concluded that this type of streaming is driven by an active shearing force generated at the endoplasm–ectoplasm boundary. By means of a suitable technique the endoplasm can be isolated out of the cell in comparatively large drops which can survive more than 24 hr. *in vitro*. The density of the naked endoplasmic drops is from 1.014 to 1.015 g./cm.^{3}; tension at the surface is from 0.002 to 0.004 dyne/cm. The isolated endoplasm can flow under an adequate pressure gradient if it is properly

introduced into an agar capillary. There is no indication that artificially induced flow under pressure gives rise to any harmful effect. The velocity profile of the endoplasm in a circular capillary represents a plug dow. From the velocity gradient of the intracapillary flow of endoplasm apparent viscosity of the endoplasm was measured under different shear stresses; it is 250 cp. when shear stress is 4.3 dyne $cm.^2$. Apparent viscosity increases rapidly as the shear stress becomes smaller than 1.5 dyne/$cm.^2$. Author

N67-14576*# Chicago Univ., Ill.
BROWNIAN AND SALTATORY MOVEMENTS OF CYTOPLASMIC GRANULES AND THE MOVEMENT OF ANAPHASE CHROMOSOMES
Edwin W. Taylor *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 175–191 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The viscosity of cytoplasm in cultured cells of the newt (*Triturus viridescens*) was estimated from measurements of Brownian motion of granular components. The average viscosity was about 300 cp., but it varied considerably from cell to cell. In addition to Brownian movement granules were occasionally seen to undergo saltatory displacements of several microns in a few seconds. These displacements cannot be accounted for as Brownian movements unless they occur in local regions with a viscosity at least one hundred times smaller than the average. From a knowledge of the viscosity, the mechanical work in saltatory and chromosomal movements was estimated. Neither type of movement appeared to depend on particle size or cell viscosity. From considerations of the general character of the movements and approximate calculations of the power that can be generated it is concluded that the movements cannot be produced by thermal, electrical, hydrodynamic, or diffusion fields. It is suggested that saltatory movements arise from interaction with motile cytoplasmic filaments. The mechanism of filament movements and the presence of a countercurrent stream in the fluid adjacent to the filaments is discussed in terms of the propagation of waves along the filaments. Author

N67-14577*# Yeshiva Univ., New York. Dept. of Pediatrics.
FLOW PROPERTIES OF HEMOGLOBIN IN THE HEMOLYSING RED CELL
Joseph A. Kochen *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 193–202 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

In order to visualize the outward flow of hemoglobin from individual red cells, the emerging hemoglobin was complexed with Alizarin Red S. This resulted in the formation of steadily lengthening streams of precipitated extruded intracellular material which remained attached to the red cell ghosts at the sites of membrane breakdown. Hypotonic hemolysis induced by a sudden decrease in the ionic strength of the surrounding medium resulted in the extrusion of a single stream of hemoglobin from each lysing red cell. By assuming that the diameters of the extruded streams were essentially the same as the diameters of the membrane defects through which the hemoglobin emerged, and by relating these values to the critical red cell volumes, fading times and proportional hemoglobin loss, it was possible to compute the diffusion coefficient of hemoglobin in the lysing red cell. These studies suggest that sudden osmotic hemolysis is preceded by an influx of extracellular fluid which results in swelling of the red cell and a dilution of its hemoglobin content. The increase in red cell volume leads to the formation of a single microscopic region of complete membrane breakdown through which the intracellular hemoglobin escapes by a process of free passive diffusion. Author

N67-14578*# London Univ. (England). Dept. of Physiology.
THE FLOW PROPERTIES OF BLOOD AS A FACTOR IN THE STABILITY OF PULSATILE FLOW
D. A. Mc Donald *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 205–213 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The applicability of concepts determining the transition from laminar to turbulent flow, which are based on studies of steady flow, is discussed in relation to the oscillatory flows found in the circulatory system. While transient breakdowns of laminar flow occur at relatively low Reynolds' numbers, there is some evidence that there may be increased stability with regard to sustained turbulence. The distributon of rates of shear and inflections in the velocity profiles that occur in pulsatile flow are considered in relation to this problem, together with probable changes due to the inhomogenous character of the blood. Author

N67-14579*# Itek Corp., Palo Alto, Calif. Vidya Div.
A STUDY OF AUSCULTATORY BLOOD PRESSURES IN SIMULATED ARTERIES
Alvin H. Sacks, K. R. Raman, and Jack A. Burnell *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 215–230 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

After an analysis of the pulsatile viscous flow in flexible tubes, a large-scale pulsating flow system was constructed and various simulated arteries of 1 in. diam. were tested over wide ranges of pulse rate, pressure level, and pulse pressure using, first, various mixtures of water and glycerol and, finally, whole steer blood as the fluid. The oscillatory intra-arterial pressures were recorded by pressure transducers attached to both static and total pressure probes in the flow itself, and these are compared with the systolic and diastolic pressures which were obtained by the clinical auscultatory technique, using a stethoscope and a specially designed pressure chamber. In addition, simultaneous measurements were made of arterial wall displacements and the velocity of the pulse wave along the tube. The simulated system has exhibited many of the qualitative features of a living human subject, and the entire spectrum of characteristic Korotkoff sounds was produced in the artery. The test results indicate that the auscultatory systolic and diastolic pressure readings are consistently higher than the corresponding maximum and minimum of the oscillatory intraarterial pressures by an amount which depends on the stiffness and thickness of the arterial wall. Author

N67-14580*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
DIMENSIONAL ANALYSIS OF PULSATING BLOOD FLOW, AN INTRODUCTION
W. McComis, S. Charm (Tufts Univ., Boston), and G. Kurland (Harvard Univ.) *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 231–242 refs Prepared in Cooperation with Tufts Univ. and Harvard Univ. (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

A detailed consideration is made of the equations of motion for pulsatile flow of a non-Newtonian fluid through cylindrical tubes and the usual assumptions made in obtaining a solution. In view of the fact that the assumptions necessary to reduce the theoretical equations to a solvable form are unrealistic for flow of blood through small tubes, the authors suggest dimensional analysis as a method for obtaining equations which describe the pressure-velocity relationships. Author

N67-14581*# Kanematsu Memorial Inst., Sydney (Australia). Dept. of Research.
PLASMA SKIMMING IN HUMAN BLOOD FLOWING THROUGH BRANCHING GLASS CAPILLARY CHANNELS
A. A. Palmer *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 245–255 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Partial plasma skimming (i.e., unequal distribution of cells and plasma) was found consistently when human blood with anticoagulants flowed through branching glass channels, of dimension 200 μ or less in the plane of branching, whenever the rate of flow from the branches was unequal or if the arrangement of the branches was such that there was unequal distribution of axial and peripheral blood. Results with channels which divided into three branches were in good agreement with these assumptions; however, when less than about one-seventh of the total flow passed into any one branch the results became inconsistent probably because of eddy formation. Hence, although complete plasma skimming never occurred, the possibility that there was a narrow cell-free plasma zone near the wall cannot be excluded. Partial plasma skimming was greatest at the lowest shear rate tested; it fell as the apparent shear rate at the wall as increased to about 20 $sec.^{-1}$ and thereafter remained at an almost constant level as the shear rate was further increased. The addition of high molecular weight dextran to the blood greatly increased partial plasma skimming. Author

N67-14582*# Royal Institution of Great Britain, London.
DEVELOPMENT OF INSTRUMENTATION FOR THE TESTING OF EXTRACORPOREAL FLOW AND DEFORMATION OF BIOLOGICAL MATERIALS
K. Weissenberg *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 261–266 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The development of an instrument is discussed which allows testing of the mechanical shear properties of a material over wide ranges of conditions by taking goniometric measurements of the distributions of the movements and forces in space and time. Author

N67-14583*# Liverpool Univ. (England). Dept. of Civil Engineering.
A NEW CAPILLARY-TYPE VISCOMETER
R. B. Whittington and John Harkness (Musgrove Park Hosp., England) *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 267–279 refs Prepared in Cooperation with Musgrove Park Hosp. (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The general U tube viscometer is analyzed, and the conditions for unidirectional or oscillatory flow are derived. Ostwald's viscometer, as a unidirectional instrument, is analyzed. A new pressurized instrument is compared with the Ostwald. The question of true absolute determination is discussed. There are some observations on non-Newtonian measurements and on intrinsic viscosity. Author

N67-14584*# Kobayashi Inst. of Physical Research, Tokyo (Japan).
A NEW CAPILLARY VISCOMETER FOR MEASURING THE VISCOSITY OF SMALL AMOUNTS OF BLOOD
Heiji Kawai, Eiichi Fukada (Inst. of Phys. and Chem. Res.), Takayoshi Ibe, and Hisao Shono (Rion Co., Ltd., Tokyo) *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 281–297 refs Prepared in Cooperation with the Inst. of Phys. and Chem. Res. and Rion Co. (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

A graduated glass tube is closed at the top and bottom with two syringe needles and held in a vertical position. A negative pressure is produced within the glass tube by releasing a compressed rubber ball joined to the upper side of the tube. The air and liquid to be tested are drawn through the top and bottom capillaries, respectively, into the glass tube. Maximum height of liquid thus drawn in measures the value of viscosity within the accuracy of 4%. The volume of liquid required is only 0.3 ml., and the measuring time is less than 10 sec. The viscosity of whole blood as a function of hematocrit and the viscosity of plasma as a function of protein contents have been studied. The viscosity of venous blood in a dog has been measured *in vivo* by inserting the needle of the viscometer into the external jugular vein. Variation of viscosity with the injection of aqueous solution of glucose has been observed. Author

N67-14585*# Goteborg Univ. (Sweden). Surgical Dept. I.
RHEOLOGICAL DISTURBANCES FOLLOWING TISSUE INJURY
Lars-Erik Gelin *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 299–315 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Tissue injury induces a decreased fluidity of blood especially at lower rates of shear. The decreased fluidity is caused by increased hematocrit, increased viscosity of plasma, and an additional factor called "viscosity-plus factor." The viscosity-plus factor accelerates with decreasing rate of shear, increasing hematocrit, and increasing vehicle viscosity. Decreased fluidity of blood is of especial importance for the venous return and for the postcapillary flow where there is a low pressure head and a low flow rate. An increased viscosity of blood means by itself a threatening stagnation. Hemodilution with agents able to reduce viscosity, especially at low rates of shear, has resulted in remarkable improvements in severe clinical conditions. Author

N67-14586*# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
STREAMING BIREFRINGENCE STUDY OF THE INTERACTION OF SUBMICROSCOPIC RODS AND SPHERES
H. Wayland and Marcos Intaglietta *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 317–335 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

A streaming birefringence apparatus using Faraday cell modulation and photoelectric detection is described. This apparatus was capable of angle of isocline measurement to $\pm 1^{\circ}$ for a ratardation of 0.5 A. and retardation measurements of 0.3 A. This apparatus was used to study the streaming birefringence of mixtures of rodlike particles 3000 by 180 A. (tobacco mosaic virus) and 250 A. diam. spherical particles (southern bean mosaic virus). With constant amounts of rods (0.3%) the specific retardation of the system first dropped and then increased with the addition of the spherical particles with a minimum at 0.5% spheres. Possible explanations are discussed. Author

N67-14587*# Rochester Univ., N. Y.
THE INFLUENCE OF ELECTROKINETIC CHARGE ON THE RHEOLOGICAL PROPERTIES OF RED BLOOD CELL SUSPENSIONS
Harold A. Cox, Jr. and Gouq-Jen Su *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 337–350 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Suspensions of human erythrocytes in various isotonic media were studied by means of coaxial cylinder viscometry (from 400 to 1800 $sec.^{-1}$) and microelectrophoresis to determine whether or not a relationship existed between the electrokinetic charge on the cells and the rheological behavior of the suspensions. It is shown that the electrokinetic charge does not play a dominant role in controlling suspension flow behavior under normal conditions in this shear rate region. This was demonstrated through experiments using albumin solutions, normal serum, isotonic sucrose, and an isoantibody solution as suspending media. Reasons are given why a charge-flow relationship in these suspensions could be expected under other conditions, such as very low shear rates. The addition of a polyvalent cation to the system is capable of decreasing cell mobility to such an extent that the viscosity increases significantly, as was demonstrated with $AlCl_3$ in physiological saline. Author

N67-14588*# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Civil Engineering.

THE PROFILE VISCOSITY AND OTHER CHARACTERISTICS OF BLOOD FLOW IN A NON-UNIFORM SHEAR FIELD

George Bugliarello, Chandra Kapur, and George Hsiao *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 351-370 ref (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The phenomenon and features of blood flow are investigated in detail, with capillaries in the vertical position so as to eliminate the asymmetries in the flow pattern caused by sedimentation, which had been shown to affect significantly the results in the horizontal layout). Velocity profiles, determined by averaging over the whole useful duration of the film the velocities of erythrocytes observed at fixed radial stations, were nearly axisymmetrical in all cases, as expected from the absence of settling effects. Although determination of the experimental viscosity profiles is subject to a considerable degree of uncertainty, the occurrence of off-center viscosity peaks at the higher hematocrits suggests a concentration effect caused by a concurrent drift of the erythrocytes from the walls and the centerline toward an intermediate radial position. The axial symmetry of the average flow permitted the more accurate measurement of the peripheral layer characteristics (thickness, standard deviation), and from them the determination of the average concentration in the cell-rich core of the flow. S.P.

N67-14589*# London Univ. (England). St. Mary's Hospital Medical School.

THE DIFFERENCE IN CIRCULATION TIMES BETWEEN ERYTHROCYTES AND PLASMA *IN VIVO*

S. Rowlands, A C. Groom, and H. W. Thomas (Reading Univ.) *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 371-379 refs Prepared in Cooperation with Reading Univ. (See N67-1456 05-04) CFSTI: HC $9.55/MF $2.75

Evidence is presented that *in vivo* the red cells have a shorter circulation time than the fluid constituents of blood. A mechanism which would explain the shorter circulation time of cells is discussed. Author

N67-14590*# Reading Univ. (England). National Inst. for Research in Dairying.

THE FLOW OF RED CELL SUSPENSIONS THROUGH NARROW TUBES: THE (EXTRACORPOREAL) DETERMINATION OF THE DIFFERENCE IN MEAN VELOCITIES OF RED CELLS AND THEIR SUSPENDING PHASE

of these proteins may be achieved by fluorescent labeling and observation by fluorescent microscopy (rat mesentery). The spreading of the labeled material after passing the wall of the terminal vessels was demonstrated. Two different forms of spreading in the perivascular tissues may be distinguished. Normally, tiny capilliform fluorescent streaks arranged in a network will develop. This phenomenon would be compatible with a flow along a pre-formed system. If permeability is increased pathologically, the extra vascular fluid will spread in a diffuse cloudy manner. The velocity of spreading of fluorescent material was determined. Maximal flow rate occurs for the dye penetrating from capillaries (3 μ/sec.). The lowest values are found around arterioles. In cases of increased vascular permeability, spreading velocity reaches maximal values around all sections of the terminal vascular bed. These investigations of the streaming interstitial fluid will give access to a new field of biorheology. Author

N67-14591*# Goteborg Univ. (Sweden). Dept. of Surgery.

RHEOLOGICAL DISTURBANCES AND THEIR TREATMENT IN CLINICAL SURGERY

Bengt Zederfeldt *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 397-410 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

It has been shown that tissue injury of different kinds is followed by changes in the physical properties of blood with increased viscosity, especially at low rates of flow, marked changes in the capillary circulation with stagnation in postcapillary vessels as a dominant finding. This leads to decreased venous return and metabolic disturbances. Low viscous dextran is one agent able to improve the capillary blood flow when this flow is decreased by changes in the physical properties of blood and thereby improves the tissue nutrition. Author

N67-14592*# Hamburg Univ. (West Germany). First Medical Clinic.

HEMORHEOLOGICAL INVESTIGATIONS IN THE "ARTERIAL SPIDERS" OF THE HUMAN SKIN

Harald Harders *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 413-424 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The "arterial spider" of the human skin is a suitable model for hemorheological studies in man by immediate accessibility of a terminal arterial vascular tree under unusually high pressure by the use of cantharide blisters. The central arteries may have inner diameters up to several hundred microns and are visible in their connections with the arterial branches, the capillary network, and collecting venous net. Direct microscopical observation under high magnification of flow characteristics and behavior of streaming cells, micromanipulation, and pressure recordings are possible. The morphology of the vascular spiders is described with emphasis on unusual vascular formations as spiral arteries and abrupt changes of inner vascular diameter. Functional and rheological findings and pressure recordings are discussed, which show systolic arterial pressures exceeding 100 mm. Hg and dropping abruptly within the course of few millimeters. Under clinical conditions the arterial spiders are a valuable sign in chronic liver disease. They do not constitute a localized vascular abnormality but are part of a widespread structural and functional transformation of the whole peripheral vascular bed. This transformation is, e.g., expressed by palmar erythema and changes in the terminal vascular bed of mucous membranes, skin, and finger tips. The origin and the purpose of such universal microvascular rearrangement in liver diseases are still unknown. Author

N67-14593*# Massachusetts Eye and Ear Infirmary, Boston. Microcirculatory Lab.

BIOLOGICAL REACTIONS INTERFERING WITH FLOW THROUGH THE MICROCIRCULATION

John W. Irwin and Dolores C. Alcaide *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 425-430 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Methods to study the pulmonary microcirculation of living rabbits have been presented. Changes in both the caliber of these vessels and in the fluidity of the blood flowing through them have been noted during anaphylaxis, histamine shock, and serotonin shock. Pharmacological doses of epinephrine also markedly affect the flow of blood through the pulmonary microcirculation. It is suggested that studies in rheology must take into account the capacity of the microscopic pulmonary blood vessels to change their calibers rapidly and the fact that the consistency of blood is not necessarily constant. Author

N67-14594*# Harvard Univ., Boston, Mass. Dept. of Medicine.

THE EFFECTS OF PLASMA PROTEINS UPON THE RHEOLOGY OF BLOOD IN THE MICROCIRCULATION

Roe E. Wells, Jr. *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 431-438 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Each of the three major fractions of the plasma proteins has a different effect upon suspension stability and viscosity. The changes observed *in vitro* do not always correlate with those observed *in vivo*. Both globulin and fibrinogen cause cell aggregation but as globulin exists at 3 to 4 times the concentrations of fibrinogen it accounts for the major viscosity effects of the two fractions. Albumin inhibits cell aggregation and reduces viscosity. Cell aggregation *in vivo* may lead to reduced or stagnant flow, and conversely, stagnant flow in the presence of increased fibrinogen or globulin may lead to profound cell aggregation. The integrity of cell aggregates increases with increasing fibrinogen or globulin levels which may withstand the excursion from the venous system through the larger vessels to eventually occlude the arteriolar system. Author

N67-14595*# Cambridge Univ. (England). Anatomy School.
VISUAL PARTICLE VELOCITY MEASUREMENT IN FLUID STREAMS
P. A. G. Monro *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 439–449 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The principles of methods for measuring the velocities of flowing blood cells are discussed. A description is given of a prototype instrument designed to measure directly very slow blood cell velocities seen in small veins as well as the much faster velocities (up to 5 mm./sec.) seen in arterioles in the rabbit ear chamber and in the everted hamster cheek pouch. A more compact eyepiece visual velocity measuring instrument is also described. This may be exchanged for the eyepiece of an ordinary monocular microscope and is more convenient for measuring the very much higher velocities (up to 10^5 times their diameter per second) of blood cells or other particles caused to flow in fine glass tubes. The appearances of blood flowing at high velocities in fine blood vessels are discussed. These indicate that flowing blood in the larger arterioles contains loose aggregates of red cells separated by zones of relatively cell-free plasma. Author

N67-14596*# Erlangen Univ. (West Germany). Medical Clinic.
FLOW PATTERN PERTAINING TO VASCULAR PERMEABILITY AS OBSERVED BY FLUORESCENCE VITAL MICROSCOPY
Siegfried Witte *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 451–458 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The intravascular blood flow forms the basis of an undisturbed vascular permeability. Of special interest is the behavior of macromolecular material especially of the plasma proteins. Visibility of these proteins may be achieved by fluorescent labeling and observation by fluorescent microscopy (rat mesentery). The spreading of the labeled material after passing the wall of the terminal vessels was demonstrated. Two different forms of spreading in the perivascular tissues may be distinguished. Normally, tiny capilliform fluorescent streaks arranged in a network will develop. This phenomenon would be compatible with a flow along a pre-formed system. If permeability is increased pathologically, the extra vascular fluid will spread in a diffuse cloudy manner. The velocity of spreading of fluorescent material was determined. Maximal flow rate occurs for the dye penetrating from capillaries (3 μ/sec.). The lowest values are found around arterioles. In cases of increased vascular permeability, spreading velocity reaches maximal values around all sections of the terminal vascular bed. These investigations of the streaming interstitial fluid will give access to a new field of biorheology. Author

N67-14597*# Goteborg Univ. (Sweden). Dept. of Anatomy.
INTRACAPILLARY RHEOLOGICAL PHENOMENA
P-I. Branemark *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 4 1965 p 459–473 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Intracapillary flow phenomena, the shape and behavior of the blood corpuscles when passing the capillary system, their relation to one another and to the endothelial wall are described and illustrated microphotographically on the basis of direct microscopic observations of living tissue capillaries in animals and man. The complexity of capillary structure and function is demonstrated. The examples of capillary rheology described and illustrated might form a basis for further calculations and analysis in attempts to understand capillary function. Author

N67-14598*# University Coll., London (England). Dept. of Physiology.
SOME MECHANICAL PROPERTIES OF COLLAGENOUS FRAMEWORKS AND THEIR FUNCTIONAL SIGNIFICANCE
R. D. Harkness and Margaret L. R. Harkness *In* N. Y. Med. Coll. Proc. on the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 477–488 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Examination of the mechanical properties of the uterine cervix, the narrowest part of the birth canal in the rat, gives evidence that two factors are involved in the change which takes place in pregnancy to allow the birth of the mature fetus; an increase in the natural circumference of the collagenous framework, and an increase in its extensibility under tension. This property was measured by the ratio of the rate K of extension, when this had become constant under constant load, to length l_0 at zero time obtained by extrapolation, the figures so obtained being corrected to a standard tension per unit cross-sectional area of collagen, calculated for length l_0 from the total collagen content of the sample. No increase in pregnancy was found in the extensibility of the uterus itself. A similar examination of rat's skin showed a marked drop (80 times) in extensability with age associated with a rise in tensile strength. Thus there appears to be a change in the properties of the collagenous framework of the skin increasing the surface mechanical resistance more than would be expected from change in collagen content, which, per unit area, also increases with age. Some properties of the skin of an animal, the hippopotamus, with peculiarly high surface mechanical resistance are discussed. Author

N67-14599*# Sydney Univ. (Australia). Dept. of Medicine.
RHEOLOGY OF SYNOVIAL FLUID AND ITS ROLE IN JOINT LUBRICATION
Leopold Dintenfass *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 489–503 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The theories of lubrication were reviewed, and it was concluded that neither the classical hydrodynamic theory nor the boundary theory permits an adequate description and explanation of lubrication in synovial joints. It is suggested that the key factor is the thixotropic behavior of synovial fluid which enables preserving constant load-bearing capacity at various rates of movement. The elastic properties of the articular cartilage might depend on the presence of synovial fluid in its pores. The pressure exerted in the fluid will depend on the elasticity of the cartilage and on the area of contact. The velocity gradient in the gap will depend on the normal and lateral deformations in the articular cartilage. Pathorheology (rheological pathology) of the synovial joints is discussed and related to physicochemical and morphological changes in both synovial fluid and cartilage. The proposed outline of lubrication in synovial joints explains the interdependence of synovial fluid and articular surfaces. Both synovial fluid and articular cartilage are necessary components of joint lubrication. Author

N67-14600*# New York Medical Coll., N. Y. Dept. of Biochemistry.

FACTORS AFFECTING THE RHEOLOGICAL BEHAVIOR OF HYALURONIC ACID

Ward Pigman, G. Matsumura, and A. Herp *In its* Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 505–519 refs Supported by Public Health Service (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The rheological characteristics of hyaluronic acid are markedly dependent upon many substances found in tissues and fluid. They are markedly affected by the presence of salts, pH, natural autooxidants, anti-oxidants, and oxygen. Three-dimensional networks (semigels) are formed which, considerable evidence shows, could affect the movement of large molecules including the diffusion of proteins. The gel structure of the intracellular ground substance of connective tissue is probably provided by hyaluronic acid and seems to be highly dependent upon the degree of polymerization. Since the gel structure influences the mobility, variations in gel structure may provide a mechanism of control of permeability of metabolites moving to and from cells and capillaries. Author

N67-14601*# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Wool Research Labs.

STRUCTURAL TRANSITIONS IN NATIVE COLLAGEN AND THEIR PHYSIOLOGICAL SIGNIFICANCE

B. J. Rigby and P. Mason *In* N. Y. Med. Coll. Proc. on the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 521–534 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Four structural transitions in collagen are considered, viz., the shrinkage temperature T_s, at which a specimen shrinks abruptly to about one-quarter of its original length; the melting temperature T_m, which is the true thermodynamic melting point of the crystalline system and may be 10°C. or more below T_s; the glass transition temperature T_g, which is lower than T_m and which marks an abrupt increase in the thermal expansion coefficient; and finally the denaturation temperature T_D, which is the temperature at which collagen molecules in dilute solution undergo the transition from helices to random coils. Measurements of T_s and T_g are described and discussed in relation to partial premelting of the specimens, the effects of swelling in water, and the influence of prolonged mechanical strain. The bulk transition T_g is the only one of the transitions which occurs in the vicinity of normal body temperature and may be closely involved in the pathology of collagenous structures. It is suggested that the effects of such factors as swelling, pH, amino acid composition; and mechanical loading, which have already been studied in relation to T_s, should not be examined in relation to T_g. Author

N67-14602*# Laboratorium fuer Polarisationmikroskopie, Bremen (West Germany).

OPTICAL POLARIZATION OF SPINNING THREADS OF THE VITREOUS BODY OF ANIMAL EYES AS AN EXPRESSION OF THEIR BIORHEOLOGICAL BEHAVIOR [POLARISATIONSOPTIK AUS DEM GLASKOERPER TIERISCHER AUGEN GESPONNENER FAEDEN ALS AUSDRUCK IHRES BIORHEOLOGISCHEN VERHALTENS]

Hans H. Pfeiffer *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 535–546 refs In GERMAN; ENGLISH summary (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Three effects of thread-shaped deformation of the vitreous humor of animal eyes were qualitatively and quantitatively studied in polarized light: the flow birefringence, the double absorption or dichroism, and the double diffraction. For each case, an attempt was made to interpret the behavior of the spinning threads by assuming the orientation theory within its limitations. Author

N67-14603*# College Scientifique Universitaire de Tours (France). Lab. d'Hematologie.

THE THROMBODYNAMIC PROPERTY OF A CLOT: THE SPECIFIC HEMORHEOLOGICAL PROPERTY EXPLORED BY THE THROMBELASTOGRAPH (THE THROMBODYNAMIC FUNCTION OF PLAQUETTES, FIBRIN, AND CERTAIN FACTORS OF PLASMA AND SERUM) [LA PROPRIETE THROMBODYNAMIQUE DU CAILLOT: PROPRIETE HEMORHEOLOGIQUE SPECIFIQUE EXPLOREE PAR LE THROMBELASTOGRAPHE (LA FONCTION THROMBODYNAMIQUE DES PLAQUETTES, DE LA FABRINE ET DE CERTAINS FACTEURS DU PLASMA ET DU SERUM)]

Maurice E. Leroux *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 549–569 refs In FRENCH (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

The specific hemorheological property of blood clots was studied by Hartert's thromboelastograph. This is called a thrombodynamic property because it shows the physiological ability of clots to remain in equilibrium *in situ* with intravascular pressure during hemostasis because of their rigidity and parietal adherence. The property develops progressively during structuration of the clot by fibrin, factor XIII, calcium, platelets, and other serological factors. The thrombodynamic function of platelets is essential and includes all vital activity during hemostasis. The structural evolution of the clot depends on the result of the antagonistic syneresis forces off fibrin, and of the retraction of the platelets. Transl. by R.LI.

N67-14604*# Heidelburg Univ. (West Germany).

CLOT RETRACTION. KINETICS AND CORRELATION WITH THE CLOTTING PROCESS

H. Hartert *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 571–580 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Retraction of the blood clot consists apparently of a chemical phase, which brings about a strain in the clot. Retraction (i.e., the physical phase of retraction) takes place after chemical tightening of the clot. The moment when it begins depends on the process of detachment at the interface between clot and surface of the container. The speed of retraction depends on the volume of the clot and on the number of blood cells, provided a normal amount and quality of fibrinogen as well as platelets are present. Roughly speaking, the yield is determined by the same factors. The physical potency of retraction remains active for several hours after clotting, yet decreases progressively. After 4 hours, e.g., it still has two-thirds of its initial value. The chemical phase of retraction seems to be identical with that phase of the clotting process in which the fibrin and platelets containing clot structure is established. Author

N67-14605*# Goteborg Univ. (Sweden).

FAT EMBOLISM–A HEMORHEOLOGIC DISTURBANCE

Sven-Erik Bergentz *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 581–592 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

Posttraumatic fat embolism is generally assumed to be caused by intravasation of major fat droplets from traumatized fat tissue, particularly the bone marrow. Fat embolism is, however, a relatively common phenomenon even without a mechanical injury. In experimental animals fat embolism can be produced in different ways, including the initiation of an intravascular coagulation process, for instance by injection of thromboplastic substances. Evidence is given to show that the posttraumatic fat embplism can be caused by a hemorheologic disturbance with a change in the physical state of the fat normally occurring in the blood. This change is probably due to an intravascular coagulation process initiated by the trauma. Author

N67-14606*# Sydney Univ. (Australia). Dept. of Medicine.
A STUDY IN RHEOLOGY OF BLOOD CLOTTING IN HUMAN SUBJECTS
Leopold Dintenfass *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 593–600 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

A study of blood clotting was carried out by means of a cone-in-cone rotational viscometer. Blood samples were obtained from healthy persons and from patients suffering from anaemia, coronary infarction, venous thrombosis, leukemia, rheumatoid arthritis, polycythemia, and cancer. Also blood from a sheep was employed. Clotting of blood was made apparent by a viscosity increase. The rate of clotting depended not only on the origin of the sample but also on the velocity gradient at which such clotting took place. At body temperature, clotting proceeds more rapidly at higher velocity gradients. Author

N67-14607*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
INFLUENCE OF PLASMA PROTEINS ON THE RHEOLOGY OF HUMAN BLOOD
A. Britten (Mass. Gen. Hosp.), Robert B. Pennell (Protein Found., Boston), E. W. Merrill, W. G. Margetts, G. R. Cokelet et al *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 601–611 refs Prepared in cooperation with Mass Gen. Hosp. and Protein Found. (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75

By means of a viscometer, further studies were made on the role of fibrinogen and the other plasma proteins in the rheology of blood measured near and at zero shear. These studies include correlation of the rheological parameters (including yield stress) with the measured fibrinogen content of numerous samples of normal human blood and blood from a patient with afibrinogenemia and comparison of the rheological properties of suspensions of red cells in the Cohn fractions. Author

N67-14608*# Columbia Univ., New York. Coll. of Physicians and Surgeons.
VISCOSITY OF BLOOD AT LOW SHEAR RATES: OBSERVATIONS ON ITS RELATION TO VOLUME CONCENTRATION AND SIZE OF THE RED CELLS
Magnus I. Gregersen, Branko Peric, Shu Chien, Duncan Sinclair, Chen Change et al *In* N. Y. Med. Coll. Proc. of the 4th Intern. Congr. on Rheol., Pt. 4 1965 p 613–628 refs (See N67-14561 05-04) CFSTI: HC $9.55/MF $2.75
(Contract DA-49-193-MD-2272)

In vitro tests on heparinized blood from elephant, man, dog, and goat revealed species differences in the blood viscosity at low rates of shear. These differences may be related to the mean corpuscular volume of the red cell, although species differences in the plasma may also play a role. Similar, though less pronounced, results were obtained for red cells supended in Ringer's solution. Author

N67-14635*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
COMMUNICATIONS BIOPHYSICS
M. B. Sachs *In its* Res. Lab. of Electron 15 Oct. 1966 p 159–164 refs (See N67-14621 05-34) CFSTI: HC $6.00/MF $1.25
(Contract DA-36-039-AMC-03200(E); Grants NSF GK-835; NIH G-MH-04737-06)

A quantitative description is given of the responses of auditory nerve fibers to two-tone stimuli. A single variable, i.e., rate of spike discharge, is used for this description. Iso-rate contours for responses to one-tone stimuli were constructed by means of a sweep-frequency technique. When rate was measured as a function of the frequency of one of two tones, that tone was presented as a sweep-frequency signal. If a second tone was present, it was presented as a continuous tone at the fiber's characteristic frequency. Data were collected for testing mathematical descriptions of responses by using tone-burst stimuli and measuring the discharge rate after the transient at the tone-burst onset. By this method, expressions were developed to describe the relationship between discharge rate and the stimulus parameters of the two-tones. K.W.

N67-14636*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
NEUROPHYSIOLOGY
R. Moreno-Diaz, W. F. Pickard, B. Howland, and Stephen J. Wiesner (Brandeis Univ.) *In its* Res. Lab. of Electron. 15 Oct. 1966 p 165–178 refs (See N67-14621 05-34) CFSTI: HC $6.00/MF $1.25
(Contract AF 33(615)-3885; Grant NIH G-NB-04985-03)

Presented are three articles, the first of which discusses stability of networks with loops, specifically: (1) the state transition matrix of a neural network, (2) network stability and oscillations, and (3) stability for a single neuron. The second article is a brief summary of two impalement techniques for use in studying the electrical properties of myelinated fibers in the dorsal roots of cats. The third article describes a method for fabricating large-aperture sphero-cylinder lenses. The method depends on the deformation of square plates by couples of forces applied at opposite corners. The advantage of this method is that the forces involved are self-equalized and need be applied at only four points. Included is a discussion of test methods for plastic-cast crossed-cylinder lenses and the use of a crossed-cylinder lens to test camera lenses. K.W.

N67-14703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CEREBRAL CORTEX AND THE FUNCTION OF THE VESTIBULAR APPARATUS
E. Sh. Ayrapet'yants and V. A. Kislyakov 29 Jul. 1966 53 p refs Transl. into ENGLISH from Kora Bol'shikh Polushariy i Funktsiya Vestibulyarnogo Apparata, An SSSR (Moscow), 1962 p 1–4, 604–619
(FTD-TT-66-30; TT-66-62447; AD-640313) CFSTI: HC $3.00/MF $0.50

The basic theories and works of Rudolph Magnus are reviewed, and questions arising from his work are considered. Factual material accumulated in the Soviet Union during three decades relating to the problem of the cerebral cortex and the function of the vestibular apparatus is presented with an extensive bibliography. Alterations in vestibular reactions after extirpation of the cerebral cortex and with various influences on it are discussed, and the question of localization of the cortical terminus of the vestibular analyzer is considered. The study of the cortical regulation of vestibular reactions according to the method of conditioned reflexes is also assessed. L.E.W.

N67-14719# Air Force Systems Command, Brooks AFB, Tex.
AEROSPACE MEDICINE CONSIDERATIONS IN MANRATING SPACE ENVIRONMENT SIMULATORS
Paul W. Musgrave and Donald I. Carter Jun. 1966 26 p refs
(AMD-TR-66-2; AD-639645) CFSTI: HC $1.00/MF $0.50

Manrating of space environment simulators has become a necessity to facilitate the operation of these devices and to carry out testing of equipment within near-vacuum conditions. Protection of the individual performing duty within these environment extremes has presented interesting problems to the physician, physiologist, and engineer. This paper describes the physical facility

requirements and operational procedures which must be integrated to provide a satisfactory degree of safety for these personnel. Author (TAB)

N67-14734# School of Aerospace Medicine, Brooks AFB, Tex.
EXPERIMENTAL INVESTIGATIONS WITH ELECTRICAL STIMULATION OF THE OCULOMOTOR NUCLEUS: THE EFFECTS OF STIMULUS FREQUENCY Interim Report, Sep. 1962–Jun. 1964
Donald G. Pitts Jul. 1966 17 p refs
(SAM-TR-66-65; AD-639640) CFSTI: HC $1.00/MF $0.50

Procedures and methods for the study of the central control of accommodation by electrical stimulation are presented. Positive accommodation, an increase in the dioptric power of the eye, and negative accommodation, a decrease in the dioptric power of the eye, were found by brain-stem stimulation in the cat. The frequency threshold for positive accommodation was about 4 cps. The frequency threshold for negative accommodation was about 10 cps. Frequencies of 60 and 90 cps were more efficient in producing positive accommodation, while negative accommodation varied directly with the frequency up to the 120 cps limiting frequency. The central control of accommodation by the oculomotor nucleus appears to depend somewhat on the stimulus frequency. Not all responses can be explained by frequency alone, and a definitive theory must await further data and analysis. Author (TAB)

N67-14761*# National Aeronautics and Space Administration, Washington, D. C.
SPACECRAFT STERILIZATION TECHNOLOGY
1966 601 p refs Conf. held at Pasadena, Calif., 16–18 Nov. 1965; Sponsored by NASA
(NASA-SP-108) GPO: HC $2.25; CFSTI: MF $2.50 CSCL 06T

Conference papers on NASA sterilization requirements, microbiological control and monitoring, and sterilization techniques are presented. For individual titles see N67-14762–N67-14797. Author

N67-14762*# Illinois Univ., Urbana.
BASIS FOR THE STERILITY REQUIREMENT
Kimball C. Atwood *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 3–10 (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The necessity for spacecraft sterilization is assessed from two viewpoints: the scientific gains that may not be realized if some significant effect of contamination of the extraterrestrial sites should occur; and the probability that any significant effect will occur. The Martian environment is discussed in relation to the multiplication of terrestrial organisms, and the question of what would happen if earth contaminants were picked up in an assay of Martian matter is examined. Life detection instruments, and their limitations, are considered, and it is suggested that an attempt be made to obtain evidence that no organisms like terrestrial organisms are present. Another stratagem proposed is the extensive use of life detection instruments that are not especially designed to detect extraterrestrial biota but will detect terrestrial-like organisms in an extraterrestrial environment. M.G.J.

N67-14765*# National Aeronautics and Space Administration, Washington, D. C.
NASA REQUIREMENTS FOR THE STERILIZATION OF SPACECRAFT
Lawrence B. Hall et al *In its* Spacecraft Sterilization Technol. 1966 p 25–39 ref (See N67-14761 05-05) GPO: HC $2.25: CFSTI: MF $2.50

Decontamination requirements for lunar landing spacecraft are reviewed, in which primary reliance for decontamination is placed on the die-away of microorganisms over a period of time. To meet the more rigorous requirements for sterilization of planetary landing capsules, the general plan includes four major phases: (1) development of sterilizable capsule hardware; (2) limitation of the quantity of viable biological loading; (3) application of terminal sterilization; and (4) protection of the sterile capsule from recontamination through launch. Several alternative methods of limiting the viable burden on a capsule are discussed. These include clean handling throughout; heat decontamination of parts, and clean subassembly; and heat decontamination before clean final assembly. The broad NASA sterilization guidelines for planetary landing hardware are listed; however, it is pointed out that such guidelines are undergoing constant reevaluation and adjustment. M.G.J.

N67-14766*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STERILIZATION AND QUARANTINE PARAMETERS FOR CONSIDERATION DURING THE DESIGN OF PLANETARY VEHICLES
Charles W. Craven, Joseph J. Mc Dade, and Jay O. Light *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 43–50 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The tentative policy adopted as a constraint on all launches for Mars is outlined, and the known sources of contamination are summarized. Capsule sterilization procedures, based on chemical decontamination and exposure to dry heat, have been selected as optimum, and steps taken to insure the development of sterilizable materials and components are discussed. Although heating to 135°C for 24 hours has proved adequate, the possibility is mentioned that a lower temperature for a longer time may be selected for the flight programs. Sterilization is aimed at the inactivation of all microorganisms, in particular the fungi and bacteria; problems connected with their destruction are discussed. It is expected that all subsystems, including the various science payloads, will be subjected to one chemical decontamination cycle (ethylene oxide), and one dry heat sterilization cycle as part of the flight acceptance test before the start of final assembly. Capsule assembly and sterilization procedures are depicted. M.G.J.

N67-14767*# Minnesota Univ., Minneapolis. Dept. of Environmental Health.
ENVIRONMENTAL MICROBIOLOGY AND THE CONTROL OF MICROBIAL CONTAMINATION
Joseph J. McDade (JPL), Martin S. Favero (Public Health Serv.), George S. Michaelsen, and Donald Vesley *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 51–86 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Levels of microbial contamination have been presented for the intramural environments of 17 different facilities located in three geographical areas of the United States. The data obtained indicate that a well run clean room can and does reduce the level of intramural microbial contamination. Such studies also have shown that the primary source of microbial contamination in a clean room is the operating personnel. Soil-type species, such as bacterial and mold spores, did not appear prevalent in the total population of microorganisms recovered within the clean rooms sampled in this survey. Elimination of microbial contaminants such as spores is of critical importance in obtaining sterility by dry heat, or at least in increasing the reliability that a given sterilization procedure successfully will meet the NASA planetary quarantine requirements. Consequently, these preliminary data indicate that use of a clean room environment for assembly of space hardware has merit. Author

N67-14768*# Mayo Clinic, Rochester, Minn.
SKIN CARRIAGE OF BACTERIA IN THE HUMAN
John A. Ulrich *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 87–95 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Several techniques required to assess the bacterial population on and in the skin are discussed. Areas of high and low density of bacteria on the skin are found. The pattern of spread is common in all normal individuals and no sex differences have been observed. Each person maintains a level of population within a limited range and climatic changes appear to have little or no influence on the level. Methods such as scrubbing and flushing and the use of germicides can cause a temporary reduction in numbers, but there is a rapid return to normal levels. Mechanical barriers still remain the best method to handle sterile objects. Author

N67-14769*# Public Health Service, Washington, D. C. Communicable Disease Center.
QUANTITATIVE ASPECTS OF SHEDDING OF MICRO-ORGANISMS BY HUMANS
Dick K. Riemensnider *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 97–103 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

In order to study shedding of all microorganisms from people, a stainless steel chamber large enough to accommodate a standing adult was constructed. This chamber, called a microbiotank, was designed to permit sterilization by steam prior to occupancy by the subject to be evaluated, and to facilitate easy recovery of organisms shed into it. The techniques developed for these quantitative investigations are described, and details are presented on the test procedures used. Data are given to show the total viable particles shed by individuals at various exposure times in the microbiotank, and the consistency of microbial shedding from individuals on consecutive days. It was concluded that good personal hygiene plus the wearing of sterile clothes reduces the numbers of microorganisms shed into the environment. M.G.J.

N67-14770*# Army Biological Labs., Fort Detrick, Md.
MICROBIOLOGICAL BARRIER TECHNIQUES
G. Briggs Phillips *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 105–135 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The types of microbiological barrier techniques and equipment that could be useful in solving spacecraft sterilization problems are defined and illustrated. The five stages of microbiological contamination control are listed as (1) recognize and define the problem; (2) establish contamination control criteria; (3) employ approaches and techniques of control; (4) use microbiological testing and surveillance; and (5) analyze results and certification procedures. The importance of each is discussed. Microbiological barrier systems are classified according to purpose, size, and degree of containment, and specific examples of each are given. Recommended sterilization and decontamination agents for each barrier application are listed. Advantages and disadvantages are assessed, with emphasis focused on heat, vapors and gases, liquid decontaminants, and radiation. Recommended conditions of use for such agents are summarized, and certain desirable minimum features for the microbiological barriers are listed. M.G.J.

N67-14771*# Minnesota Univ., Minneapolis.
VISUAL MONITORING AS AN ASSAY TECHNIQUE
R. Angelotti, K. H. Lewis (Public Health Serv.), and D. W. Drummond *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 137–146 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The applications of visual monitoring to microbiological contamination control during spacecraft assembly, test, and launch are discussed in the context of a complete monitoring system. It is pointed out that such monitoring is needed to assure both operational reliability and contamination control. As an example, the microbiological monitoring of milk production is discussed to illustrate the place of such techniques in a successful commercial operation. The needs for exchanges of information between functional groups are stressed, and mechanisms are indicated by which such problems can be solved. Although most monitoring can be performed by nonprofessional personnel, the recommendation is made that a professional microbiologist visual observer be present in the spacecraft handling area. M.G.J.

N67-14772*# Minnesota Univ., Minneapolis. School of Public Health.
SURVEY OF MICROBIOLOGICAL TECHNIQUES FOR RECOVERY FROM SURFACES
Donald Vesley *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 147–153 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Standardized methodology is being developed for several applications of microbial surface sampling in the spacecraft sterilization effort. Surface evaluations will include: (1) room surfaces in assembly areas (Rodac and swab methods), (2) clothing and packaging materials (Rodac method), (3) stainless-steel strips to determine cumulative contamination over an extended period in assembly areas (rinse method), (4) piece part evaluation (rinse and direct agar plating methods), and (5) subsystems evaluation (rinse and direct agar plating methods on detachable coupons designed into the system). In particular, the combination rinse and direct agar plating technique appears to be a valuable tool for quantitative and qualitative evaluation of microbial loading prior to terminal sterilization. Author

N67-14773*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROBIOLOGICAL TECHNIQUES FOR RECOVERY FROM INTERIORS OF SOLIDS
Earl G. McNall, William T. Duffy (Dyn. Sci. Corp.), and John J. Iandolo *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 155–176 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The need for developing adequate pulverization techniques for exposing microorganisms within solids is discussed, along with the necessity for developing methodology to overcome the adverse environments provided by the entrapping solids. The widely different forms of pulverization produced by various blade and tooth conformations of saws are described, and tabulated data are presented to show the effect of pressure and blade designs on the pulverization of plastic materials. Solid rocket propellants are considered the most difficult spacecraft component to pulverize; however, polyester and epoxy resins can be satisfactorily pulverized by sawing. Techniques for leaching, neutralization, and culture of certain solid spacecraft materials are also discussed. M.G.J.

N67-14774*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF A BIOLOGICAL INDICATOR FOR DRY-HEAT STERILIZATION
Alexander S. Irons et al *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 177–189 (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The indicator system will consist of a spore tablet, a sealed carrier or container, and a handling procedure designed to prevent inadvertent contamination of the space hardware being assayed. It will be capable of discerning, biologically, the attainment of the conditions considered necessary to sterilize space hardware.

Sterilization of the indicator will not, in itself, prove that sterility of the lander capsule has been achieved; it will merely verify that the particular process being utilized was successfully applied. The process used to produce sterility must have been previously shown to be reliable and predictable as to the probability of attaining sterility. Author

N67-14775*# Massachusetts Inst. of Tech., Cambridge.
SURVEY OF CERTAIN NONTHERMAL METHODS OF DECONTAMINATION AND STERILIZATION
Gerald Silverman *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 193–206 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The feasibility and limitations inherent in using ionizing radiations for spacecraft sterilization are discussed. The types of radiation for inactivating microorganisms are classified into particle radiations and electromagnetic radiations; for practical considerations, these are limited to fast electrons, X-rays, gamma rays, and ultraviolet light. The biological effects of ionizing irradiation are examined, and the radiation resistivities of several biological systems are given. Additional factors to be considered in this sterilization technique are identified as the dose rate, the presence of oxygen and organic materials, protective compounds, physiological state, water content, and temperature during irradiation. Microwave and dielectric heating processes and the use of lasers are considered briefly. M.G.J.

N67-14776*# National Aeronautics and Space Administration, Washington, D. C.
DRY-HEAT STERILIZATION FOR PLANETARY-IMPACTING SPACECRAFT
Carl W. Bruch *In its* Spacecraft Sterilization Technol. 1966 p 207–229 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The dry-heat cycle of 135°C for 22 hours being investigated for the sterilization of planetary spacecraft is described herein. A historical approach of how that particular cycle was derived is presented. After an analysis of some of the environmental factors that influence dry-heat sterilization, various mathematical considerations of the available data are examined. By use of activation energy calculations, it is shown that some components might suffer less damage with high-temperature short-time cycles. It is also necessary to consider the integration of the lethality that occurs during the comeup time and cooldown time of the heating process with the lethality that occurs at the desired holding temperature. Author

N67-14777*# Army Biological Labs., Fort Detrick, Md.
GASEOUS STERILIZATION
Charles R. Phillips *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 231–257 refs Submitted for Publication (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Ethylene oxide, formaldehyde, and beta-propiolactone are identified as the compounds used most frequently in gas sterilization applications, and the advantages and disadvantages of each are assessed. Based on a literature survey, other gases which are considered to have bactericidal properties are discussed. These include propylene oxide, ozone, methyl bromide gas, chloropicrin gas, epichlorohydrin and epibromohydrin, ethylene imine, glycidaldehyde, and peracetic acid. An extensive bibliography is included. M.G.J.

N67-14778*# Army Biological Labs., Fort Detrick, Md.
FILTER APPLICATIONS FOR SPACECRAFT STERILIZATION PROGRAM
Herbert M. Decker, Lee M. Buchanan et al *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 259–272 ref (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Air filtration as a method of removing bacteria from the air is discussed in relation to the five categories of filters used in biological air cleaning. These are roughing filters; medium efficiency filters; high efficiency filters; ultrahigh efficiency filters, also classified as high efficiency particulate air filters; and filters for complete filtration. Test results of filters in each category are tabulated, and it is shown that the higher the efficiency, the greater the pressure drop across the filter. Also discussed is the development of a portable dioctyl phthalate test apparatus, for determining the effectiveness of installed filters in removing 0.3 micron particulate material from air. Methods of air cleaning by washing and scrubbing are reviewed, along with such techniques as the electrostatic precipitator, heat sterilization, and ultraviolet light treatment. M.G.J.

N67-14779*# Minnesota Univ., Minneapolis. School of Public Health.
SPACECRAFT CONTAMINATION RESULTING FROM HUMAN CONTACT
Donald Vesley, Orlando R. Ruschmeyer, and Richard G. Bond *In* NASA, Washington Spacecraft Sterilization Technol. 05-05) GPO: HC $2.25; CFSTI: MF $2.50

Contamination transferred by workers in assembly processes is discussed, and summary data are presented on studies directed toward obtaining data about the extent of microbial contamination transferred by human hands. Tables are included to show the contamination detected on metallic and nonmetallic component materials after handling by groups of four persons; survival after storage of microorganisms on contaminated materials; and levels of microbial contamination detected during simulated component assembly trials under different control methods. Results of preliminary data analyses indicate: (1) Variability in microbial shedding from hands of different individuals is extremely high. (2) Nonmetallic substances such as epoxy laminates, Teflon, and Lucite may be more readily contaminated than metals and may retain viable particles for longer periods. (3) Sporeforming microbes comprise a very high percentage of surviving species following 12 to 20 weeks of storage. (4) The use of sterile gloves or a single hand washing with a hexachlorophene soap can considerably reduce microbial transfer. M.G.J.

N67-14780*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENGINEERING PROBLEMS IN STERILIZATION OF SPACECRAFT
Victor J. Magistrale *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 285–292 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

The kinds of engineering problems engendered by the spacecraft sterilization requirement are surveyed in relation to its effect on all aspects of design, hardware development, assembly, test, and launch of a spacecraft and capsule. Two mission modes for planetary exploration are considered: an impact trajectory with deflection of the spacecraft; and a flyby trajectory of the spacecraft with subsequent capsule deflection. Subsystems hardware problems and operational problems incurred by the sterilization criteria are also assessed, and various approaches proposed as solutions to these problems are discussed. Among the points made in the survey are: (1) Recognition of the probabilistic approach is mandatory as its provides an analytical basis for sound engineering judgment. (2) A quantitative methodology, in the form of a mathematical method of counting microorganisms, should be developed to determine how microbial contamination varies with the imposition of sterilization requirements. M.G.J.

N67-14781*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTAMINATION ANALYSIS AND MONITORING
Jack D. Johnson et al *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 293–305 refs (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

For an operational approach to certification of sterility of space hardware, it is necessary to apply the probability concept. The report is concerned with the applicability of mathematics to predict the probability of achieving sterility in a complex space hardware system. As such, this approach is concerned with the manipulation of microbiological data rather than mathematical rigor. Author

N67-14782*# National Aeronautics and Space Administration, Washington, D. C.
SPACECRAFT STERILIZATION PROGRAM
James R. Miles *In its* Spacecraft Sterilization Technol. 1966 p 309–311 (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.25

Some background information is provided on the implementation and requirements of the sterilization program which is being conducted to create the technology needed to develop sterilizable spacecraft for planetary landings. R.N.A.

N67-14783*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRONIC PARTS STERILIZATION PROGRAM AT THE JET PROPULSION LABORATORY
Warren H. Lockyear *In* NASA, Washington Spacecraft Sterilization Technol. 1966 p 313–326 (See N67-14761 05-05) GPO: HC $2.25; CFSTI: MF $2.50

This report documents the electronic parts sterilization program. The program is geared to reflect current NASA sterilization policy. The major effort of the current program is concerned with heat sterilization. The primary objective is to establish an approved list of heat sterilizable electronic parts. The secondary objective is to establish maximum information in the new era of higher operating temperatures and longevity of electronic parts. Author

N67-14876# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEDICAL MONITORING OF THE CONDITION OF COSMONAUTS BELYAYEV AND LEONOV DURING TRAINING AND ORBITAL FLIGHT
I. T. Akulinichev, A. S. Antoshchenko, V. A. Znachko, A. Ye. Ivanov, V. I. Lebedev et al *In its* Cosmic Res. 4 Aug. 1966 p 224–240 refs (See N67-14861 05-30) CFSTI: HC $6.00/MF $1.50

Results are presented on the medical monitoring of the condition of cosmonauts Belyayev and Leonov during high-altitude training sessions in a pressure chamber, in carrying out portions of their flight assignment in a training vehicle and during Leonov's extravehicular activities outside the "Voskhod-2" vehicle in outer space. Medical monitoring data analysis demonstrated that under conditions of ground training, as well as during orbital flight, both cosmonauts exhibited temporary functional disruptions of physiological functions, associated with nervous-emotional stresses, and in Leonov's case with application of considerable physical stresses. Author

N67-14877# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF SPACE-FLIGHT FACTORS ON WHEAT SEEDS AND THE PLANTS PRODUCED FROM THEM
G. V. Il'ina, N. N. Kuznetsova, S. G. Rydkiy, and V. G. Vysotskiy *In its* Cosmic Res. 4 Aug. 1966 p 241–247 refs (See N67-14861 05-30) CFSTI: HC $6.00/MF $1.50

The purpose of this investigation was to study the influence exerted by the factors of space flight on the sprouting and germination energy in wheat seeds, as well as the growth, development and harvest of plants produced from the seeds. We took Krasnozerna wheat seeds after they had been subjected to flights aboard the "Vostok-5" and "Vostok-6" space vehicles. Observations of the growth and development of the plants was carried out under the conditions of a vegetation experiment. Author

N67-14887*# Schwarz Bioresearch, Inc., Orangeburg, N. Y.
SUPERIOR DIET FOR MAN IN SPACE Annual Report, Oct. 1965–Oct. 1966
Norman A. Rosenthal Dec. 1966 268 p refs
(Contract NASw-517)
(NASA-CR-80969) CFSTI: HC $3.00/MF $2.60 CSCL 06S

Experiments were conducted to determine the stability of chemically defined liquid diets under several environmental conditions and to determine their effect on the intestinal flora of rats. Deterioration via the Maillard reaction was found to be a function of temperature and related to the presence of substances in the diet which can initiate free radical formation through peroxidation reactions. For long term storage with refrigeration, the amino acid and carbohydrate components of liquid diets should be stored separately and mixed just before feeding. A new mechanism of non-enzymatic browning (Maillard reaction) is proposed. This mechanism involves an induction period in which equimolar amounts of amino acid and aldose react to form an enolamine or ketosamine followed by free radical attack of the amine to cause oxidative polymerization. Differences exist in the intestianl floar of different rat strains and in rats of the same strain obtained from different sources. Under conditions where coprophagy is not prevented, the intestinal microflora of rats is not significantly modified by feeding chemically defined liquid diets. S.P.

N67-14889*# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
MEDICAL AND BIOLOGICAL APPLICATIONS OF SPACE TELEMETRY Final Report
[1966] 109 p refs
(Contract NASw-846)
(NASA-CR-80967) CFSTI: HC $3.00/MF $1.30 CSCL 06B

A lengthy definition of biotelemetry is presented, and medical and biological applications are enumerated. By means of telemetry in intensive care wards, the status of the acutely ill patient can be constantly monitored and assessed. Continuous monitoring and warning signals provided by biotelemetry can inform the surgeon and anesthesiologist of the patient's condition during operations. The use of biotelemetry for diagnostic monitoring of the heart's activities during minor operations in the hospital or in the doctor's office is discussed. Information is presented on telestimulator systems used in conjunction with telemetry devices, so that physiological responses of subjects receiving electric stimulation of the brain can be remotely observed. System characteristics, psychophysiological applications, space applications, and possible medical uses for such systems are described. Finally the microminiaturization of biotelemetry systems for reduced size, lower power, and increased reliability is considered. S.P.

N67-14891*# Hawaii Inst. of Geophysics, Honolulu. Geochemistry Div.
SEARCH FOR BIOLOGICAL PROCURSOR MOLECULES IN VOLCANIC VOLATILE SYSTEMS Semiannual Status Report, Mar.–Dep. 1966
John J. Naughton Sep. 1966 12 p
(Grant NGR-12-001-012)
(NASA-CR-80965) CFSTI: HC $3.00/MF $0.65 CSCL 07C

Studies of the natural volcanic gaseous system for its elemental and molecular composition and the equilibrium molecular and free radial components to be found in gaseous systems are presented. Activities included analysis of results following trends in the gas composition of a lava lake and fumarole. A high-dispersion spectrometer was constructed for measurement of emission and absorption spectra. Reflexing systems were set up over lava lake drill holes to simulate the thermal system that might evolve prebiotics in a volcanic or fumarole situation. Further work on the extraction and analysis of gases from inclusions in ultrabasic nodules from deep crustal sources is reported. S.P.

N67-14961# Library of Congress, Washington, D. C. Aerospace Technology Div.
THE EFFECT OF SPACE FLIGHT FACTORS ON CENTRAL NERVOUS SYSTEM FUNCTIONS Surveys of Foreign Scientific and Technical Literature
Christopher H. Dodge and Janice L. Smith 4 Aug. 1966 42 p refs Summary of Data
(ATD-66-99; TT-67-60029; AD-642186) CFSTI: HC $3.00/MF $0.65

The report summarizes 16 articles which concentrate heavily on the isolated and combined effects of acceleration and radiation on mammals. Titles are as follows: effect of radial accelerations on brain temperature; effect of centrifugation on otolith function; effect of vibration on cerebrospinal reflexes; effect of vertical vibration and noise on conditioned reflexes; changes in cerebral bioelectricity and oxygen metabolism; effect of vibration and analyzer exclusion on brain metabolism; cerebral oxygen metabolism, bioelectricity, and conditioned reflex activity during vibration; respiratory changes during vibration; X-ray effect on cerebral venous flow; comparative effect of neutron, proton, and gamma irradiation (300 rad); comparative effect of neutron and gamma irradiation (25 rad); comparative effect of neutron, proton, and gamma irradiation (150 rad); comparative effect of chronic and acute gamma irradiation and nervous activity; effect of prolonged gamma irradiation on vestibular function; combined effects of vibration and chronic irradiation on vestibular function; combined effects of vibration and ionizing radiation on conditioned reflexes. Author (TAB)

N67-14964# Siena Univ. (Italy). Inst. of Medical Pathology.
BRAIN STEM SYSTEMS AND BEHAVIOR Final Scientific Report, 1 Jun. 1965–31 May 1966
Cesare Bartorelli and Alberto Zanchetti Jul. 1966 62 p refs
(Grant AF-EOAR-65-6)
(AFOSR-66-2413; AD-640985) CFSTI: HC $3.00/MF $0.75

Research was performed: (1) on central and reflex regulation of emotional behavior; and (2) on central and reflex regulation of circulation during the wakefulness-sleep cycle. Author (TAB)

N67-14966# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAN IN A SPACESHIP
A. Lebedinskiy, S. Levinskiy, and Yu. Nefedov 6 Apr. 1966 14 p Transl. into ENGLISH from Med. Gazeta (USSR), 18 Sep. 1964 p 3
(FTD-TT-65-1591; TT-64-51542; AD-640255) CFSTI: HC $1.00/MF $0.50

Prolonged tests on human subjects in hermetically sealed chambers showed that the atmospheric composition in the enclosure is the most essential factor that influences the organism of the human subject under observation. Individual differences in metabolisms of different men reflect on the qualitative and quantitative composition of volatile contaminants exuding into the air as well as the microflora compatibility. Supplementary cleaning of the air from bacteria and chemical admixtures, ultraviolet radiation of the skin, introduction of increased quantities of vitamins in the food ration, special complex physical exercises and some medical media, as well as the organization of a gradual transition from test conditions to normalcy are recommended to overcome medical and psychological factors of space travel. G.G.

N67-14977# School of Aerospace Medicine, Brooks AFB, Tex.
SPEED OF RECOVERY FROM CORIOLIS STIMULATION IN MOTION SICKNESS IN RELATION TO PILOTS AND NONPILOTS, JUNE–DECEMBER 1965
Patrick J. Dowd Jul. 1966 11 p refs
(SAM-TR-66-63; AD-639598) CFSTI: HC $1.00/MF $0.50

Certain flight maneuvers, such as an aircraft banking and turning, can be simulated by the USAFSAM biaxial stimulator, resulting in a Coriolis effect. Motion sickness can easily be induced by Coriolis stimulation for both pilots and nonflyers. An ex post facto analysis of the rate of decay of vertical nystagmus was used to determine the differences between pilots and nonpilots who were sick or nonsick. Results implied that the more rapid the rate of decay of nystagmus, the more rapid the abatement of autonomic stimulation, which decreases the chances of summing activity over time to reach required levels for general visceral responses resulting in motion sickness. The findings demonstrate the effects of flying experience on the rate of decay of nystagmus elicited by a Coriolis stimulation. Author (TAB)

N67-14996# FMC Corp., Santa Clara, Calif.
ON SITE SIMULATION OF SOURCE DATA GENERATION Technical Report, 14 Jun. 1965–1 Jul. 1966
Bruce N. McArthur, Anne Melby, and George Reid Wright-Patterson AFB, Ohio, Res. and Tech. Branch, Aug. 1966 191 p refs
(Contract AF 33(615)-3156)
(ASD-TR-66-12; AD-639755) CFSTI: HC $5.00/MF $1.00

An onsite study of source data generation by operational personnel in a simulated operational environment was performed. The purposes were to measure source data error levels, determine the effects of performance feedback, goal-setting, special type font and special handprinting instructions, on source data accuracy, and develop effective criteria for personnel selection and assignment. Criteria tested for potential in personnel selection and assignment included standard and specially designed clerical aptitude tests, general intelligence tests, a nonprojective personality test, a vocational interest blank, Civil Service supervisory tests, visual acuity scores, and other human factors. A representative sample of personnel involved in source data generation on-the-job was comprised of 15 women and 33 men. Operational simulation experiments employed typical source data materials. For a reading and legibility study, computer-generated synthetic codes were used. Author (TAB)

N67-15024# Naval Submarine Medical Center, Groton, Conn.
FREQUENCY SHIFTS OF A WHISTLE BLOWN IN DIFFERENT GASES
Russell L. Sergeant 29 Sep. 1966 7 p
(MR-66-16; AD-640378) CFSTI: HC $1.00/MF $0.50

In a study of the resonating characteristics of a whistle in an effort to explain variations in voice quality observed in helium speech, it was found that the pure tone production of a whistle follows the same principles for frequency resonance as that found in the human voice. Different degrees of upward shift in frequency occur for pure oxygen or a helium mixture. A taped signal does not change when played in helium-rich environment. Diffusion rates between gases appears to be important for minor shifts when the gas breathed is not the same as the environmental gas spoken into. Information presented in this report helps explain why helium speech, which is an important aspect of diving and underwater communications, sounds unusual. Author (TAB)

N67-15034# Ohio State Univ. Research Foundation, Columbus. Human Performance Center.

THE EFFECT OF TEAM FEEDBACK ON INDIVIDUAL PERFORMANCE AND SELF-EVALUATION Final Report

William A. Johnston and William C. Howell [1966] 15 p refs

(Grant AF-AFOSR-985-66)

(AFOSR-66-1948; AD-640404) CFSTI: HC $1.00/MF $0.50

The research program was designed to assess the role of team feedback in small-group activity. Team feedback was simulated by telling the subject that he had a partner and that feedback reflected his team performance relative to average performance. Actually, feedback represented the subject's individual tracking performance relative to a criterion, the stringency of which was manipulated experimentally. A stringent criterion produced poor feedback as though the subject had a poor partner, and a lenient criterion simulated a good partner. In general, the subjects performed best with good partners (lenient criteria). If one partner was replaced by a poorer partner, the subjects performance was retarded. The subjects accepted the credit for good team scores induced by a lenient criterion, but attributed the blame for poor scores wrought by a stringent criterion to their contrived partners. The data support the thesis that team feedback is an important determinant of individual behavior in the small group. Author (TAB)

N67-15042# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE PROBLEM OF CHANGES IN PHYSICO-CHEMICAL AND BIOLOGICAL PROPERTIES OF PILOTS SALIVA DURING ROLLING, TURNING, AND HYPOXIA

V. V. Yefimov, B. V. Tolokonnikov, and V. A. Gamburtsev 30 Mar. 1966 11 p Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 13, no. 5, 1942 p 44-47

(FTD-TT-65-1645; TT-66-62426; AD-640284) CFSTI: HC $1.00/MF $0.50

The change in composition of saliva during rolling, turning, and hypoxia is investigated. Specifically, the changes in physiochemical state of saliva by the surface of its tension on the boundaries with air and liquid (benzol). A comparison of the data on change in the surface tension and the degree of rolling showed that only surface tension values on the boundary with benzene gave a correlation with rolling degree. A comparison of surface tension changes in the saliva and urine demonstrated that urine also changes its surface tension at ascends, but these changes are less considerable and regular than in saliva. Experiments were also carried out to determine the surface tension of saliva among pilots during passage flights on civilian aircraft. It is concluded that surface tension of human saliva changes in a majority of cases regularly due to the action of rolling, rotation, and hypoxia. S.P

N67-15064# Delaware Univ., Newark. Center for Research on Social Behavior.

COMPONENTS OF GROUP RISK TAKING

Allan I. Teger and Dean G. Pruitt (State Univ. of New York at Buffalo) 26 Aug. 1966 38 p refs

(Contract Nonr-2285(02))

(TR-18; AD-640018) CFSTI: HC $2.00/MF $0.50

In a partial replication of an earlier study by Wallach and Kogan, group risk taking was examined under conditions of discussion and information exchange. Group size was also manipulated. Unlike the earlier findings, a risky shift occurred in the information exchange condition, where the subjects only revealed to one another the contents of their prior decisions. A stronger risky shift was found when discussion was permitted. Risky shift was more pronounced the larger the size of the group. The extent of risky shift on a decision problem was found to be positively related to the initial level of risk on that problem. The results appear to support Brown's value of risk theory of group risk taking more closely than any other theory. Author (TAB)

N67-15069# Naval Medical Research Inst., Bethesda, Md.

AN ABSORPTION SPECTROPHOTOMETER CELL FOR USE AT HIGH PRESSURES AND ITS APPLICATION TO AN ENZYMIC REACTION

Robert F. Steiner 7 Nov. 1966 16 p refs

(Rept.-32; AD-641910) CFSTI: HC $1.00/MF $0.50

A cell designed for absorbancy measurements at high pressures has been constructed and used for a study of the pressure dependence of a thrombincatalyzed hydrolysis. Thrombin is not inactivated at pressures up to 20,000 psi. The rate of hydrolysis of a synthetic substrate (toluene sulfonyl arginine methyl ester) increases appreciably with pressure. Author (TAB)

N67-15073# Istituto Nazionale di Ottica, Florence (Italy).

SUBJECTIVE SHARPNESS THRESHOLD IN MAXWELLIAN VIEW AND UNDER NORMAL VIEWING CONDITIONS

Marcella Bittini and Renato Sulli (Pisa Univ.) [1965] 11 p refs Repr. from Atti Fond. Giorgio Ronchi Contrib. Inst. Nazl. Ottica (Arcetri-Florence), anno. 20, no. 3, May-Jun. 1965 p 297-306 *Its* Pubbl. Dell'ist Nazl. di Ottica, Ser. II, No. 1113

(Contract AF 61(052)-850)

(AD-637096)

Subjective sharpness threshold, relative to a given test object, is determined and related to absolute threshold. The case of Maxwellian view is compared to normal viewing conditions. The two types of vision are found not to be interchangeable, and the difference is found to vary as a function of the size of entrance pupil of the eye. The findings are discussed in terms of the effects produced by diffraction phenomena and the eye aberration on the light distribution in the retinal image. Author (TAB)

N67-15076# Parma Univ. (Italy). Inst. of Human Physiology.

PHYSIOLOGY OF CENTRAL VISUAL PATHWAYS Final Report, 1 Jan.-31 Dec. 1965

A. Arduini 20 Jan. 1966 55 p refs

(Grant AF-EOAR-65-8)

(AFOSR-66-0176; AD-628081) CFSTI: HC $3.00/MF $0.50

The transfer functions of Lateral Geniculate Nucleus and of Visual Cortex I have been determined under conditions of steady state flickering illumination at fixed intensity. The results are compared with those of steady non-flickering stimulation. Microelectrode recordings under conditions of steady illumination with non-flickering light of different intensities have been made from individual fibers in the geniculo-cortical and in the corticothalamic tracts. An analysis of mean discharge frequency and of interspike interval distribution has been performed. Author (TAB)

N67-15089# RAND Corp., Santa Monica, Calif.

A DIGITAL-COMPUTER MODEL OF SPIKE ELICITATION BY POSTSYNAPTIC POTENTIALS IN SINGLE NERVE CELLS

R. J. MacGregor Sep. 1966 42 p refs

(Contract ARPA SD-79; ARPA Order 189-1)

(RM-4877-ARPA; AD-640268) CFSTI: HC $2.00/MF $0.50

A simulation of the information-processing function of nerve cells is presented. The computer model simulates the portion of the neuron at which spike potentials are initiated. Values for parameters were specified on the basis of neuroelectric recordings so that the results obtained might be pertinent to actual nerve cells. Trial runs verify that the model is accurately reproducing the functional forms of neuroelectric data. Input-output relations under regular input are given for a wide range of input frequency and pulse amplitude. Author (TAB)

N67-15097# HRB-Singer, Inc., State College, Pa.
THE PSYCHOLOGICAL ENVIRONMENT OF PROTECTIVE SHELTERS Final Report
Grace H. Wright and Nancy H. Fenstermacher Jul. 1966 146 p refs
(Contract OCD-PS-65-5)
(Rept.-75111-2F; AD-642296) CFSTI: HC $3.00/MF $0.65

The study was designed to cross-validate measuring instruments, to provide a refinement of methodology for use in future shelter studies, to investigate the effects of specified shelter relevant stresses, and to approximate a standard for evaluation of indices of psycho-social stresses occurring in shelter confinement. These purposes were accomplished by comparing the reactions of two equivalent groups, one subjected to selected stresses and the other not, on specifically designed rating forms, tests, and experimental tasks. All other conditions of confinement were equivalent for the two groups. The validation procedure consisted of comparisons between the original group from the psychiatric hospitals and both groups from the shelter confinements. Additional information was obtained through the use of two groups in the validation portion of the study. The results of the study indicated that a shelter group who received supplementary psychological supports evidenced a greater acceptance of confinement than the group for whom none were provided. The experimental data validated previous findings and showed that certain behaviors appear to be important in the psychological environments that exist at the beginning of and following a period of confinement. Author

N67-15118# Universidad Nacional Mayor de San Marcos de Lima (Peru). Instituto de Biologia Andina.
HUMORAL CONTROL OF THE ERYTHROPOIESIS DURING ALTITUDE CHANGES Annual Report, May 1965–Apr. 1966
Cesar Reynafarje, Jose Ramos, Jorge Gurmendi, Doris Villavicencio, and German Anduaga Apr. 1966 21 p refs
(Grant DA-ARO-49-092-65-G90)
(Rept.-1; AD-639752) CFSTI: HC $1.00/MF $0.50

A study was made of humoral control of erythropoietic activity in men during and after altitude exposure. Plasma from sea level subjects after 8, 24 and 48 hours of exposure to 4,450 meters of altitude produced a gradual increase of erythropoietic activity in starved rats. Urinary extracts had the same effect in samples obtained after 24 and 48 hours. No increase of erythropoietic activity was observed in plasma or urinary extracts from altitude natives when injected to rats. A depressing effect of plasma filtrate from altitude natives after 9 days of residence at sea level had a depressory effect on erythropoiesis in rats exposed to 18,000 feet. No changes of erythropoietic activity were observed when urinary extracts of natives of altitude were injected into starved rats after several periods of time at sea level. Additional observation in the urinary extracts from aplastic patients showed a very high degree of erythropoietic activity which diminished in patients successfully treated with anabolic steroid (meta-androstenolona). Author (TAB)

N67-15119# Federal Aviation Agency, Oklahoma City, Okla.
A HOMOGENEOUS FIELD FOR LIGHT ADAPTATION
Henry W. Mertens Sep. 1966 5 p ref
(AM-66-38)

Visual judgments of size, distance, slant, etc. in the flying situation are often made under reduced cue conditions, especially during night flying. In the experimental study of spatial perception under these conditions, experiments often require long sessions in the dark and involve stimuli of low luminance allowing considerable dark adaptation to occur. The resulting change in visual sensitivity makes the control of light more difficult and increases the possibility that extraneous cues may contaminate the data. Light adaptation devices are often used to control this sensitivity but themselves may introduce extraneous cues, e.g., size and distance cues. This report describes a light adaptation device which produces a homogeneous adaptation field without extraneous cues and which can be used easily between experimental observations even though *S* is in an otherwise dark observation position. Author

N67-15120# Federal Aviation Agency, Oklahoma City, Okla.
PILOT VISION CONSIDERATIONS: THE EFFECT OF AGE ON BINOCULAR FUSION TIME
Carlton E. Melton, Jr. and Marlene Wicks Oct. 1966 9 p refs
(AM-66-35)

This study provides data regarding the relationship between vision performance and age of the individual. It has direct application to pilot visual tasks with respect to instrument panel displays, and to controller visual tasks in association with radar equipment. It also relates to the visual parameter important to the determination of a physiologic age rating for pilots. Author

N67-15121*# National Aeronautics and Space Administration, Washington, D. C.
THE ROLE OF THE VESTIBULAR ORGANS IN SPACE EXPLORATION
1966 315 p refs 2d Symp. held Moffett Field, Calif. 25–27 Jan. 1966
(NASA-SP-115) GPO: HC $2.00; CFSTI: MF $3.35 CSCL 06S

Gravitoinertial receptor mechanisms and related systems are covered in papers presented at the second symposium on "The Role of Vestibular Organs in Space Exploration." For individual titles see N67-15122–N67-15147. M.W.R.

N67-15122*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RUSSIAN EXPERIENCE OF PROBLEMS IN VESTIBULAR PHYSIOLOGY RELATED TO THE SPACE ENVIRONMENT
John Billingham *In its* The Role of the Vestibular Organs in Space Exploration 1966 p 5–13 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Russian findings related to vestibular changes encountered during space and aircraft flights and simulated laboratory experiments are reviewed. Weightlessness and motion sickness are covered, particularly as related to man; and requirements for the selection and training of astronauts are reviewed. Animal studies deal with effects of prolonged periods of acceleration, including exposure to weightlessness in orbital flight and to accelerations of more than 1 g on the centrifuge. Short-term experiments aboard aircraft in parabolic flight are classified according to the following gross reactions: (1) general lack of response to stimuli; (2) development of specific illusions, such as oculogravic; and (3) immediate induction of motion sickness. It appears that the Russians have experienced a form of motion sickness in three of their cosmonauts, and it is noted that the changes in vestibular physiology display a wide variation among different individuals. M.W.R.

N67-15123*# Naval School of Aviation Medicine, Pensacola, Fla.
THE INVERSION ILLUSION IN PARABOLIC FLIGHT. ITS PROBABLE DEPENDENCE ON OTOLITH FUNCTION
Ashton Graybiel and Robert S. Kellogg (Aerospace Med. Div. Aerospace Med. Res. Labs. (6570th) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 15–24 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Observations were made on normal subjects and deaf persons with bilateral labyrinthine defects (L–D subjects) under three different conditions in parabolic flight: (1) free floating, (2) restrained in a fiberglass mold, and (3) "standing" on the overhead during a modified parabola generating about −0.05-g unit. There were

interindividual differences in the reactions among the normal but not among the L–D subjects. Some of the normal but none of the L–D subjects experienced a reversal of their personal orientation with regard to up-down under all three conditions. This "reversal" was considered to have its genesis in the vestibular organs, probably the otolith apparatus. Our findings are in accord with Russian reports describing feelings of inversion among cosmonauts in orbital flight. Attention is called to the necessity of distinguishing between information furnished by touch pressure, kinesthesis, and stereognosis under ordinary conditions and agravic touch pressure, agravic kinesthesis, and agravic stereognosis. Author

N67-15124*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROBLEMS OF MAN'S ADAPTATION TO THE LUNAR ENVIRONMENT
William Letko, Amos A. Spady, Jr., and Donald E. Hewes *In its* The Role of the Vestibular Organs in Space Exploration 1966 p 25–32 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Experimental observations indicate that with some training man should be able to maintain his equilibrium and orientation on the lunar surface. Effects of reduced gravity on the human body are reported; and relative motions of various body members while walking, loping, and sprinting are found to be quite different for the earth and lunar gravities. Not only are there large differences in amplitudes and rates of motion of these body members, but large differences in the body lean or back angle are seen as well as a large variation in back angle with rate of locomotion. These experiments indicate that man can maintain his equilibrium even while running at about 13 ft/sec; and results indicate that wearing a suit pressurized to 3.7 psi would not alter these general conclusions. Additional experiments in reduced-gravity simulators and in 1/6-g parabolic flight are considered necessary. M.W.R.

N67-15125*# Goteborg Univ. (Sweden).
ANATOMICAL FEATURES OF THE AURICULAR SENSORY ORGANS
Hans Engstroem, Henrik H. Lindeman, and Harlow W. Ades (Illinois Univ.) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 33–46 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35
(Contract N62558-4264)

This paper contains a general survey of the structure of the vestibular sensory system—of the utricle, saccule, and semicircular ducts and crests. The major interest has been devoted to "gross" anatomical features, but a general description of the epithelial structure and also of nerve endings and blood vessels is included. Author

N67-15126*# Naval School of Aviation Medicine, Pensacola, Fla.
DIMENSIONAL STUDY OF THE VESTIBULAR END ORGAN APPARATUS
Makoto Igarashi *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 47–54 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Micromeasurements were performed to determine the dimensions of the inner-ear apparatus in the human, the squirrel monkey, and the cat by using a series of horizontal sections. The membranous semicircular canal structure in the human is almost twice as large as that of the squirrel monkey and of the cat, although the sizes of the skulls are quite different. On the other hand, the size of the canal crista is not significantly different among these three species. In other words, the human has a considerably smaller crista. The surface area of the human saccular macula is almost three times as large as that of the squirrel monkey and of the cat. Both the diameter of the cochlear base and the length of the basal membrane are less than twice as large in the human as in the other two species. Author

N67-15127*# Karolinska Institutet, Stockholm (Sweden).
MORPHOLOGICAL POLARIZATION OF THE MECHANORECEPTORS OF THE VESTIBULAR AND ACOUSTICOLATERALIS SYSTEMS
Jan Wersaell and Per-G. Lundquist (King Gustaf V Res. Inst.) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 57–72 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The vestibular sensory cells in birds and mammals contain two types of sensory cells, whereas in frogs and fishes only one type is distinguished. All sensory cells in the labyrinth are morphologically polarized with regard to the centriole of the cell. One of the sensory hairs is identical in structure with a kinocilium protruding from the centriole. It is always found at the periphery of the sensory hair bundle. Available functional and morphological data from the acousticolateralis system indicate that maximum stimulation of the hair cell occurs when the sensory hairs are displaced toward the centriole and kinocilium of the cell. A kinocilium is found also on cochlear hair cells during development, but disappears from the cochlear hair cells of mammals during late stages of differentiation. The asymmetry of the sensory cell is considered to reflect an asymmetrical organization of the hair-bearing end of the sensory cells at the molecular level, forming a direction-sensitive transducer mechanism. It is suggested that the main orientation of the sensory cells, within a certain area of the sensory epithelium, reflects the directional sensitivity of that area, which allows a charting of each part of the inner ear with regard to its function. Author

N67-15128*# Birmingham Univ. (England).
THE FUNCTIONAL SIGNIFICANCE OF THE ULTRASTRUCTURE OF THE VESTIBULAR END ORGANS
Otto Lowenstein *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 73–90 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The most important features of the comparative anatomy of the labyrinth are briefly reviewed. The cupula-endolymph system of the semicircular canals and the otolith organs are described as accelerometers sensitive to angular and linear acceleration. The signals generated by them in response to such stimuli are described with special reference to coding, and differential equations covering the transfer of information are introduced. The analysis of vestibular responses to supraoptimal stimulation in space-flight simulators is briefly mentioned. The ultrastructure of the sensory hair cell is then discussed in the light of our knowledge of its mode of functioning. The double innervation of the hair cell and the composition and topographic orientation of the sensory hair processes of the sensory cells in the cristae and maculae are described in this context. Finally, unsolved questions of mechanoelectric transduction are discussed. Author

N67-15129*# Defence Research Medical Labs., Toronto (Ontario).
SPECIFIC GRAVITY AND VISCOSITY OF ENDOLYMPH AND PERILYMPH
K. E. Money, M. Sokoloff, and R. S. Weaver *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 91–98 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35
(DRML-629)

Samples of endolymph and perilymph of between 0.002 and 0.003 milliliter were obtained from single ears of living pigeons. Measurements of specific gravity were made in density gradient column, and it was shown that at the pigeon's body temperature (approximately 40°C), the specific gravity (referred to water at 4°C) of endolymph is 1.0033 and that of perilymph is 1.0022. Preliminary measurements indicate that at 40°C, the viscosity of endolymph is 1.15 centipoise and the viscosity of perilymph is 0.78 centipoise. The unusual high potassium concentration and low sodium concentration of endolymph reported for the cat and the guinea pig were confirmed for the pigeon. Author

N67-15130*# Zurich Univ. (Switzerland).
SOME MORPHOFUNCTIONAL AND PATHOLOGICAL ASPECTS OF THE VESTIBULAR SENSORY EPITHELIA
H. Spoendlin *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 99–116 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Neuronal connections in sensory epithelia and pathological aspects of the vestibular epithelia are discussed for 11 squirrel monkeys exposed to 5.4 g or 10.9 g on the centrifuge for periods up to 10 minutes in different head position. Although some of the monkeys manifested marked ataxia for hours following exposure, the ultrastructure of their maculae was not altered. A one-millionfold increase is considered necessary to produce damage in the cochlear receptor. Experiments in cats indicate that acute asphyxia caused no significant changes in vestibular sensory epithelia. Injection of a physiological sodium chloride solution into the endolymphatic space produced an interstitial base vestibular sensory edema. Animals that exhibited a mild vestibular reaction has somewhat irregular nuclei in a number of sensory cells; and electron microscopy confirmed the occurrence of pathological changes. Acute streptomycin intoxication produced marked pathological alterations in cristae; and, in cases where the streptomycin directly penetrated the labyrinth, most of the sensory cells were completely degenerated. Both type I and type II hair cells were affected. M.W.R.

N67-15131*# Oslo Univ., Blindern (Norway).
ANATOMICAL ASPECTS ON FUNCTIONAL ORGANIZATION OF THE VESTIBULAR NUCLEI
A. Brodal *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 119–141 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The vestibular nuclear complex of the cat is detailed, and the various efferent and afferent connections of the vestibular nuclei are considered. Studies indicate that there are two main routes from the vestibular nuclei to the cord; one from the nucleus of Deiters forming the vestibulospinal tract, the other from the medial vestibular nucleus passing in the descending medial longitudinal fabsciculus. In addition to the four classical nuclei (superior, lateral, medial, and inferior), the vestibular nuclear complex includes minor cell groups. Analyses of the efferent and afferent fiber connections of the vestibular nuclei support the suggestion that there is a functional difference between parts of nuclei and between cell groups. Study of the intrinisic organization of the vestibular nuclei and synaptic arrangements indicates the complexity of the nuclei, and that the cell groups or parts of nuclei are not functionally similar. M.W.R.

N67-15132*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE RELATIONSHIP BETWEEN THE UNIT ACTIVITY OF THE UTRICLESACCULE OF THE FROG AND INFORMATION TRANSFER
T. Gualtierotti and D. Alltucker *In its* The Role of the Vestibular Organs in Space Exploration 1966 p 143–149 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The problem discussed is the coding system of the otolith organ in the inner ear. The spontaneous firing and the evoked responses of single otolith units show such a marked irregularity that the mechanism of information transmission cannot be based on instantaneous frequency modulation. Averaging of a single-unit discharge requires a long period of time to obtain enough accuracy, whereas the reflex mechanisms of balance act on a split-second basis. Evoked responses from single units bear a logarithmic relation to the stimulus both during transients and during steady states. Therefore, a theory of information based on "edges" is not completely satisfactory inasmuch as a graded response is not required. A new theory of information transmission is therefore presented, based on instantaneous averaging of the activity of a number of single otolith units through a time gate similar to that proposed for the auditory pathways. Author

N67-15133*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPINAL REFLEXES DURING INCREASED GRAVITY
Jorge Huertas, Francesco Bracchi, and Benjamin Epstein *In its* The Role of the Vestibular Organs in Space Exploration 1966 p 151–158 refs (See N67-15121 05-04) GPO: HC $2.00; MF $3.35

An experimental technique is described that permits repeated experiments on the same animal under the same conditions. Monosynaptic responses are obtained in both cats and monkeys by this chronic preparation method when 1 g was applied for periods of 2 to 5 minutes. In animals that are awake, the monosynaptic reflex shows a spontaneous variation in amplitude from one response to another; and at the onset of 1 g accelerational gravity and for several seconds thereafter, this variation disappears and the amplitude of the reflex increases. In all the animals there was a return to initial values after acceleration. Only after repeated accelerations, and particularly after higher values, was there a fall in reflex amplitude. It is found that the spinal reflexes are generally facilitated during acceleration, and it is postulated that a vestibular mechanism may influence this phenomenon. M.W.R.

N67-15134*# San Jose State Coll., Calif.
INFLUENCE OF CONTACT CUES ON THE PERCEPTION OF THE OCULOGRAVIC ILLUSION
Brant Clark and Ashton Graybiel (Naval School of Aviation Med.) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 159–166 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The influence of otolith and nonotolith information in the perception of the visual horizontal during rotation was studied. Five normal men and five men with defective labyrinthine function acted as observers. All measurements were made in a room which could be rotated. Initial, static measurements were made while the men stood erect in the stationary room. Similar measurements were made during rotation while the observer stood on a platform set to the resultant horizontal with head and body alined with the resultant force. Data were also obtained with three other combinations of head and body position. This pocedure was designed to produce two situations for the normal men in which otolith and nonotolith information were synergistic and three others in which they were antagonistic. The results showed that the perception of the visual horizontal during rotation in this situation is quite different from that found when the observer is rigidly supported in a chair during rotation. Author

N67-15135*# Army Edgewood Arsenal, Md.
DOES LINEAR ACCELERATION MODIFY CUPULAR DEFLECTION
George H. Crampton *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 169–184 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Data from two experiments are described. In part I, human nystagmus was recorded with the head at the center of rotation and at a radius under a 1.06-g resultant. The magnitude of nystagmus, especially during constant velocity following angular acceleration, can be manipulated according to the orientation of the head with respect to the centripetal acceleration vector. In part II, single cells responsive to angular acceleration were recorded from anesthetized cat brain stem with the head at the center of rotation and at a radius under a 1.03-g resultant. Consistent differences in discharge rates were not found according to various orientations of the head with respect to the centripetal acceleration vector. It is concluded that these nystagmic changes are not due to direct acceleration effects upon the cupula, but are better explained in terms of a centrally converging otolithic influence. Author

N67-15136*# Naval School of Aviation Medicine, Pensacola, Fla.
INFLUENCE OF LINEAR AND ANGULAR ACCELERATIONS ON NYSTAGMUS
Fred E. Guedry, Jr. *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 185–198 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Nystagmus and subjective responses were compared in experimental situations involving rotation at 10 to 30 rpm about an Earth-horizontal axis. At 10 rpm, responses were continuous throughout the period of rotation. At 30 rpm, responses showed a cyclic variation about a zero baseline after about 35 seconds. At this point, sensation of rotation was equivalent to that reported by labyrinthine-defective subjects in an earlier experiment. At both 10 and 30 rpm, cyclic variations in the slow component of nystagmus had a systematic phase relation to the cyclic variation in the direction of gravity. An experiment in which nystagmus was produced by horizontal linear acceleration revealed a consistency in results between the present experiment and several previous experiments. It is proposed that the prolonged nystagmus at 10 rpm and the cyclic variations in nystagmus (noted at all rotation rates) are an indication of separate mechanisms. Other experimental findings are discussed in relation to the proposed hypothesis. Author

N67-15137*# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
MODIFICATION OF PER- AND POST-ROTATIONAL RESPONSES BY THE CONCOMITANT LINEAR ACCELERATION
A. J. Benson *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 199–213 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The nystagmus and sensation of turning engendered by an angular acceleration are modified by the direction and magnitude of the concomitant linear acceleration. With a linear acceleration of 1 g, the rate of decay of postrotational responses was increased when otolithic and other gravireceptor signals were not in accord with signals from canal receptors. Responses to angular stimuli in yaw suffered a greater decrement than those in pitch or roll. From experiments in which the subject's orientation to gravity was changed immediately following an impulsive deceleration, it was concluded that these effects were brought about by inhibition, within the central nervous system, of canal afferents by competing gravireceptor signals. However, for higher linear accelerations and rotating linear acceleration vectors, it is not possible to exclude peripheral mechanisms. Author

N67-15138*# Massachusetts Inst. of Tech., Cambridge.
CONTROL ENGINEERING APPROACHES TO HUMAN DYNAMIC SPACE ORIENTATION
Laurence R. Young, Jacob L. Meiry, and Yao T. Li *In* NASA, Washington The role of the Vestibular Organs in Space Exploration 1966 p 217–227 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35
(Grant NsG-577)

Mathematical descriptions are given of the input-output relations characterizing the vestibular mechanisms; studies in eye stabilization, including the influence of vestibular inputs, neck proprioceptive inputs, and fixed-head visual tracking, are covered; and vestibular research is related to man as a member of a closed-loop system for controlling the orientation and position of a vehicle. Space orientation of the pilot is functionally divided into the study of sensors, the central system for control and compensation, and motor mechanisms by which the human transfers information back to the vehicle. The areas considered most important are visual, tactile, and vestibular inputs; and the usual joystick hand control and postural control are as outputs. Adaptive mechanisms for output control are studied to provide a mathematical description of the human operator as an input-output device or a set of devices. M.W.R.

N67-15139*# Franklin Inst., Philadelphia, Pa. Research Labs
DETERMINATION OF PHYSICAL CONSTANTS OF THE SEMICIRCULAR CANALS FROM MEASUREMENT OF SINGLE NEURAL UNIT ACTIVITY UNDER CONSTANT ANGULAR ACCELERATION
Klaus L. Cappel *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 229–236 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Labyrinthal responses to inertial stimulation are studied in relation to the mechanical properties of the semicircular canals, with the cupula-canal system considered as a damped spring-mass system with a single degree of freedom. It is noted, however, that its representation by a nonhomogeneous second-order differential equation has not always been correct. A decreasing response to continued stimulation is obtained from single nerve units in the anesthesized cat brain stem; and of 29 sets of data, nine have been analyzed. Damping-to-inertia and spring-constant-to-inertia ratios indicate there is underdamping during stimulation and overdamping during return, with the damping almost invariably higher in the return phase. This increase may be related to nonlinearities. Properties of the system are considered consistent with servo design practice in which an increase in gain would be balanced by an increase in damping to prevent instability. Further, a considerable proportion of the nerve units show remarkable symmetry of response under stimulation in opposite directions. M.W.R.

N67-15140*# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
LACK OF RESPONSE TO THERMAL STIMULATION OF THE SEMICIRCULAR CANALS IN THE WEIGHTLESS PHASE OF PARABOLIC FLIGHT
Robert S. Kellogg and Ashton Graybiel (Naval School of Aviation Med.) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 237–243 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The objective of this study was to clarify the mechanism of caloric nystagmus in man by conducting the test during weightlessness. Eight subjects were selected on the basis of a strong nystagmus response to irrigation with ice water. Nystagmus was determined by oscillograph tracings and direct observation, and, in addition, subjective responses of the subject were obtained. The experimental evidence indicated that, under the conditions of this experiment, zero gravity completely suppressed caloric nystagmus. This supported Barany's original hypothesis that caloric nystagmus was dependent on difference in specific weight of the endolymph in the horizontal canal. Author

N67-15141*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXAMINATION OF A POSSIBLE FLIGHT EXPERIMENT TO EVALUATE AN ONBOARD CENTRIFUGE AS A THERAPEUTIC DEVICE
Ralph W. Stone, Jr., William Letko, and W. Ray Hook *In its* The Role of the Vestibular Organs in Space Exploration 1966 p 245–256 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

General engineering and other factors involved in a flight experiment with an onboard centrifuge are investigated to substantiate or refute results of ground-based studies that have shown the onboard centrifuge capable of attenuating some of the expected effects of weightlessness. The onboard centrifuge could also permit the examination of the vestibular system in flight, the sensitivity and thresholds of the otoliths, and responses to stimulation of the semicircular canals. Since the centrifuge provides a means of simulating space flight maneuvers, its use in reentry simulation is suggested. Some physiological effects of weightlessness are reported, along with details of the ground-based centrifuge tests. Engineering considerations of an onboard centrifuge

are detailed, as is the experimental program to evaluate the prophylactic and therapeutic value of exposure to centrifugal force as a means of preventing debilitation from weightlessness for extended missions. M.W.R.

N67-15142*# Illinois Univ., Urbana.
NEEDS, PLANS, AND IDENTIFICATION OF THE PATHOLOGIC EFFECTS OF PROLONGED EXPOSURE TO WEIGHTLESSNESS ON THE VESTIBULAR ORGANS
Harlow W. Ades and Hans Engstroem (Goeteborg Univ.) *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 257–262 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Methods and possibilities of evaluating disintegration of structural components inside the vestibular system are presented. Many problems encountered are paralleled by those found in the evaluation of cochlear damage after exposure to noise or toxic agents. For that purpose special methods for analysis of the structural pattern and of the ultrastructure of the cochlear sensory epithelium were developed. It is recommended that a similar structural study be undertaken immediately on the vestibular epithelium. Substantial efforts must also be devoted to the problem of vascular supply in the vestibular labyrinth. Author

N67-15143*# Aerospace Medical Div. Aeromedical Research Lab (6571st), Holloman AFB, N. Mex.
EXPERIENCE WITH THE CHIMPANZEE AS AN EXPERIMENTAL SPACE-FLIGHT ANIMAL
Clyde H. Kratochvil *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 265–271 refs (See N67-15121 05-04) GPO: HC $2.00; MF $3.35

The experience of the laboratory with the two Project Mercury animal flights indicated that the chimpanzee was an excellent surrogate for man in this environment. Further experiments have been carried out using a complex multiple-operant schedule to evaluate the performance of the subject before, during, and after a rapid decompression to 150,000 feet. No permanent brain damage in any subject has resulted from a exposure of 150 seconds at this altitude. Another experiment was carried out to evaluate an advanced life support capsule. It was found here that major problems were the chronic restraint of the animal and the collection and disposal of urine and feces. Reliable solutions to these problems are needed before any prolonged animal flight can be considered. All experiments should require an evaluation of the ability of the subject to function in the new environment. The electroencephalogram, along with measures of psychomotor performance, has been found quite effective. Author

N67-15144*# Naval School of Aviation Medicine, Pensacola, Fla.
LONG-TERM PERFORMANCE OF SQUIRREL MONKEYS UNDER SPACE SIMULATION CONDITIONS. PART I: CHARACTERISTICS OF APPROACH AND CAPSULE
Deitrich E. Beischer *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 273–275 (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The necessity and importance of orbital animal flights for a duration of 6 months is stressed. Such flights should closely simulate conditions in later manned space flight. Unrestrained animals, conditioned to perform certain tasks and observed by a television camera, are expected to furnish valuable physiological and behavioral information. A capsule housing life support and working stations for two squirrel monkeys was built and tested in laboratory experiments. A low-residue liquid diet promises great savings in food supply and waste disposal. Some results of long-term laboratory experiments are described. Author

N67-15145*# Naval School of Aviation Medicine, Pensacola, Fla.
BEHAVIORAL TECHNIQUE, PART II
John S. Thach, Jr. *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 276–282 (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

Behavioral measures were obtained from two squirrel monkeys under two-degree-of-space simulation conditions in order to evaluate the adequacy of the design. Relationships were established between work requirements and diet and water intake, weight, and efficiency of work. Extended and severe isolation appeared to reduce locomotor activity. When the monkeys lived under continuous light, their activity cycles increased to longer than 24-hour periods. The behavioral technique was sensitive yet stable, but limited by persisting problems with liquid diets. Author

N67-15146*# University of Southern Calif., Los Angeles.
A PROGRAM FOR THE STUDY OF LONG-TERM ADAPTATION TO A WEIGHTLESS ENVIRONMENT PROVIDING THREE-DIMENSIONAL FREEDOM OF MOVEMENT
J. P. Meehan and J. P. Henry *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 283–292 refs (See N67-14121 05-04) GPO: HC $2.00; CFSTI: MF $3.35

The mechanical details of a working model of a proposed small-animal space station which is currently undergoing bench tests are briefly described, together with supporting evidence pointing to the feasibility of the program. The 12-cubic-foot canister weighs less than 300 pounds when loaded for a 9- to 15-month period. It would transmit data by slow-scan television, permitting determination of the growth and activity of a group of weightless mice. If feasible, animal recovery and/or substitution by rendezvous in orbit would supplement the data collected by television. Inclusion of a small preliminary test capsule in a manned Gemini or Apollo flight would permit determination of the effectiveness of the life support, waste disposal, and nesting arrangements before commitment to a full-scale long-term flight. Animals born and raised in such a station would have lacked throughout half a lifetime the normal otolithic and proprioceptive information differentiating subjective space into an up-and-down and sideways. Given recovery, measurement of the effect of such deprivation on their adaptation to horizontal and vertical mazes in a 1-g environment would be possible. Author

N67-15147*# University of Southern Calif., Los Angeles.
CENTRAL NERVOUS, CARDIOVASCULAR, AND VISUOMOTOR STUDIES RELATING TO SPATIAL ORIENTATION IN A 30-DAY PRIMATE FLIGHT
W. R. Adey *In* NASA, Washington The Role of the Vestibular Organs in Space Exploration 1966 p 293–307 refs (See N67-15121 05-04) GPO: HC $2.00; CFSTI: MF $3.35
(Contract NAS9-1970; Grants NsG-502; NsG-505; AF-AFOSR-246-63; AF-AFOSR-61-81)

Central nervous mechanisms underlying orienting and visual discriminative functions are discussed. Interrelations of vestibular and optic sensory influxes with corticodiencephalic and limbic mechanisms as essential substrates for spatial orientation are reviewed. Techniques for central nervous, cardiovascular, peripheral nervous, and autonomic monitoring during the 30-day primate flight in Biosatellite D are discussed. A 6.8-kilogram Macaca nemestrina monkey will be tested in two behavioral tasks involving delayed matching-to-sample, and an eye-hand coordination test. Environmental support involves an oxygen-nitrogen gas system. Pellet feeding combines reward and ad libitum methods, with water provided from the fuel cell power system. Data acquisition and analysis techniques are reviewed. Author

N67-15152*# General Technical Services, Inc., Yeadon, Pa.
GENERAL DYNAMICS OF THE PHYSICAL–CHEMICAL SYSTEMS IN MAMMALS
A. S. Iberall, M. H. Ehrenberg, and S. Z. Cardon Aug. 1966 110 p refs
(Contract NASw-1066)
(NASA-CR-81081; Rept.-6) CFSTI: HC $3.00/MF $1.30 CSCL 06P

Models of dynamic regulator chains to account for the dynamic characteristics of selected systems in mammals from a physical-chemical point of view are discussed. It is quite clear that a highly coordinated central thesis of dynamic regulation (homeokinesis) has emerged as the physical basis for the physiological view of homeostasis, both for physiological and psychological phenomena. Its foundation is a large class of oscillators, forming a rather extensive biological spectrum, whose dynamic shifting represents the paths toward regulation. Most characteristic of the biological system is the moment to moment locking of the oscillator systems into orbital synchronous paths, whose stability margins are determined by cues furnished by external and internal inputs to the brain. The nervous system images a patterned memory for guide algorithms upon which to act. Author

N67-15162# Joint Publications Research Service, Washington, D. C.
THE USE OF ELECTRONICS IN PHYSIOLOGICAL RESEARCH
Ye. Babskiy, I. Akulinichev, and O. Bokser 12 Jan. 1967 8 p Transl. into ENGLISH from Med. Gazeta (Moscow), 5 Dec. 1966 p 3
(JPRS-39499; TT-67-30149)

The cooperation of the sciences of medicine and electronics is particularly felt in the study of higher neural activity and neurophysiological investigations. Devices for these complex studies such as many-sided reflexometers, and equipment for the storage, processing, and evaluation of data are described with emphasis placed in the field of mathematical methods for evaluating neurophysiological information. A.G.O.

N67-15169# Joint Publications Research Service, Washington, D. C.
ORGANOTIN COMPOUNDS USED IN CONTROL OF PLANKTON GROWTH
N. S. Stroganov 28 Dec. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 5, 1966 p 1189–1191
(JPRS-39292; TT-66-35714) CFSTI: $1.00

The algi- and zoocidal properties of organotin compounds were investigated to determine the feasibility of using these compounds for water purification in industrial enterprises. Results show that organotin inhibits the viability of algae and daphria even at a concentration of 0.02 mg/liter. It is concluded that organotin compounds have an advantage over mineral tin because they prove toxic for planktonic organisms at substantially lower concentrations. A.G.O.

N67-15178# Joint Publications Research Service, Washington, D. C.
PROTECTIVE MASKS AVAILABLE FOR AGRICULTURAL WORKERS IN USSR DESCRIBED
G. Kobrits 28 Dec. 1966 6 p Transl. into ENGLISH from Zashchita Rast. ot Vreditelei i Boleznei (Moscow), no. 9, 1966 p 30–32
(JPRS-39281; TT-66-35703) CFSTI: $1.00

Descriptions and operating characteristics are given for protective masks to prevent the inhalation of chemicals used in combating weeds, pests, and plant diseases. C.T.C.

N67-15179# Joint Publications Research Service, Washington, D. C.
RADIOTOXICOLOGICAL ASPECTS OF RADIOACTIVE CONTAMINATION
Gh. Furnica and N. Racoveanu 29 Dec. 1966 15 p refs Transl. into ENGLISH from Igiena (Bucharest), v. 15, no. 10, 1966 p 577–587
(JPRS-39318; TT-66-35740) CFSTI: $1.00

Aspects of radiotoxicology are reviewed with emphasis placed on the importance of new studies such as calculation of the internal radiation dose, the path followed during incorporation, absorption, retention, and excretion of radionuclides, specific metabolism of radioactive isotopes, decontamination and forced excretion of nuclides, and the methods used for controlling contaminations. A.G.O.

N67-15180# Joint Publications Research Service, Washington, D. C.
REVIEW OF NON-SOVIET RESEARCH WITH DOLPHINS
29 Dec. 1966 5 p Transl. into ENGLISH from Sov. Krasnyy Krest (Moscow), no. 5, 1966 p 18–19
(JPRS-39317; TT-66-35739) CFSTI: $1.00

Experiments dealing with man's efforts to "understand the language of dolphins" are reviewed. Analysis of the sounds produced by dolphins has led to the identification, in addition to various kinds of whistles and shrill sounds, of such rarely occurring sounds as grunts and calls. It is reported that certain whistles were used as calls, while others were used for transmission of information. The whistling sounds, which consisted of rising and falling notes followed by low sounds, were found to represent conversational phrases. A.G.O.

N67-15261# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF AORTIC BLOOD VELOCITY COMPUTED FROM THE PRESSURE PULSE, SEPTEMBER 1963–APR. 1966
John D. Boyett, Darwell E. Stowe, Leroy H. Becker, and William E. Britz, Jr. Aug. 1966 11 p refs
(SAM-TR-66-75; AD-639642) CFSTI: HC $1.00/MF $0.50

A method for computing aortic blood flow from the aortic pressure pulse by analog computer technics was evaluated. The method provides a continuous stroke-by-stroke indication of aortic blood flow through the use of a simple cardiac catheter. Aortic blood flow calculated from the area under the computed linear velocity curve was compared with cardiac output which was obtained by indicator dilution technics. Good correlation was found to exist between the two methods. Author (TAB)

N67-15263# Northwestern Univ., Evanston, Ill. Auditory Research Lab.
AN EXPANDED TEST FOR SPEECH DISCRIMINATION UTILIZING CNC MONOSYLLABIC WORDS Auditory Test No. 6, 16 Jan. 1964–15 Apr. 1965
Tom W. Tillman and Raymond Carhart Brooks AFB, Texas, School of Aerospace Med., Jun. 1966 16 p refs
(Contract AF 41(609)-2643)
(SAM-TR-66-55; AD-639638) CFSTI: HC $1.00/MF $0.50

Northwestern University Auditory Test No. 6 is composed of four lists of 50 consonant-nucleus-consonant (CNC) monosyllabic words each. The construction of the test followed the same scheme employed earlier in the development of N. U. Test No. 4, a less extensive version using the same type of material. The four lists of N.U. Test No. 6 were given twice to each of two subject groups--one group with normal hearing and another with sensorineural hypoacousis. During each administration, six ascending presentation levels were used ranging from -4-dB to 40-dB sensation level. The two groups yielded articulation functions highly

similar to those obtained with the earlier test (N.U. Test No. 4). The new test (N.U. Test No. 6) appears to have good interlist equivalence and high test-retest reliability. It thus retains the desirable features of the earlier tool while doubling the inventory of items available for the measurement of phonemic discrimination. Author (TAB)

N67-15264# Honeywell, Inc., Minneapolis, Minn.
INFORMATION ANALYSIS OF THE ELECTROENCEPHALOGRAM Final Scientific Report, 1 Sep. 1965–31 Aug. 1966
Donald I. Tepas Sep. 1966 31 p refs
(Contract AF 49(638)-1601)
(AFOSR-66-1941; Doc.-12021-FRI; AD-639712) CFSTI: HC $2.00/MF $0.50

Average potentials synchronized with cardiac cycle, motor activity, auditory stimulation, and visual stimulation were reliably detected and isolated in the electroencephalographic activity from one pair of scalp leads. The results indicate that the averaging technique need not be limited to the detection of potentials directly evoked by sensory stimulation. The data also demonstrate that it is possible to detect and measure several average potentials in a single human electroencephalographic recording. In addition, the data show that time-locked average potentials simultaneously present in a given electroencephalographic recording can summate in an algebraic manner. This suggests that a major portion of conventional electroencephalographic recordings may consist of the algebraic sum of a number of concomitant specific potential changes. The averaging technique is suggested as a general method whereby component parts of electroencephalographic activity can be separated for systematic experimental analysis. Author (TAB)

N67-15271# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.
OXYGEN CONSUMPTION AND BODY TEMPERATURES OF ESKIMOS DURING SLEEP Technical Report, 17 Jun.–3 Jul. 1963
Frederick A. Milan and Eugene Evonuk 3 Jul. 1966 22 p refs
(AAL-TR-66-10; AD-639670) CFSTI: HC $1.00/MF $0.50

The paper reports the results of measurements of metabolism and body temperatures taken during 14 nights of comfortably warm sleep in six male Eskimos from the village of Wainwright on the arctic coast of Alaska. The mean age of these subjects was 20.8 (plus or minus 1.26) years, mean height 169.1 (plus or minus 5.08) cm, mean weight 66.6 (plus or minus 2.0) kg and mean value for percent body fat 9.1 (plus or minus 1.08)%. These data show the effects of the sleep cycle on metabolism and body temperature. The sleeping metabolic rate declined from 50 (plus or minus 7.35) kcal/sq m/hr at 2230 hours to 39 (plus or minus 5.22) kcal/sq m/hr at 0600 hours. Concomitantly, rectal temperature, which was negatively correlated with time ($r = -.965393$), fell from 37.0 (plus or minus .386) C at 2230 hours to 35.4 (plus or minus .386) C by 0600 hours. Calculated mean body temperature was directly related to the level of metabolic activity. These coastal Eskimos had essentially normal values for early morning basal metabolic rates in contrast to Anaktuvuk Pass Eskimos from the interior of Alaska who are hypermetabolic. Author (TAB)

N67-15272# Universidad Nacional Mayor de San Marcos, Lima (Peru).
PATHOLOGY AT HIGH ALTITUDE Annual Report, May 1965–Apr. 1966
Alberto Cuba-Caparo, Juan Takano, Leoncio Vega, and Ramon Puron Apr. 1966 15 p
(Contract DA-ARO-49-092-65-G91)
(Rept.-1; AD-639753) CFSTI: HC $1.00/MF $0.50

The study of 41 autopsies and 276 surgical and biopsy specimens from high altitude, 12,000 feet above sea level, are presented. The autopsy results are given in three tables, showing the distribution by age, race and sex of the patients; the fundamental diagnosis in four groups (prematures, new born, children and adults); and the anatomo pathological diagnosis. The pathological diagnosis of two hundred seventy six surgical and biopsy specimens are shown. They are classified as: (a) Tumors, (b) Inflammation, (c) Parasitic diseases and (d) Miscellaneous. These specimens, collected in eight and a half months of work in Chulec Hospital and Hospital Obrero de la Oroya, are insufficient to draw conclusions about the incidence of the different observed diseases. TAB

N67-15297*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
PRODUCTION OF LOW CONCENTRATION PARTICULATE AEROSOLS BY A SONIC DISSEMINATOR TECHNIQUE
Virgil L. Dugan Dec. 1966 17 p
(NASA Order R-09-019-040)
(NASA-CR-81147; SC-RR-67-14) CFSTI: HC $3.00/MF $0.65 CSCL 06B

Details are given on an ultrasonic vibrator technique which can produce particulate aerosols with concentrations levels below 5000 particles per cubic foot in an enclosed volume. Data are also included to show the repeatability with which a given concentration may be obtained on a surface for a given settling period. The basic operation of the sonic disseminator is described, along with the experiments which were conducted in a class 100 laminar flow clean room facility. Results indicate that the disseminator is suitable for either viable or nonviable particulate aerosols, and is capable of aerosolizing the contaminant particles in their individual states. M.G.J.

N67-15322# Stanford Univ., Calif. Systems Theory Lab.
SEQUENTIAL DECISION AND CONTROL PROBLEMS IN SNAKE FORMS
Tom G. Sharpe Jun. 1966 82 p refs
(Contract Nonr-225(83))
(SEL-66-049; AD-639705) CFSTI: HC $3.00/MF $0.75

The report is a study of properties and problems in multilink chains, or snake forms, biological snakes are not considered. The study deals primarily with geometric and kinematic details of movements of snake forms. The problem of general concern is that of placing the head of the snake on a given target. Subproblems arise as various schemes of target acquisition are discussed. Topics considered include minimax (in maximum curvature sense) snakes, sequential control, black box snakes (determining state from error measurements), path constrained target approach, minimum time target approach, binary (two position angle) snakes and adaptive target approach. It is found that the minimax convex snake with equal link lengths has the appearance of a piecewise linear approximation to an arc of a circle plus a straight line segment. Also, a sequential control scheme is developed that will carry the head to the target with a finite number of angle changes. Author (TAB)

N67-15329# Brussels Univ. (Belgium).
RESEARCH CONCERNING THE INFLUENCE OF ACUTE EXPOSURE TO COLD ON THE THYROID FUNCTION Final Report, 1 Sep. 1963–31 Aug. 1965
A. M. Ermans and M. Camus Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jul. 1966 38 p refs
(Contract AF 61(052)-714)
(AAL-TR-66-7; AD-639669) CFSTI: HC $2.00/MF $0.50

The quantitative aspects of iodine metabolism were evaluated in normal healthy human subjects by means of a tracing method and long-term iodine balance studies. The behavior of the specific activities of hormonal iodine in the intra- and extra-thyroidal compartments cannot be explained on the basis of a relationship of precursor to product when the thyroidal compartments are considered as a whole. On the contrary, experimental findings fit with such a relationship if one considers the fraction of the thyroid compartment which is mobilized by exogenous TSH. A kinetic model of iodine metabolism taking account of such a functional heterogeneity was studied by means of digital and analog computers. One interesting aspect of this heterogeneity is the very high specific activity of the organic iodine released by TSH, when TSH is given a short time after the administration of radioiodine. This approach appears to be a very sensitive method for the detection of any TSH-like effect on the thyroid gland. This property has been used for the estimation of the influence of an acute exposure to cold on the thyroid function of eight volunteers. Twenty-four hours after the administration of I-125 the volunteers were kept for two hours at 4°C. A marked increase of the levels of PBI-125 was observed four hours after the end of cold exposure; plasma PBI-127 was also increased but to a lesser extent; the validity of these findings was checked by a parallel experiment at normal temperature. Author (TAB)

N67-15334# Florida State Univ., Tallahassee. Dept. of Statistics.
THE USE OF LIMIT THEOREMS IN PAIRED COMPARISON MODEL BUILDING
W. A. Thompson, Jr. and Jagbir Singh Jun. 1966 21 p refs
(Contract Nonr-988(08); Grant NSF GP-3807)
(M111; ONR-TR-20; AD-639656) CFSTI: HC $1.00/MF $0.50

The Thurstone and the Bradley-Terry models, both initially advanced on intuitive grounds, have proved useful in the analysis of paired comparisons. The psychological meaning of these models and their relation to one another is unclear, but they fit data. Stevens has observed that there may be two basic mechanisms of discrimination (1) additive and (2) substitutive. We advance two corresponding mathematical models: that experienced sensation is (1) the sum of a large number of independent signals and (2) the maximum of a large number of independent signals. These assumptions yield (1) Thurstone's model and (2) the model of Bradley-Terry. Psychological interpretations of the various parameters, in terms of sensation, present themselves in a natural manner. Thus this paper presents a theory which unifies and interprets two paired comparison models that have proved useful in fitting experimental data. Author (TAB)

N67-15357# Harvard Univ., Cambridge, Mass. Biological Labs.
[ANALYSIS OF COLOR VISION MECHANISMS] Final Report
George Wald 6 Oct. 1966 5 p refs
(Contract Nonr-1866(38))
(AD-640714) CFSTI: HC $3.00/MF $0.65

Summary data are presented on several laboratory investigations of color vision mechanisms. Among the findings reported are: (1) Microspectrophotometric measurements of the color vision pigments in single parafoveal cones of the human retina suggest that some red cones may contain mixtures of the red and green sensitive pigments. (2) Psychophysical measurements on human subjects, using the method of selective adaptation with bright colored backgrounds, isolated the action spectra of the three color vision pigments in the fovea. It was found that the red and green sensitive pigments contribute almost equally to the overall sensitivity of the fovea; the blue sensitive pigment only slightly. A bibliography of general and theoretical papers related to the research is included. M.G.J.

N67-15359# Bunker-Ramo Corp., Canoga Park, Calif.
THE UTILIZATION OF HUMAN FACTORS IN FORMATION BY DESIGNERS Technical Report, Dec. 16, 1965–Sep. 15, 1966
David Meister and Donald E. Farr 16 Sep. 1966 105 p refs
(Contract Nonr-4974-00)
(AD-642057) CFSTI: HC $3.00/MF $0.65

Three design tests were developed to determine how human factors criteria and information are applied to design problems. Each 4-hour test was administered individually to 20 designers. Test results indicate that designers have little or no interest in human factors and usually fail to apply human factors criteria to design. They do not read human factors handbooks. Design analyses appear to be quite primitive, being largely determined by spatial constraints and experiential stereotypes. Designers have difficulty in anticipating operational problems that may result from design parameters and are unable to evaluate completed designs. Design managers are somewhat more sophisticated in their design analyses than designers, but only slightly so. Both designers and human factors specialists were highly consistent in their responses. The most important source of information for the designer is the design specification. Where a designer does not have formally assigned responsibility for a design parameter, his analysis will not reflect this factor. It is recommended that design specifications emphasize human factors to the same extent that other functional requirements are emphasized. The format of handbook material directed at designers should be simplified, and contain procedures for analyzing design problems and examples of the application of information to these problems. Author (TAB)

N67-15360# Ohio State Univ. Research Foundation, Columbus.
VISUAL RECOVERY FROM HIGH INTENSITY FLASHES II Final Report, 15 May 1965–15 May 1966
Norma D. Miller Brooks AFB, Tex., School of Aerospace Med., Jul. 1966 65 p refs
(Contract AF 41(609)-2426)
(AD-64231) CFSTI: HC $3.00/MF $0.65

Some new instrumentation was developed and a number of refinements were made in the existing special test equipment for investigating the visual recovery following high intensity flashes. The primary areas of apparatus modification were (1) increased capability for the measurement of source energy in absolute units, (2) increased precision in the measurement of recovery times, (3) extended range of flash durations for recovery measurements, and (4) inclusion of pupillographic recording as a measure of flash effect. The consensual pupil reflex was measured for six subjects for flash energies from 150,000 to 30,000,000 td.sec. The flash durations were varied from 250 microsec to 1.5 sec. Flash fields subtended a visual angle of 7.5 degrees in most of the work with a 2 degree centrally fixated field used in one part of the study. Author (TAB)

N67-15406# Army Medical Research Lab., Fort Knox, Ky.
THE LATERAL GENICOLATE COMPLEX OF THE OWL MONKEY *AOTES TRIVIRGATUS*
Arthur E. Jones 13 Jun. 1966 17 p refs Repr. from J. Comp. Neurol., v. 126, no. 2, Feb. 1966 p 171–179
(Grant NSF-24125
(USAMRL-669; AD-640667)

The owl monkey is the only nocturnal monkey and possesses a pure rod retina. The lack of retinal cones and the apparent achromatic visual behavior of the animal suggest that any anatomical substrate of primate color vision in the higher visual centers should be missing in the owl monkey. The lateral geniculate nucleus of Aotes is composed of four lamina and the LGN of trichromatic Macaca six. The pregeniculate nucleus of Aotes is composed of two lamina and that of Macaca one. The nucleus intergeniculatus

of Ateles (also a trichromatic species) and Macaca is a ventral extension of the pulvinar in Aotes. A 1:1 relationship between retinal ganglion cells and LGN cells is found in Aotes, but is probably not found in Macaca. Author (TAB)

N67-15407# Bunker-Ramo Corp., Canoga Park, Calif. Human Engineering Group.

PILOT OPINION SURVEY OF A MOVING TAPE VERNIER PITCH DISPLAY CONCEPT

Barbara J. Kelso 26 Aug. 1966 18 p

(Contract AF 33(615)-5225)

(MR-66-15; AD-640717) CFSTI: HC $3.00/MF $0.65

The report discusses the evaluation of a moving tape vernier pitch display concept. Objective of the evaluation was to elicit opinions from pilots and engineers on: (1) the potential merit of the display concept for continued development, and (2) suggestions for improving the display format. PIS (Photographic Instrument Synthesizer) films of the pitch indicator were shown, and comments were elicited through an open-ended questionnaire. The report describes the display concept, the method employed in the evaluation, results of the questionnaire, and suggested follow-on work. Author (TAB)

N67-15409# David Taylor Model Basin, Washington, D. C. Structural Mechanics Lab.

EFFECTS OF OVERPRESSURE ON THE EAR

Arthur E. Hirsch Aug. 1966 14 p refs

(DTMB-2252; AD-640921) CFSTI: HC $3.00/MF $0.65

Tolerance levels of the human ear to various types of overpressure are discussed. Author (TAB)

N67-15431*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE DEVELOPMENT OF NOTIONS ON THE MATERIAL BASIS OF LIVING STRUCTURES, FROM ANTIQUITY TO THE BEGINNING OF THE 20TH CENTURY

L. Ya. Blyakher *In its* Life Phenomena—A Historical Surv. 1966 p 3-44 refs (see N67-15430 06-04) CFSTI: HC $3.00/MF $0.65

A historical review of the orderly occurrences and origins of biological processes, ancient cytological concepts, and speculative theories on living organisms is presented. Notations are reported on the discreteness of matter in animate bodies during the 17th and 18th centuries. The discovery of biological cells, and early attempts to explain their structure and chemical composition, as well as hypotheses on the nature of protoplasm and of bearers of vital characteristics within the cell are also included. Theories based on the assumption of the existence of representative particles are recapitulated among other attempts to develop an idea of the substrata of vital phenomena. An extensive bibliography follows. R.LI.

N67-15432*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ORIGIN, DEVELOPMENT AND PROSPECTS OF THE THEORY OF THE BIOLOGICAL FIELD

L. V. Belousov *In its* Life Phenomena—A Historical Surv. 1966 p 45-91 refs (See N67-15430 06-04) CFSTI: HC $3.00/MF $0.65

The biological field theory in relation to embryological and biological cell concepts is reviewed. The field principles establish the presence or absence of a connection between the most variegated initial influences and the form of the embryo, without dealing with the problem of the creation of this form out of deliberately nonvectorial influences. A survey of the developmental course of purely experimental embryology over the last 20–30 years, seen from the point of view of the field, leads to the conclusion of the growth of evidence of the autonomous, yet reciprocal, character of the components of morphogenesis. An extensive bibliography is included to augment the discussion points. R.LI.

N67-15433*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE BIRTH OF ELECTROCARDIOGRAPHY IN RUSSIA

N. A. Grigoryan *In its* Life Phenomena—A Historical Surv. 1966 p 92-115 refs (See N67-15430 06-04) CFSTI: HC $3.00/MF $0.65

Electrocardiography is reviewed from the historical standpoint, and bibliographical references are provided in an attempt to overcome the literature deficiency in the U.S.S.R. on the historical development of that science. The construction of the string galvanometer and the curve of human cardiac currents obtained with it are considered a milestone in clinical physiology. R.LI.

N67-15434*# Israel Program for Scientific Translations, Ltd., Jerusalem.

V. N. LYUBIMENKO'S STUDIES OF CHLOROPHYLL AND THEIR MODERN DEVELOPMENT

E. M. Senchenkova *In its* Life Phenomena—A Historical Surv. 1966 p 116-171 refs (See N67-15430 06-04) CFSTI: HC $3.00/MF $0.65

Chlorophyll, photosynthesis, and their scientific development are reviewed from open literature sources. Some topics discussed are: chlorophyll, an intricate protein complex; nature of chlorophyllogen and protochlorophyll in plants and the prerequisites of their formation; patterns of chlorophyll biosynthesis and the role of protochlorophyll in this process; influence of external factors on synthesis and accumulation of chlorophyll; quantitative variability of chlorophyll; chromatic adaptation; fossil chlorophyll; and, chlorophyll and heredity of plants. R.LI.

N67-15545# Atomic Energy Commission, Washington, D. C. Div. of Biology and Medicine.

RADIOTHERAPY

H. D. Bruner *In* Du Pont Large Scale Production and Appl. of Radioisotopes May 1966 19 p refs (See N67-15525 06-22) CFSTI: HC $3.00/MF $0.65

Technological progress and trends in the field of radiation therapy for medical purposes are surveyed. The following are highlighted: electromagnetic radiation treatment of disease, radio therapy for cancer, increasing knowledge of biomedical effects of radiations, better understanding of the interactions of radiations with living tissues and of dosimetric principles, and the effectiveness of a particular type of radiation therapy. Technical data describe: experimental and standard devices and systems producing ionizing radiations, such as: orthotherapy X-ray machines with 250 to 400 kV peak energy and dose rates of up to 500 Roentgens per minute at working distances up to 1 meter; ^{60}Co and ^{137}Cs teletherapy machine; super-voltage X-ray machines; tiny yttrium-90 beads deposited in the pituitary gland by needles through nasal passages; as well as ^{90}Sr-^{90}Y tipped needles inserted into human pain-conducting bundles, and for pituitary destruction purposes. Future possibilities of neutron dosimetry are also briefly outlined. R.LI.

N67-15550*# National Aeronautics and Space Administration, Washington, D. C.

ON THE DEVELOPMENT OF X-RAY INJURIES TO THE SKIN [K VOPROSU O RAZVITII RENTGENOVSKIKH PORAZHENIY KOZHI]

L. A. Afrikanova Dec. 1966 8 p Transl. into ENGLISH from the book "Trudy Vsesoyuznoy Konferentsii Patologoanatomoy" Leningrad, 1956 p 332-337

(NASA-TT-F-10630) CFSTI: HC $3.00/MF $0.65 CSCL 06R

Present-day and historical concepts and directions in the study of the pathological process of X-ray injuries to the skin are summarized, and compared with the author's findings. The article evaluates changes in the afferent side of the reflex arc providing innervation to the irradiated sector of skin (nose & lip of cat). Study conditions and parameters are specified, and changes occurring 10 min to 3 weeks and 2 months after specimen exposure are exhaustively examined. The author details his disagreement with most investigators that radiation damage to skin consists of selective injury of vessel walls by radiation energy. Author

N67-15553*# National Aeronautics and Space Administration, Washington, D. C.

CHANGES IN THE PERIPHERAL DIVISION OF THE AUDITORY ANALYZER IN ACUTE RADIATION SICKNESS [IZMENENIYE PERIFERICHESKOGO OTDELA SLUKHOVOGO ANALIZATORA PRI OSTROY LUCHEVOY BOLEZNI]

M. Ya. Kozlov Oct. 1966 11 p refs Transl. into ENGLISH from Vestn. Otorinolaringol. (Moscow), v. 20, no. 2, 1958 p 29-35

(NASA-TT-F-10361) CFSTI: HC $3.00/MF $0.65 CSCL 06R

The function of the peripheral section of the auditory analyzer in guinea pigs was estimated with the aid of leads and recording of bioelectricity of the cochlea. In the first group of experiments (10 animals), quantitative evaluation of hearing was carried out. The second group underwent total X-ray irradiation with the dose of 350 R; subsequently, at the height of radiation sickness hearing was evaluated by the same method as above. The ability to hear decreased, on the average, from 3.9 to 9.1 dB. Author

N67-15555*# National Aeronautics and Space Administration, Washington, D. C.

A SYSTEM FOR THE GENERATION OF MONOCHROMATIC RADIATION FOR PHOTO-BIOLOGICAL INVESTIGATIONS [EINE ANLAGE ZUR ERZEUGUNG MONOCHROMATISCHER STRAHLUNG FUER PHOTOBIOLOGISCHE UNTERSUCHUNGEN]

G. Schoser Oct. 1966 8 p refs Transl. into ENGLISH from German

(NASA-TT-F-10367) CFSTI: HC $3.00/MF $0.65 CSCL 06B

The author describe a recently designed interference-filter monochromator system for biological investigations. The spectral range is from 400-800 nm; the system consists of 16 monochromator units. The output obtained previously by middle-volt projectors (110 V/750 w) is reached here at much lower cost and with much less optical equipment. It operates with newly developed ellipsoid reflector lamps (12 V/150 w, Osram) as the radiation source. Each unit utilizes a simple optical system. The overall efficiency is as good as that of a high power projector (Prado, 750 w, Leitz). The improvements in interference filters do not still require strictly parallel rays in order to prevent stray losses. With filters of the new design, a deviation of 20° causes a change of 1 nm in the wavelength. This makes the system less sensitive to adjustments. They are made by centering the illuminated area. Author

N67-15560*# National Aeronautics and Space Administration, Washington, D. C.

ISOLATION AND PROPERTIES OF A RNA-DNA COMPLEX FROM *ESCHERICHIA COLI CELLS* [VYDELENIYE I SVOYSTVA KOMPLEKSA RNK-DNK IZ KLETOK *ESCHERICHIA COLI*]

N. S. Vladychenskaya and V. S. Tongur Oct. 1966 19 p refs Transl. into ENGLISH from Biokhimiya (Moscow), v. 31, no. 3, 1966 p 484-490

(NASA-TT-F-10368) CFSTI: HC $3.00/MF $0.65 CSCL 06A

RNA, not split by ribonuclease, was found in logarithmically growing *E. coli* cells. A preparation containing this RNA and DNA behaves as homogeneous material in an ultracentrifuge and gives a one-step fusion curve. It is concluded that this material is a RNA-DNA complex. The complex can be detected by either the phenol or detergent methods of isolating nucleic acids. During denaturation the complex breaks down into two components, one of which is destroyed by ribonuclease. In cells taken in the ninth hour of growth the complex to all intents and purposes is absent. Author

N67-15660# York Univ., Toronto (Ontario). Molecular Psychobiology Lab.

MOLECULAR NEUROCHEMISTRY OF THE BRAIN DURING CONDITIONED AVOIDANCE BEHAVIOR

John Gaito, James Mottin, Elizabeth Schaeffer, James H. Davison, and Joanne Rigler 14 Oct. 1966 38 p refs

(Contract Nonr-4935(00); Grant NRC APB-110)

(MPL-4; AD-641615) CFSTI: HC $3.00/MF $0.65

Four experiments were conducted to evaluate neurochemical changes in brain tissue of rats in a one way active avoidance conditioning task. The dependent variables were amounts of RNA, DNA, and proteins; ratios of these three; the specific activity of RNA, protein, and tissue pool fractions; and the relative specific activity of RNA and protein fractions. Lower amounts of labelled precursors were found in the tissue pool, RNA, and protein fractions in most brain tissues of learning animals than in control rats. The results concerning individual brain tissues suggested that the medial ventral cortex, and possibly the medial dorsal cortex, play an important role in this type of learning. Author (TAB)

N67-15687*# National Aeronautics and Space Administration, Washington, D. C.

INHIBITION OF RNA SYNTHESIS BY ACTINOMYCIN [O PODAVLENII SINTEZA RNK AKTINOMITSINOM]

S. Yu. Luk'yanov and N. G. Shuppe Oct. 1966 11 p refs Transl. into ENGLISH from Biokhimiya (USSR), v. 31, 1966 P 521-527

(NASA-TT-F-10369) CFSTI: HC $3.00/MF $0.65 CSCL 06A

A study was made of the mechanism of inhibition of RNA synthesis in a cell-free system. It was demonstrated experimentally that the derived quantitative relationships can be used also in the case of intact cells. An estimate is given for the number of guanine-cytosine pairs in the considered DNA section. Under the influence of AM there first will be an inhibition of those RNA molecules which have the greatest molecular weight and whose nucleotide composition includes a relatively large number of guanine-cytosine pairs This also can be attributed to the fact that AM first inhibits synthesis of ribosomal RNA (high-molecular and guanine-cytosine type), and, second, inhibits the synthesis of messenger RNA (high-molecular, but the AU type) and, thereafter, inhibits the synthesis of transport RNA (low-molecular, but of the guanine-cytosine type). Author

N67-15688*# National Aeronautics and Space Administration, Washington, D. C.

CAROTENE CONTENT IN DUNALIELLA SALINA TEOD. ALGAE UNDER CONDITIONS OF LABORATORY CULTIVATIONS [VMIST KAROTYNU U VODOROSTI DUNALIELLA SALINA TEOD. PRY VYROSHCHUVANNI YIYI V LABORATORNYKH UMOVAKH]

I. G. Drokova, R. Ts. Popova, and N. D. Tup Dec. 1966 11 p refs Transl. into ENGLISH from Ukr. Biokhim. Zh. (Kiev), v. 21, no. 5, 1964 p 44-49

(NASA-TT-F-10433) CFSTI: HC $3.00/MF $0.65 CSCL 06C

The authors show the possibility of accumulating carotene on converting the green form of Dunaliella salina into the red by

changing the NaCl concentraton in the nutrient medium. The hydrolysate of yeast, ammonium bicarbonate, vitamins B, PP and isovalerianic aldehyde stimulated carotene accumulation in green and red cells: ribonucleic acid furthered the accumulation of green cells without having an unfavorable effect on the process of converting the green cells into red. Author

N67-15700*# National Aeronautics and Space Administration, Washington, D. C.
THE "BIOSPUTNIK" IS CONDUCTING INVESTIGATIONS [BIOSPUTNIK VEDET ISSLEDOVANIYA]
N. Gurovskiy Nov. 1966 5 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 5, 1966 p 32-34
(NASA-TT-F-10650) CFSTI: HC $3.00/MF $0.65 CSCL 06S

A general discussion is presented of the medical and biological investigation of the regions of intense radiation in the inner radiation belt of the earth. Developments are outlined in view of the launching of the biological satellite Cosmos 110, which has an orbit higher than any manned spacecraft and is intended for a prolonged stay in zones of increased radiaton. Discussed in particular are the role of animals aboard the satellite, the effects of cosmic radiation, solar flares, weightlessness, radiation protection, and the life support system for animals aboard the spacecraft. K.W.

N67-15703*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROBIOLOGICAL SURVEY OF ENVIRONMENTALLY CONTROLLED AREAS
W. W. Paik, M. R. Christensen, and J. A. Stern *In its* Space Programs Sum. No. 37-41, Vol. IV 31 Oct. 1966 p 7-16 refs (See N67-15701 06-11) CFSTI: HC $3.00/MF $0.65

This report presents a comprehensive review of all work to determine the microbial populations present within environmentally controlled areas. Emphasis is placed on a sampling program conducted in the JPL facilities that includes assembly and sterilization, spacecraft assembly, structural test facilities, and industrial clean rooms. Levels of microbial contamination in conventional and laminar flow clean rooms were obtained from incubated air samples, surface sampling, and assay methods. Results demonstrated a correlation between the level of airborne microbial contamination and (1) the number of personnel in the area, (2) their activity level, (3) their clothing restrictions, and (4) the degree of environmental control imposed upon the personnel and the work area. G.G.

N67-15734*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLUOROMETRIC DETERMINATION OF NUCLEIC ACIDS. I. DEOXYRIBOSE ASSAY OF BIOLOGICAL MATERIAL
J. H. Rho and J. R. Thompson *In its* Space Programs Sum. No. 37-41, Vol. IV 31 Oct. 1966 p 170-173 refs (See N67-15701 06-11) CFSTI: HC $3.00/MF $0.65

In the investigation of extraterrestrial life, essential biological compounds in soil samples were studied. A fluorometric determination of deoxyribonucleic acid (DNA) was applied to the estimation of a bacterial population and of DNA in soil microorganisms. Fluorescent reaction products from 3,5-diaminobenzoic acid in 4 N HCl and deoxyribose were measured in the procedure described. Applied to pure DNA and *E. coli*, the method yielded values in close agreement with those based on calculation and permits the determination of as little as 10^5 cells of *E. coli* and the microbial population in 5 to 25 mg of sandy desert soil samples. R.LI.

N67-15809*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOIL STUDIES—DESERT MICROFLORA. IDENTIFICATION OF SOME ALGAE FROM ANTARCTICA
R. E. Cameron *In its* Space Programs Sum. No. 37-40, Vol. 4 31 Aug. 1966 p 123-133 refs (See N67-15781 06-34) CFSTI: HC $3.00/MF $0.65

Information on the algal flora of the Antarctic continent, especially with regard to examination and identification of previously unreported algal specimens is presented. Antarctic algae are described, and compared with other desert algae. A table is included of typical population and communities of algae in the samples chosen for additional study. The most frequently observed algae were filamentous blue-greens. Most of the Antarctic algae are mesophilic or hydrophilic species. Protective mechanisms were observed in some algae which are also found in other desert algae. N.E.N.

N67-15830*# AiResearch Mfg. Co., Los Angeles, Calif.
FULL PRESSURE SUIT HEAT BALANCE STUDIES
E. C. Wortz, R. A. Diaz, D. K. Edwards, L. E. Browne, E. J. Prescott et al Feb. 1965 226 p refs
(Contract NAS9-2886)
(NASA-CR-81183; LS-140) CFSTI: HC $3.00/MF $0.65 CSCL 06A

Experiments were conducted to establish a thermal balance between heat removal and metabolic rate in the pressurized Gemini G2-C full pressure suit at sea level and at 32,500 ft. The pressure suit ventilation gas inlet conditions were dew-point temperature of 33°F, flow rate of 17.1 ft^3/min with the suit pressurized to 3.7 psig over cabin ambient, and dry-bulb temperatures of 76°F at sea level and 50°F at altitude. Data are reported for 10 subjects exercising at 1.4 and 2.0 mph on a level treadmill. Conclusions are drawn concerning metabolic rates, heat storage, and the adequacy of sea level simulation. Author

N67-15850*# National Aeronautics and Space Administration, Washington, D. C.
MANUAL CONTROL
1966 422 p refs Proc. of the 2d Ann. NASA-Univ. Conf., Cambridge, Mass., 28 Feb.-2 Mar. 1966
(NASA-SP-128) GPO: HC $2.50; CFSTI: MF $0.65 CSCL 05H

Symposium papers on discrete and continuous models; adaptive, multivariable and optimal control, information theory, display, motion and stress, and analysis and design methods are presented. For individual titles See N67-15851-N67-15880.

N67-15851*# National Aeronautics and Space Administration, Washington, D. C
SUMMARY
Lawrence R. Young and Roger Windblade (MIT) *In its* Manual Control 1966 p 1-11 (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Papers presented at the NASA-university program conference on manual control are summarized according to the models, control devices, performance of operators, and information theory. Emphasis in the conference was on the development of models to describe human operator behavior in detail in multiple-loop, multiaxis, time-varying or deliberately nonlinear tracking situatons. Ideas on tracking ability are applied to a variety of vehicle control tasks. The three-day meeting was attended by about 100 specialists in the field of engineering psychology. M.W.R.

N67-15852*# Michigan Univ., Ann Arbor.
SUMMARY OF SINE-WAVE TRACKING STUDIES
R. W. Pew, J. C. Duffendack, and L. K. Fensch *In* NASA, Washington Manual Control 1966 p 15-24 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

A sine-wave tracking studies illustrate the extent to which the predictability of the input and of the control device dynamics can be utilized with extended practice. Analysis of the error power spectra establishes the presence of a stable source of noise power in the operator's output that has implications for deriving models of manual tracking performance. Author

N67-15853*# University of Southern Calif., Los Angeles.
ASYNCHRONOUS FINITE STATE MODELS OF MANUAL CONTROL SYSTEMS
G. A. Bekey and E. S. Angel *In* NASA. Washington Manual Control 1966 p 25-37 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Grants NGR-05-018-022; AF-AFOSR-1018-66)

Mathematical models are presented based on the assumption that the operator quantizes his input and output into a limited number of states. Data processing is performed on asynchronous samples of this coarsely quantized input, and the human operator behaves as a finite-state machine. A hybrid output element or hybrid actuator is used to achieve a continuous variation of output position. To provide for the generation of timed output waveforms in manual tracking, the concept of the hybrid actuator also provides a bridge between binary decisions and continuous time. The application of standard logical design techniques to the synthesis and minimization of the resulting mathematical models is discussed. For the particular case of compensatory control of a pure inertia plant, a human controller model can be synthesized by using only threshold gates, flip-flops, gates, and hybrid actuators. Proposed research in further applications of finite-state machine theory to manual control is discussed. Author

N67-15854*# Systems Technology, Inc., Inglewood, Calif.
SOME NEUROMUSCULAR SUBSYSTEM DYNAMICS
Duane McRuer *In* NASA, Washington Manual Control 1966 p 39-43 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contracts NAS2-2824; AF 33(657)-10835)

Describing-function models are presented for the transfer dynamics for the complete human operator. A precision-type model is a minimum form compatible with both the fine-detail, low variability data for random appearing forcing functions and the dynamics of the movement components in step responses. An approximate model reduces the number of parameters used without causing serious degradation in the analytical description of the data. The same gain, equalization, and basic latency elements are exhibited by both models; although they differ in their neuromuscular system aspects. The precision model uses high frequency effects of third order; the approximate model uses low frequency approximations of either the first order, so-called neuromuscular lag, or of a pure time delay. An elementary neuromuscular system model is presented in which loop gain is the only system parameter that has to be varied to create a covariant connection between the equivalent time delay and the low frequency phase lag parameter. M.W.R.

N67-15855*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PROCESS OF ADAPTATION BY THE HUMAN CONTROLLER
Jerome I. Elkind and Duncan C. Miller *In* NASA, Washington Manual Control 1966 p 47-63 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract AF 33(657)-10124)

A model is presented for the detection, identification, and modifications phases of the process by which the human operator adapts to changes in dynamics. The model contains (1) an internal adjustable portion for the plant dynamics, (2) a threshold detector compares change in error rate due to control movement with that predicted by the internal portion, (3) a decision tree that identifies change in dynamics by sequentially determining modifications in the internal portion that must be made for observed and predicted error rates to correspond, (4) and a switching tree that permits rapid and sequential changes in human controller characteristics. The detection and identification models accurately predict the time at which the human controller will detect a change in plant; and the dependence of identificaton time on plant change uncertainty and complexity is predicted. The mode-switching adjustment was verified by analysis of the adjustment process of well-trained controllers who exhibit very rapid changes in characteristics when they have detected a change in plant dynamics. M.W.R.

N67-15856*# Systems Technology Inc., Inglewood, Calif.
MODEL OF HUMAN-OPERATOR RESPONSE TO STEP TRANSITIONS IN CONTROLLED ELEMENT DYNAMICS
D. H. Weir and A. V. Phatak *In* NASA, Washington Manual Control 1966 p 65-83 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract NAS2-1868-4)

A critical control problem involving the vehicle/controlled-element system results from a step transition (sudden change) in the controlled element. Practical examples include failure of a manned aircraft stability augmenter, or the large changes in center of gravity which might occur during staging in the manual control of boost. Derivation of an analytical model useful in predicting operator transition response is summarized. Extensive use is made of experimental data from a variety of sources. Topics such as detection criteria and the effects of learning, alerting, and uncertainty about the new dynamics are included by reference only. Author

N67-15857*# Purdue Univ., Lafayette, Ind.
ADAPTIVE MODEL OF THE HUMAN OPERATOR IN TIME-VARYING CONTROL TASK
E. E. Gould and K. S. Fu *In* NASA, Washington Manual Control 1966 p 85-97 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

A model is presented for the human operator engaged in one-dimensional, compensatory, visual-manual tracking. Instead of a lumped input-output model, the human operator is considered as a system consisting of an input device (visual stimulus), an adaptive controller (central nervous system), and an actuator (arm and muscle mechanism). The main concern of this paper is modeling the strategy of the adaptive controller section. Pattern recognition techniques, which usually attempt to mimic human behavior are used in the model to identify the type of plant being controlled. This basis for a model is then augmented by more conventional techniques to more closely approximate human behavior. The model has been simulated and is presently undergoing extensive tests. Author

N67-15858*# Massachusetts Inst. of Tech., Cambridge.
MAN IN AN ADAPTIVE AND MULTILOOP CONTROL SYSTEM.
Y. T. Li *In* NASA, Washington Manual Control 1966 p 99-105 (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

While consideration of the difficulties involved in the control of a multiloop system makes it appear that man's role is very limited, it is emphasized that the human operator is extremely important because of his visual perception of his natural surroundings

and his ability to make impromptu adaptive control under unexpected or very complicated conditions. Because numerous accidents are averted by experienced pilots, manual control should be a part of the primary control loop of the dominating vehicle output for the critical phase of operation. In a multiloop system, man should be burdened only by tasks that must be performed under adverse conditions; automatic devices should be used for load-relieving purposes. Both system design and operator training should place the emphasis on operator effectiveness in emergency situations. Man's role in a continuous adaptive control loop is delineated; and the multiloop in vehicle control systems, control problems of higher order systems, and an intercoupled multiloop system are discussed. M.W.R.

N67-15859*# Cornell Aeronautical Lab., Buffalo, N. Y.
TIME VARYING AND NONLINEAR MODELS OF HUMAN OPERATOR DYNAMICS
W. W. Wierwille and G. A. Gagne *In* NASA, Washington Manual Control 1966 p 107–108 (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract NAS1-4920)

Nonlinear synthesis models are discussed in relation to manual control problems. Important gains in accuracy can be attained by using nonlinear and time-varying models that are at the present time largely in the research stage and are not as yet ready for use in system design. Time-varying linear models will generally possess errors of approximately 10% for a smoothing time of approximately 5 sec, while only 6% error is attributed to nonlinear time-varying errors. Nonlinear constant-coefficient models are considered to have 20% error. It is noted that there appears to be no simple relationship between the time variations of the linear time-varying transfer characteristics and the signals of the corresponding manual control system. Individual time variations appear to be a functon of the biological mechanism of the human operator whose fluctuatins are random functions of time that are not deterministic functions of the system signals. M.W.R.

N67-15860*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USEFULNESS OF TRANSINFORMATION AS A MEASURE OF HUMAN TRACKING PERFORMANCE
T. Wempe and D. Baty *In its* Manual Control 1966 p 111–129 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

This study was conducted to determine the applicability of information theory concepts to human tracking tasks. Data for one subject's tracking performance were analyzed for various bandwidths of the forcing function. The task was to track a filtered gaussian input, displayed on a cathode ray tube, by operating a controller with fixed-gain dynamics. This paper first examines different ways of applying information theory concepts to this tracking task as related to definitions of signal and noise. Then, describing functions and measures of information processing rates were determined for the experimental data. This provided material to examine measures of transinformation rates along with relative tracking error for the same task. Finally, the concept of human capacity as related to this simple tracking task was investigated. Author

N67-15861*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED INFORMATION CAPACITY AS A PERFORMANCE INDEX IN MANUAL TRACKING TASKS
Patrick A. Gainer *In its* Manual Control 1966 p 131–139 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Two applications of the concepts of information theory to the assessment of human performance in compensatory tracking tasks are presented. One analyzes the input and output of the whole system, treating as noise any part of the output that is not correlated to the input through a linear dynamic system. The second application considers only the tracking error signal and the filtering operations that must be performed on it. Although the second approach is rather crudely approximated, it shows that the human operator may logically use his information capacity in ways which are not made apparent by linear analysis of throughput. Until more is learned of the internal dynamics of the human operator, there is little hope for the discovery of a single performance index for evaluation of control and display systems. Author

N67-15862*# TRW Systems, Redondo Beach, Calif.
HUMAN PERFORMANCE IN SINGLE-AXIS AND TWO-AXIS TRACKING SYSTEMS
E. P. Todosiev, R. E. Rose, and L. G. Summers *In* NASA, Washington Manual Control 1966 p 143–158 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract NAS1-4419)

A compensatory tracking experiment was performed on single and uncoupled two-axis tracking systems to determine the effects of training and task difficulty on the parameters of a describing function model of the human operator. The plant dynamics were identical in both the single-axis system and the symmetrical two-axis system. Second-order dynamics consisting of a pure integration and first-order lag were used. Task difficulty was varied by changing the magnitude of the lag time constant and the frequency bandwidth of the input disturbance. Analysis of system tracking error showed that the rate at which error decreased with training was dependent upon task difficulty. The amplitude ratio and phase lead of the model describing function increased with training, indicating an increase in open-loop bandwidth and a decrease in phase margin. Increasing the plant lag time constant resulted in an increase in the model lead time constant and a decrease in the zero frequency gain. No significant difference was found to exist in the tracking error per axis between the two-axis tasks and the single-axis tasks. However, the model lead time constant was significantly greater in two-axis tracking. Author

N67-15863*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TWO-DIMENSIONAL MANUAL CONTROL SYSTEMS
William H. Levison *In* NASA, Washington Manual Control 1966 p 159–180 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Experiments were conducted to determine what modifications to the current models of the human controller of single-variable systems are necessary for them to be good representations of the controller in two-variable situations. These experiments were performed with a single compensatory display and a single two-axis control. Two descriptors of performance were obtained for each axis: the normalized mean squared error, and the describing function. Of prime interest was the extent to which performance on a given axis was modified by the requirement of simultaneously tracking a second axis. Two-axis performance degradation was small when the tracking conditions were homogeneous and when the inputs were heterogeneous. Large and significant performance differences were seen when the dynamics were heterogeneous. Three factors affect human controller characteristics in two-axis control: visual-motor interaction, differential allocation of attention, and nonhomogeneity of required equalization when the controlled-element dynamics are nonhomogeneous. A simple model was developed to predict visual-motor interference effects. Single-axis describing-function models for the human controller should be modified to include the effects of these factors to obtain accurate predictions of human-controller characteristics in two-axis situations and also in higher dimensional control situations. Author

N67-15864*# Systems Technology Inc., Inglewood, Calif.
PILOT DESCRIBING FUNCTION MEASUREMENTS IN A MULTILOOP TASK
R. L. Stapleford, D. T. McRuer, and R. Magdaleno *In* NASA, Washington Manual Control 1966 p 181–204 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract NAS2-1868-3)

The quasi-linear pilot model and adjustment rules evolved for single loop systems are considered applicable to the command loop of multiloop control situations with an integrated display. With certain reservations, this pilot loop model is also applicable to inner loop closures. To reduce the inadvertent excitations of a subsidiary or nuisance mode, the pilot will adopt a control crossfeed; and even while providing both crossfeed and inner-loop damping, pilot performance can be as good as that for a single loop task. The subjective opinion of the pilot, however, becomes severely degraded. In the event of several feedback possibilities, the pilot can select those which permit the best performance with the least effort on his part. Describing function measurements for multiloop systems are considered, and details are presented for the experiments undertaken. M.W.R.

N67-15865*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PILOT RESPONSE IN MULTILOOP TRACKING TASKS IN COMBINATION WITH SIDE TASKS
James J. Adams *In its* Manual Control 1966 p 205–209 refs (See N67-15850 06-05) GPO: HC$2.50; CFSTI: MF $0.65

Multiloop tracking system characteristics show that linear pilot models aid in a quantitative understanding of damper failure. Human control of a system based on horizontal translation control of a simulated Apollo lunar excursion module was studied for a letdown maneuver, with six degrees of freedom. Performance was smooth when pilots followed a predetermined pitch program, and then adjusted pitch attitude and thrust to establish a stable hovering condition and to reduce horizontal velocity to zero Additional side tasks had no affect when the prescribed program was followed, but they did effect ability to establish the hovering stability. Closed loop characteristics illustrated before and after a damper failure indicate the normal system has an attitude mode of motion with positive damping ratio. When vehicle damping is removed, the ratio becomes negative; and when the analog model representing the response of the human controlling an undamped vehicle is substituted, system characteristics again become stable. M.W.R.

N67-15866*# Honeywell, Inc., Minneapolis, Minn.
SYMBOLIC AND PICTORIAL DISPLAYS FOR SUBMARINE CONTROL
Robert C. McLane and James D. Wolf *In* NASA, Washington Manual Control 1966 p 213–228 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract Nonr-3675(00))

The research program leading to the development of several integrated display concepts for nuclear submarines is described. The experiments established guidelines for use of these integrated displays in vehicle control including monitoring and mission plan revision as a function of external constraints such as attacking weapons systems. The displays evaluated were classed in two general categories—symbolic and pictorial. The experimental approach employed tests designed to reveal differences between the displays, including measurement of tracking performance with forced sampling or blanking; recording reaction, judgement, and decision times in response to the presence of a homing torpedo; and determination of the correctness of the decision on collision imminence. There was no appreciable degradation in tracking performance due to periodic blanking of the display for as long as 75% of a 10-sec period. The pictorial or contact analog format produced lower tracking error scores than those with symbolic depth-azimuth format. This result was a general trend which may be attributable to their perceptual differences and differences in their quickening equations. The predictor display yielded a significantly smaller number of collisions than any of the other display configurations. There were no significant differences between the displays in the recordings of reaction, judgment, and decision times. Author

N67-15867*# Massachusetts Inst. of Tech., Cambridge.
SOME EFFECTS OF MOTION CUES ON MANUAL TRACKING
Lawrence R. Young *In* NASA, Washington Manual Control 1966 p 231–239 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

It has been adequately demonstrated that sustained high acceleration or vibration can have a deleterious effect on tracking ability. This paper considers some situations in which the motion cues, as felt in flight or moving base simulation, yield a significant improvement in pilot performance. The first of these situations is in a control task requiring more lead compensation than is easily developed from visual displays. The vestibular and tactile sensations contribute velocity and acceleration information which is used in stabilization. Experiments on control of inverted pendulums and VTOL's, with and without motion cues, demonstrate the extent to which this lead is used in certain tasks. Tests of labyrinthine-defective patients on similar tasks demonstrated the critical importance of vestibular inputs. The importance of motion cues in rapid adaptation to controlled element failures was investigated in a simulated blind landing experiment. Motion effects were found to be important in a class of flexible booster control experiments. These results were combined with many comparisons of fixed-base, moving-base, and flight experiments in the literature to arrive at some general conclusions regarding the effects of motion cues on tracking. Author

N67-15868*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACCELERATION STRESS EFFECTS ON PILOT PERFORMANCE AND DYNAMIC RESPONSE
Melvin Sadoff and C. B. Dolkas *In its* Manual Control 1966 p 241–257 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

A wide range of acceleration environments, varying from zero gravity to high sustained accelerations were studied in relation to pilot performance and dynamic response. Results indicate that the control-performance decrements observed at high sustained accelerations were attributable to decreased pilot gains and corresponding reductions in open-loop system crossover frequency. Limited results for extreme vibratory accelerations suggest that performance deterioration was associated with a reduction in pilot lead equalization (and a corresponding reduction in open-loop crossover). Under short-term weightless conditions, performance in a simulated control task was appreciably poorer than under comparable 1 g conditions for one of two sets of simulated vehicle dynamics investigated. This was attributed primarily to increased pilot excitation of the vehicle's lightly damped short-period mode. Data from Voskhod flights indicated that cosmonauts did not perform as well in a simulated control system as during ground training sessions. Author

N67-15869*# Defense Research Corp., Santa Barbara, Calif.
THE EFFECT OF MINOR ALCOHOL STRESS ON TRACKING SKILL
C. B. Gibbs *In* NASA, Washington Manual Control 1966 p 259–267 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Twenty men were tested in step-input tracking, with minor stress imposed by moderate alcohol dosage and an incompatible directional relation between control and display. Directional errors, response latencies, and eye movements were recorded before and after drinking, when breathalyzer readings were zero, and at 0.05 and 0.1% breathalyzer levels which may be produced in a man weighing 160 pounds by drinking two and four 12-ounce bottles of beer, respectively. Alcohol caused a progressive increase in response latencies in and errors ($p < 0.01$); there was no evidence for a threshold below which alcohol has no adverse effect. The test emphasized the markedly different effects of the same alcohol dosage on the skill of different subjects, but habitual drinkers obtained no undue advantage on the test. The task was learned quickly, and extensive practice did not reduce the discriminatory power of the test. The effects of a dose producing a 0.05% breathalyzer reading were not significantly different in an ascending or descending series of levels of intoxication. The alcohol dosages tested had no significant effect on simple reaction time. Author

N67-15870*# Hughes Aircraft Co., Culver City, Calif.
AN EVALUATION OF THREE TYPES OF HAND CONTROLLERS UNDER RANDOM VERTICAL VIBRATION
A. Z. Weisz, R. W. Allen, and C. J. Goddard *In* NASA, Washington Manual Control 1966 p 269–277 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Investigated was the effect of hand control design on continuous manual control performance in a vibration environment. Degradations in manual tracking due to whole-body vertical vibration were experimentally determined. The three controllers compared in the study consisted of: (1) a standard free-moving hand control without spring centering and with negligible friction or viscous damping; (2) a viscously damped low-inertia pencil stick without spring centering; and (3) a torque stick with negligible motion response to applied torques about the center of the hand grip. Results of the study indicate that the speed of response possible with a rigid controller leads to improved tracking performance in both static and vibration environments. K.W

N67-15871*# National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif.
HUMAN DESCRIBING FUNCTIONS MEASURED IN FLIGHT AND ON SIMULATORS
Harriet J. Smith *In its* Manual Control 1966 p 279–290 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Comparisons have been made between human describing functions measured in flight and on the ground using two different types of ground simulation. A T-33 variable–stability airplane was used for the in-flight measurements. The ground tests were conducted in the T-33 airplane on the ground with simulated instrument flight and also on a general-purpose analog computer in conjunction with a contact analog display. A multiple-degree-of-freedom controlled element was used in a single-loop compensatory tracking task. The input disturbance in each case consisted of the sum of 10 sine waves with a cutoff frequency of 1.5 radians per second. No significant difference is indicated between the average describing functions measured in flight and those measured in a fixed-base simulator; the variance was considerably higher in the flight data. The system open-loop describing functions measured in the fixed-base simulator agreed well with previous results in which the tracking task was similar, although the controlled-element dynamics were different. Average linear coherence was close to the values in this investigation, although the linear-correlation function was always equal to 1. Author

N67-15872*# Massachusetts Inst. of Tech., Cambridge.
PREVIEW CONTROL BEHAVIOR AND OPTIMAL CONTROL NORMS
T. B. Sheridan, B. F. Fabis, and R. D. Roland *In* NASA, Washington Manual Control 1966 p 293–310 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Grant NsG-107-61)

A model, based on the theory of optimal control, is presented for characterizing the human operator in a preview control task, that is, where he can observe the input targets and their importance prior to the time he must initiate a response to them. While in need of much further development from the behavioral science point of view, the model provides a frame of reference for investigation of performance value and learning in manual control. Two exploratory experiments are reported which may illustrate some relevant experimental variable and provide a rough comparison of the human operator to an optimal preview controller. Author

N67-15873*# Bunker-Ramo Corp., Canoga Park, Calif.
STUDIES IN OPTIMAL BEHAVIOR IN MANUAL CONTROL SYSTEMS: THE EFFECT OF FOUR PERFORMANCE CRITERIA IN COMPENSATORY RATE-CONTROL TRACKING
Richard W. Obermayer, Raymond B. Webster, and Frederick A. Muckler *In* NASA, Washington Manual Control 1966 p 311–324 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract NAS2-3113)

Twelve college students performed compensatory tracking with rate control dynamics (1/s) and a low-frequency forcing function composed o f the sum of six sinusoidal components. After two practice sessions, the subjects performed the basic task with four performance criteria: (1) keep the display bar in the center, (2) only keep the display bar from exceeding 1-centimeter boundaries on the display face, (3) minimize a total score which is the sum of mean-squared display deviation and mean-squared control deflection, and (4) minimize mean-squared display deviation. The following kinds of information were collected: learning curves; display, control, and total scores; amplitude ratio and phase at each forcing function frequency; centimeter tolerance-band counts; correlation coefficients; reversals; oscillograph recordings; control and display amplitude distribution; and average control response as a function of display deviation. The data show different levels of human control behavior and nonamplifier-type behavior, and yield methodological implications. Author

N67-15874*# Battelle Memorial Inst., Columbus, Ohio.
HUMAN DECISION-MAKING IN MANUAL CONTROL SYSTEMS
R. E. Thomas and J. T. Tou *In* NASA, Washington Manual Control 1966 p 325–334 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

A model is proposed to describe human decision making in manual control systems. The human operator in the control loop is represented by a model which will generate an output consisting of (1) operational control actions as a result of sequential decision-making and (2) verbal statements or heuristics of how to achieve optimal control. The operational control actions are generated by a search algorithm, and the verbal statements are determined through detection of invariance of variables associated with minimum incremental cost. At high levels of generality and verbal prescriptions for obtaining optimal control are called heuristics. By using heuristics adaptive features can be introduced into the search algorithm. The proposed model will carry out sequential evaluation of the validity of the heuristics which are derived on the basis of past experience. By associating a Bayesian probability with the derived heuristic, this model simulates the evolution of a heuristic to a high subjective probability of being valid, even though the controller may have difficulty in executing

the heuristic as shown by control actions which do not optimize the criterion function. An experiment is suggested for testing the validity of the proposed model. Author

N67-15875*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DIFFERENTIAL GAMES AND MANUAL CONTROL
Sheldon Baron *In its* Manual Control 1966 p 334–345 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Variational methods are used to solve a particular pursuit-evasion differential game. The problem involves the determination of optimal strategies for both the pursuer and evader. The performance measure is the miss distance at some fixed terminal time. Both pursuer and evader have limited control energy. The performance of a trained research pilot, for both single- and two-axis control tasks is compared with that of the optimal pursuer. State vector display and "quciened" display are discussed. A film showing typical pilot performance is presented. The results suggest that differential game problems could be quite useful in the study of manual control. Author

N67-15876*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DYNAMICAL SYSTEM MODELING OF HUMAN OPERATORS–A PRELIMINARY REPORT
Peter L. Falb and George Kovatch *In its* Manual Control 1966 p 345–358 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Results from control theory are applied to the development of dynamical system models for human operators in a control loop. Linear differential equation models are examined to determine the model from estimates of the impulse response. The system order, the system matrix, and the system gains are adjusted. Nonlinear Volterra series models are also considered and an identification method is used to estimate the kernels. Author

N67-15877*# Systems Technology Inc., Ingelwood, Calif.
A "CRITICAL" TRACKING TASK FOR MAN-MACHINE RESEARCH RELATED TO OPERATOR'S EFFECTIVE DELAY TIME
H. R. Jex, J. D. McDonnell, and A. V. Phatak *In* NASA, Washington Manual Control 1966 p 361–377 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contracts NAS2-2288; AF 33(615)-2826)

A closed-loop compensatory tracking task, which yields a measure of the human operator's time delay characteristics while tracking, constrains his behavior to within very narrow limits, and provides a low variability indicator of the operator's tracking ability, was analyzed based on recent human response research. The results of an experimental program are described, which enables describing function and critical task measures to be compared. An "autopaced" critical task mechanization and operating procedure is described which yields consistent, reliable, and very low variance measurements of the critical levels of instability. An analysis of the measured human operator describing functions shows that, when operating near criticality, the subject's behavior is adequately represented by the most recent human-operator describing-function models and adaptation laws. Further, the extrapolation of describing function data to the critical level of instability shows that the operator is constrained by the vanishing stability margins. The just-controllable first-order divergence is shown to be related dominantly to the operator's effective time delay, and secondarily to low-frequency neuromuscular adaptation effects. Very good agreement is demonstrated between theory and experiment for both stability and performance parameters. Author

N67-15878*# Dunlap and Associates, Inc., Darien, Conn.
DESIGN APPLICATIONS OF ADAPTIVE (SELF-ADJUSTING) SIMULATORS
Charles R. Kelley *In* NASA, Washington Manual Control 1966 p 379–401 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65
(Contract Nonr-4986(00))

The usefulness of adaptive simulators in manual control system design is explored. The history and development of the field of adaptive vehicle simulaton is reviewed. The technique of adaptation most suitable for design studies is one in which operator performance is kept at a present criterion level by means of adaptive changes in task difficulty. This technique permits design variables to be assessed without the intervention of operator error scores. The performance criterion used to measure operator performance is important in adaptive as well as nonadaptive simulation. Time-on-target scores were analyzed and found to be excessively imprecise. The recommended performance criterion for many applications is rms error in one axis and vector error in two or more independent axes. Example design data are presented with respect to (1) display gain, (2) continuous versus on-off control, and (3) one versus two versus three axes. Data were gathered in each case on an acceleration control task in which forcing function amplitude was varied adaptively. The relation of each design variable to forcing function amplitude, with operator error constant, is described for the example task. Author

N67-15879*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge Mass.
DISCUSSION OF SPECTRAL HUMAN-RESPONSE ANALYSIS
Lawrence W. Taylor *In its* Manual Control 1966 p 403–412 refs (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Estimates of describing functions and associated parameters that represent a human pilot performing a compensatory tracking task, while being subjected to a random-appearing input, are expressed in terms of cross-, and power-spectral-density functions. The expression most commonly used for spectral densities is the Fourier transform of the autocorrelation and cross-correlation functions. Use of an equivalent expression for spectral-density functions, the product of the Fourier transforms of the signals divided by the record length, makes several simplifications become evident. The estimates of the human describing function are seen to be unchanged by correlation with the signals and are shown to be equal to the ratio of the Fourier transforms of the pilot's output and error. The expression for the linear-correlation coefficient is shown to be ill-defined, since it equals 1 under all circumstances. Alternate definitions of this parameter are discussed. The need for a sum of sine waves for an input is also discussed, and the technique for making measurements of the remnant is outlined. In addition to the analytical consideratons, a computational advantage results which enables improvements in accuracy. Author

N67-15880*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ANALYSIS AND PREDICTION OF PERFORMANCE OF A DIGITAL COMPUTER FACILITY FOR FLIGHT SIMULATION STUDIES
M. C. Grignetti and J. I. Elkind *In* NASA, Washington Manual Control 1966 p 413–417 (See N67-15850 06-05) GPO: HC $2.50; CFSTI: MF $0.65

Theory and partial results of the design are presented. The facility is to provide a group of experimenters with the means of monitoring the signals and data obtained from their experiments while they are being run (1) for extracting information from these signals in order to control the experiments; (2) for recording the data and signals in permanent files; (3) for editing these data;

and (4) for applying of analysis techniques to the edited data. Since it is assumed that demands for service will be random and subject to unpredictable interruptions and delays, the system is designed to service a nonpredictable, randomly varying load. Markov models forming the basis of queuing theory are recommended to represent and analyze the system's behavior. Computer problems of real-time and high-priority are discussed, and user probabilities are determined by the analytical and the Monte Carlo methods. K.W.

N67-15883*# San Francisco Univ., Calif. Inst. of Chemical Biology.

BRAIN AMINO ACIDS AND BIOGENIC AMINES UNDER VARIOUS ATMOSPHERIC MIXTURES Semiannual Report, May–31 Oct. 1966

Arthur Furst 12 Dec. 1966 20 p

(Grant NGR-05-029-001)

(NASA-CR-81238) CFSTI: HC $3.00/MF $0.65 CSCL 06A

The possible environmental effects upon brain biochemistry were investigated by exposing rats to various gaseous atmospheric mixtures and measuring the free amino acid pool and biogenic amine content. Details are presented on an improved exposure chamber which exposes 5 to 10,400-gm rats at near 1 atm for periods up to 35 hr. From brain tissue analyses, at least 37 separate ninhydrin-positive compounds were detected and measured, and are tabulated. Exposure to 100% O_2 for 18 hr appeared to reduce the concentration of aspartic acid in brain tissue, but exposure for 72 hr seemed to increase the concentration. The same concentration changes were noted for methionine as for aspartic acid. Tyrosine concentration was reduced under both exposure conditions. Gamma-aminobutyric acid rose under the 18 hr exposure. Differences were noticed between the strains of rats. Serotonin was detected. N.E.N.

N67-15933*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

ACOUSTICALLY EVOKED POTENTIALS IN THE RAT DURING CONDITIONING

Robert D. Hall and Roger Greenwood Mark 30 Nov. 1966 86 p refs

(Grant NsG-496; Contract DA-36-039-AMC-03200(E); Grants NSF GK-835; NIH G-MH-04737-06)

(NASA-CR-81247; TR-455) CSCL 06C

Acoustically evoked potentials were recorded from unanesthetized rats in a series of experiments designed to study changes in sensory evoked potentials during conditioning. It is shown that when clicks are established as conditional stimuli (CS) in conditioned emotional response (CER) situations, click-evoked potentials recorded from central auditory structures and from mesencephalic reticular formation exhibit appreciable amplitude increases. Similar increases were found with Sidman avoidance conditioning. These alterations in click-evoked potentials were shown to be independent of movement or movement-related variables. Potentials evoked in central auditory structures by electrical stimuli applied to the cochlear nucleus or within the cochlea also revealed increases in amplitude during acquisition of a CER. It is concluded that changes in sensory evoked potentials observed during conditioning are not related to what may be considered the neural substrate of conditioning, but, in aversive conditioning situations at least, they are associated with fear elicited initially as an unconditioned response to noxious stimulation and later as a conditioned response. Author

N67-15941*# California Univ., Berkeley. Lawrence Radiation Lab.

[STUDIES OF HEAVILY IONIZING PARTICLES AND SPACE BIOLOGY] Semiannual Report

Tove Neville and John H. Lawrence, ed. 1966 161 p refs

(NASA Order R-104(2)09-019-900; Contract W-7405-ENG-48)

(NASA-CR-81246; UCRL-16898) CFSTI: HC $3.00/MF $0.65 CSCL 06E

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N67-15942*# California Univ., Berkeley. Lawrence Radiation Lab.

ENDOGENOUS PRODUCTION OF ^{14}CO: AND *IN VIVO* TECHNIQUE FOR THE STUDY OF HEME CATABOLISM

Stephen A. Landaw and H. Saul Winchell *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 1–10 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

A method is presented for the separation, detection, and quantitation of endogenously produced carbon-14-labelled carbon monoxide in the rat, following injection of glycine-2-^{14}C. In this method respiratory $^{14}CO_2$, the only significant breath contaminant, is removed with a sodalime absorber. The remaining breath activity, due primarily, if not entirely, to ^{14}CO, is oxidized to $^{14}CO_2$ by Hopcalite, absorbed in an ethanolamine-containing solution, and counted by liquid scintillation. Standard ^{14}CO and $^{14}CO_2$ gases,

as well as animal experimentation, confirm this method's ability to measure ^{14}CO and $^{14}CO_2$ production rates simultaneously, following a single injection of labelled glycine. Examples are given to show that this continuous, in vivo, and easily performed method can give important information containing heme catabolism. The technique should provide a unique source of information in the study of disease processes characterized by abnormal heme catabolism in man and other animals. Author

N67-15943*# California Univ., Berkeley. Lawrence Radiation Lab.
A SIGNIFICANT DIFFERENCE IN MAMMALIAN-CELL POLYPLOIDY INDUCTION BETWEEN PLATEAU AND "STAR" REGIONS OF A NEGATIVE PION BEAM
William D. Loughman, H. Saul Winchell, Mudundi R. Raju and John H. Lawrence *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 11–13 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

In the experiment, mice with the A-2 lymphoma as an ascites tumor were irradiated in a negative pion beam from the 184-inch cyclotron. Mice in the plateau portion of the beam (about 60% pions) received an average dose of about 230 rads; those in the peak region (30% to 40% pions) received about 350 rads. Ascites cells were removed from the mice and prepared for chromosome examination on the third and fourth days following irradiation; 4000 metaphase cells from each mouse were scored as essentially diploid or polyploid. The summarized results are graphically depicted, and it is shown that the incidence of polyploidy among irradiated cells increased over the control values. It is also reported that additional mammalian cell experiments with negative pion beams were performed, and that survival of mice given irradiated lymphoma cells increased over control values. All experiments indicate that negative pions in the peak (star) region of the beam have a higher relative biological effectiveness than those in the plateau region. M.G.J.

N67-15944*# California Univ., Berkeley. Lawrence Radiation Lab.
BIOLOGICAL SPECIALIZATION IN MEGAKARYOCYTES AND PLATELETS
Jean-Michel Paulus *In its* [Studies of Heavily Ionizing Particles and Space Biol.] p 14–21 refs (see N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

In considering the properties of megakaryocytes and platelets, comparisons are made with the physiological activities of five cellular types: a polypoloid cell, a glandular cell, an enucleate element, an endocytic cell, and a muscular cell. An extensive list of references is included, and biochemical and cytological analyses are recommended to elucidate some of the problems raised by this giant, multifunctional cell. M.G.J.

N67-15945*# California Univ., Berkeley. Lawrence Radiation Lab.
THE EFFECT OF ERYTHROPOIETIN ON THE GROWTH AND DEVELOPMENT OF SPLEEN COLONY-FORMING CELLS
John C. Schooley *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 22–41 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

The progressive growth and development of spleen colonies were studied in most animals, in which erythropoiesis was modified by such procedures as the production of polycythemia, the injection of immune serum capable of neutralizing the biological activity of erythropoietin, or the injection of exogenous erythropoietin. The findings indicate: (1) The development of erythroid colonies in the spleens of lethally irradiated mice following bone marrow transplantation was suppressed by the production of polycythemia or the injection of antibody against erythropoietin into the host mice. (2) The overall doubling time of colony-forming cells in the spleens of polycythemic mice was not altered by the injection of exogenous erythropoietin during the first 10 days after bone marrow transplantation. It is suggested that erythropoietin does not act on the colony-forming cell directly, but upon some erythropoietin sensitive cell derived from the colony-forming cell. M.G.J.

N67-15946*# California Univ., Berkeley. Lawrence Radiation Lab.
INFLUENCE OF SEVERE HYPOXIA ON HUMAN ERYTHROPOIETIN
William E. Siri *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 42–52 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

The influence of hypoxia on the regulation of red cell volume was investigated in human subjects exposed to oxygen partial pressures ranging from 160 mm Hg sea level) to 69 mm Hg (21,500 ft). Plasma–iron turnover, blood volume, and the ordinary hematological quantities were measured in Andeans residing at 12,500 to 17,000 ft; and in climbers at sea level, at 17,800 ft, and at 21,500 ft during an ascent of Mt. Everest. The results are assessed, and it was concluded that the findings bear out previous observations that healthy persons acclimatized to moderate altitudes (less than 15,000 ft) do not normally exhibit leucocytosis nor thrombocytosis, although temporary leucocytosis has been observed in the early stages of acclimization. No meaningful changes in either total or differential leucocyte counts were seen during extended exposure to high altitude. M.G.J.

N67-15947*# California Univ., Berkeley. Lawrence Radiation Lab.
STUDIES ON THE THYMUS AND THE RECIRCULATING LYMPHOCYTE POOL
John C. Schooley and Marvin M. Shrewsbury *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 53–63 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Experiments were conducted to determine the temporal relationships between thymectomy and the first indication of a depression in thoracic duct lymphocyte outputs. The effects of transplantation of thymic tissue on the thoracic duct lymphocyte outputs were also studied, along with the effect of altering the total recirculating lymphocyte pool using the parabiosis technique. The results show: (1) A marked decrease in the recirculating pool of lymphocytes, as measured by the hourly output of lymphocytes from the thoracic duct, occurs within a week after thymectomy. This decrease was prevented if the thymectomized animal contained a subcutaneous thymic transplant or was joined by parabiosis to an animal containing a normal thymus. This indicates that the thymus is intimately concerned in the regulation of a considerable portion of the recirculating lymphocyte pool. (2) The failure of multiple thymic transplants to elevate either the blood lymphocyte level or the output of lymphocytes from the thoracic duct suggests that some homeostatic mechanism regulates the level of thymus derived or thymus controlled lymphocytes in the recirculating lymphocyte pool. M.G.J.

N67-15948*# California Univ., Berkeley. Lawrence Radiation Lab.
SERUM–LIPOPROTEIN DISTRIBUTION AND PROTEIN ANALYSIS BY REFRACTOMETRY
Frank T. Lindgren, Norman K. Freeman, Robert D. Wills, Alicia M. Ewing, and Lin C. Jensen *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 64–74 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Potential relationships are considered between the serum–lipoprotein distribution and the serum proteins. The measurement of serum proteins by refractometry is discussed, and the mean values and standard deviations of serum protein concentrations

determined from refractometric data are tabulated together with calculations from other formulas. The relationship between specific refractive increment of serum proteins and lipoprotein classes and the refractive index of the reference media are plotted. A figure is included to show all the components measured by serum refractometry, together with the mean refractive increment values and their standard deviations for the group tested. It is apparent that neither the total serum proteins (excluding the known lipoproteins) nor total real protein can be measured accurately by serum refractometry unless the total content of serum lipoproteins is considered. It is concluded that in order to use serum refractometry to measure accurately the total serum protein macromolecules exclusive of the lipoproteins, it is necessary to measure or estimate the serum–lipoprotein spectra. M.G.J.

N67-15949*# California Univ., Berkeley. Lawrence Radiation Lab.
STUDIES ON DEFICIENT MAMMALIAN CELLS ISOLATED FROM X-IRRADIATION CULTURES
Paul W. Todd *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 72–81 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

In the experiments, the cultured mammalian cells used were human kidney line T1, and Chinese hamster bone marrow M3-1 cells. Lines of deficient cells were obtained by selecting cells from small aberrant colonies that appeared in cultures which received 500 rads of X-radiation. Based on the results, it was concluded: (1) Colonies of deficient cells appear in X-irradiated cultures of both human and hamster cells. (2) High linear energy transfer radiation is more effective than X-radiation in producing deficient cells, by the criterion of small colony development. (3) Deficient cells are respiratory deficient only to the extent that they consume less oxygen than do normal cells. (4) Hamster cells do not express their inherited deficiencies visibly in their karyotypes. However, this does not mean that heritable chromosome abberations cannot result in cellular deficiencies of the type described. M.G.J.

N67-15951*# California Univ., Berkeley. Lawrence Radiation Lab.
SECONDARY-ELECTRON DISTRIBUTION FOR HEAVY IONS
Nobuo Oda and John T. Lyman *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 87–96 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Target theory and delta ray correction are discussed, and an experiment is described to measure the absolute yield and the slowing-down spectrum of secondary electrons with energies below 50 eV. The energy spectra for Al foil bombarded with ^{4}He ions, and graphs of the total yield of electrons from a Ni foil are shown. It was found that: (1) when the velocities of the primary ions are the same, the yields for each kind of ion are proportional to the total LET's, and (2) when the velocities are different, the yield for higher velocity is higher than that for lower velocity. N.E.N.

N67-15952*# California Univ., Berkeley. Lawrence Radiation Lab.
THE INTERPRETATION OF MICROBIAL INACTIVATION AND RECOVERY PHENOMENA
Robert H. Haynes *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 97–116 refs (See N67-15941 06-04) (Grant NIH GM-12667)
CFSTI: HC $3.00/MF $0.65

Developments in molecular radiation biology are outlined, and the possibility of using classical target theory to provide new mathematical interpretations of radiation survival curves is discussed. The importance of DNA as a target for inactivation by X-rays, ultraviolet light, and nitrogen mustard is emphasized. The primary findings are summarized: (1) Reproductive death in bacteria treated with radiation arises primarily from the formation of structural defects in DNA serving to block normal DNA replication. (2) Sensitization by interference is involved in the existence of shoulders on survival curves, the synergistic interactions among the radiations, and radiosensitization by agents that bind or are incorporated into DNA. (3) Repair of UV damage in Escherichia coli B/r is a multistep process involving nuclease excision of defective single-stand segments containing pyrimidine dimers, and a nonconservative mode of DNA replication which fills in the resulting gaps. N.E.N.

N67-15953*# California Univ., Berkeley. Lawrence Radiation Lab.
INACTIVATION OF PHAGE α BY SINGLE-STRAND BREAKAGE
David Freifelder *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 117–122 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Details are presented on the experimental study of phage α inactivation, using a clear mutant of phage α propagated on *B. megaterium*, Parigi. Double stranded DNA was isolated by heating the phage for 5 min at 70°C, and identical results were obtained for both irradiated and unirradiated DNA under conditions of extended heating or denaturation. It was determined that 33% of the single stands are broken for phage α. The results of the inactivation and single-strand breakage rates are graphed. It is concluded that the *B. megaterium* phage α is more sensitive to X-ray irradiation than a typical phage of its size containing double-stranded DNA, and that the inactivating event is considered to be a single-strand break. N.E.N.

N67-15954*# California Univ., Berkeley. Lawrence Radiation Lab.
REPLICATION OF DNA DURING F'LAC TRANSFER
David Freifelder *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 123–127 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Experiments are described in which a thymine-requiring male bacterium *Escherichia coli* transfers F'Lac in a medium containing 5-bromouracil deoxyriboside (BUDR) instead of thymine, and the presence of BUDR in the transferred DNA is detected by virtue of its sensitization to the effects of short or long wavelength ultraviolet irradiation. The results of ultraviolet and visible light irradiation are graphed and discussed. It is concluded that when male cells containing F'Lac are mated with female cells, the transferred F'Lac is replicated either prior to or during the transfer process. N.E.N.

N67-15956*# California Univ., Berkeley. Lawrence Radiation Lab.
INCREASE IN PLASMA GROWTH-HORMONE LEVEL IN THE MONKEY FOLLOWING THE ADMINISTRATION OF SHEEP HYPOTHALAMIC EXTRACTS
Joseph F. Garcia and Irving I. Geschwind *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 130–136 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

Experimental procedures used in studies of the radioimmunoassay of the growth hormone (GH) are presented. Plasma GH concentrations were determined in anesthetized Rhesus monkeys following insulin hypoglycemia and sheep hypothalamic tissue injections. The plasma GH level was observed to rise approximately 40 min after the insulin hypoglycemia injection, reaching the peak in at about one hour. After the administration of hypothalamic extract, the plasma GH level began to rise between 20 and 30 min, reached peak values between 45 and 60 min, and then decreased abruptly. No fall in plasma glucose was observed. It is concluded that the results support the concept that the secretion of anterior pituitary GH is mediated by a hypothalamic neurohumoral factor. N.E.N.

N67-15955*# California Univ., Berkeley. Lawrence Radiation Lab.
PLEIOTROPY AND POLYMORPHISM
Jack Lester King *In its* [Studies of Heavily Ionizing Particles and Space Biol.] 1966 p 128-129 refs (See N67-15941 06-04) CFSTI: HC $3.00/MF $0.65

A simple model is presented which demonstrates the interaction of pleiotropy and stabilizing selection, and it is suggested that pleiotropy is a potential factor toward the maintenance of genetic diversity. Selection is against double homozygotes only, and at the most favorable gene frequencies, double homozygosis occurs in as few as 25% of all zygotes. N.E.N.

N67-15978# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
AN EXPLORATORY STUDY OF THE EFFECTS OF A HYPERBARIC ENVIRONMENT ON THE CHIMPANZEE
Technical Report, 28 Nov.–11 Dec. 1965
Alfred G. Koestler and Phillip W. Day Sep. 1966 57 p refs
(ARL-TR-66-17; AD-640870) CFSTI: HC $3.00/MF $0.65

Two chimpanzees used in six separate tests were exposed to hyperbaric conditions equivalent to 50, 200, and 300 feet of seawater. Pressures were accomplished with compressed air in a dry compression chamber. Both subjects accomplished the dives without apparent physiological damage. Behavioral tasks showed small temporary decrements during extreme pressures, particularly in auditory reaction times. No symptoms of dysbarism or inert gas narcosis were evident. The use of the chimpanzee as a precursor to man in high-pressure research is recommended. Author (TAB)

N67-16011*# Systems Technology, Inc., Hawthorne, Calif.
MODEL OF HUMAN OPERATOR RESPONSE TO STEP TRANSITIONS IN CONTROLLED ELEMENT DYNAMICS
D. H. Weir and A. V. Phatak Washington, NASA, Jan. 1967 42 p refs
(Contract NAS2-1868-4)
(NASA-CR-671) CFSTI: HC $3.00/MF $0.65 CSCL 05H

A model is derived for describing and predicting human operator dynamic response during sudden changes in the vehicle or controlled element dynamics. Data upon which the model is based are presented also. The model features distinct modes of behavior which are selected successively during the transition between the initial and final stationary tracking situations. The first transition mode is a retention phase which is modeled by the pretransition operator describing function in closed-loop control of the new controlled element dynamics. The next phase is characterized by nonlinear time optimal control. Finally, the operator switches to the quasi-linear describing function appropriate to closed-loop control of the new dynamics under stationary conditions. Author

N67-16012*# Systems Technology, Inc., Hawthorne, Calif.
A "CRITICAL" TRACKING TASK FOR MAN-MACHINE RESEARCH RELATED TO THE OPERATOR'S EFFECTIVE DELAY TIME. PART II: EXPERIMENTAL EFFECTS OF SYSTEM INPUT SPECTRA, CONTROL STICK STIFFNESS, AND CONTROLLED ELEMENT ORDER
J. D. McDonnell and H. R. Jex Washington, NASA, Jan. 1967 56 p refs
(Contract NAS2-2288)
(NASA-CR-674) CFSTI: HC $3.00/MF $0.65 CSCL 05H

The Critical Task consists of a closed-loop tracking task in which an increasingly unstable controlled element is used to yield a measure of the operator's effective time delay while tracking. In this part of the report, the task has been further developed through the analysis of additional data. In a series of experiments, it was found that the human operator's characteristics do not change as the system input level is decreased; hence, the critical task yields a valid limit when excited solely by the operator's remnant. The effects on the operator of different control stick types are investigated, and the differences in critical task scores are related to the operator's describing function characteristics. Step reaction time data are compared with the continuous measures of effective time delay and the autopacer scores. A sample analysis to determine the number of autopacer trials necessary to achieve a confident measure is made. Finally, data are presented for a second-order critical task in which on integrator precedes the first-order divergence. Author

N67-16026*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXPERIMENT M-5, BIOASSAYS OF BODY FLUIDS
Lawrence F. Dietlein and Elliott S. Harris *In* NASA, Washington Manned Space-Flight Expt., Gemini IX Mission 1 Nov. 1966 p 43-54 (See N67-16021 06-30) CFSTI: HC $3.00/MF $0.65

The M-5 experimental measurements were made to determine the metabolic cost of manned space flight by the analysis of biological fluids. Results of the analyses were used as an indication of crewman physiological status. Where changes were found to occur, efforts were made to elucidate the mechanisms producing these changes and to assess their significance relative to space flight. Author

N67-16027*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXPERIMENT D-12, ASTRONAUT MANEUVERING UNIT
John W. Donahue *In* NASA, Washington Manned Space-Flight Expt., Gemini IX Mission 1 Nov. 1966 p 55-96 (See N67-16021 06-30) CFSTI: HC $3.00/MF $0.65

The astronaut maneuvering unit (AMU) experiment was designed to provide experience in extravehicular maneuvering operations in the Gemini missions. The AMU consists of two basic modules. The extravehicular life support system chestpack contains the life support system, emergency oxygen supply, and all systems status and malfunction displays. The backpack contains the propulsion, flight control, oxygen supply, malfunction detection, and communications systems. Detailed descriptions of these systems are given. The Gemini IX-A AMU mission called for inspection, preparation, and donning activities followed by maneuvering evaluations. The AMU activities were terminated before the donning was completed. More work effort than anticipated was needed by the EVA pilot to maintain his position in preparing the AMU for flight, which caused his visor to completely fog. Despite the positioning problem, the preparation tasks were completed. Details of these activities are discussed. R.N.A.

N67-16084# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.
PROBLEMS IN DEPTH PERCEPTIONS: EQUIDISTANCE JUDGEMENTS IN THE VICINITY OF A BINOCULAR ILLUSION
Frank L. Agee Jr. (M.S. Thesis), and Walter C. Gogel Jul. 1966 12 p refs
(AM-66-24; AD-641476) CFSTI: HC $3.00/MF $0.65

Judgments of the size and distance of objects are sometimes made in aircraft under background-viewing conditions that may themselves create false sensory impressions (illusions). In this study, the effects of a background illusion on judgments of the size and distance of objects that were independent of that background were examined. Misleading size cues associated with a binocularly observed trapezoidal window produced an apparent depth orientation of the window that was different from its physical orientation. As expected, it was found that errors occurred in adjusting two other

objects (disks) to apparent equidistance with each other in the presence of the window and that the direction of the errors in apparent equidistance was related to the direction of the errors in the perceived slant of the trapezoidal window. It was less clear that errors in the judgment of apparent equidistance occurred when the orientation of the window and the separation of the disks were vertical rather than horizontal. Possible explanations for discrepancies between the magnitude of the perceptual errors associated with the trapezoidal window and those associated with the equidistance judgments are discussed. Author (TAB)

N67-16092*# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aviation Medical Center.

A COMPARISON OF OCULAR COUNTERROLLING MOVEMENTS BETWEEN NORMAL PERSONS AND DEAF SUBJECTS WITH BILATERAL LABYRINTHINE DEFECTS

Earl F. Miller, II and Ashton Graybiel 18 Feb. 1962 13 p refs Sponsored by the Office of Life Sci. Programs Joint report with NASA *Its* Rept.-68

(NASA Order R-47)

(NASA-CR-81264) CSCL 06P

The reliability and validity of counterrolling as a functional test of the otolith organs were investigated by comparing measurements obtained from a group of healthy persons with those from a group of subjects with labyrinthine defects (L-D subjects). The photographic technique used is described, and the results are presented in tabular form. Measurements of several photographs at each body position disclosed a small but significant variation in both groups of subjects which was interpreted as instability of torsional eye position. The findings in the normal subjects revealed a characteristic pattern of counterrolling; however, the results from the L-D subjects did not disclose the characteristic pattern found in normal subjects in most instances. It was felt that the highly significant group differences must have been due to loss of function of the auricular sensory organs, and intraindividual differences in the L-D group are best explained by the presence of some residual otolith function. L.E.W.

N67-16147# United States Rubber Co., Mishawaka, Ind.

LIGHTWEIGHT INSULATED FOOTWEAR Final Report

Robert W. Pooley, Leighton E. Fisher, Alexander D. Shaw, III, and Conrad S. Rohs Natick, Mass., Army Natick Labs., Sep. 1966 150 p refs

(Contract DA-19-129-AMC-690(N))

(TR-67-23-CM; AD-640629) CFSTI: HC $3.00/MF $0.65

A number of candidate materials were compounded, tested, and evaluated with an aim toward the development of a lightweight (15 oz. per boot), impermeable, (water absorption maximum weight 5%), insulated, (for service down to -20 deg.) boot for periods of up to 2 hours of inactivity. These materials included expanded elastomers and plastics, solid plastics, metals, fabrics, adhesives, and coating materials. Design and fabrication studies were conducted to incorporate the most promising materials into a prototype boot, and to determine the insulating properties of the materials used singly and in combination with each other. Based on the data obtained, prototype boots were assembled. An experimental pull-on type boot weighing 15 1/2 onuces was worn by the Project Officer in the Climatic Test Chambers at the U. S. Natick Laboratories at -30F. for a period of 2 hours. These studies indicate the feasibility of producing lightweight insulated boots through materials research. Author (TAB)

N67-16187# Chicago Medical School, Ill.

INTERNAL BODY MOVEMENT ALONG THREE AXES RESULTING FROM EXTERNALLY APPLIED SINUSOIDAL FORCES Final Report, 31 May–30 Nov. 1963

John L. Nickerson and Milana Drazic Wright-Patterson AFB, Ohio, AMRL, Jul. 1966 19 p refs

(Contract AF 33(657)-10748)

(AMRL-TR-66-102; AD-641135) CFSTI: HC $3.00/MF $0.65

The report presents the results of observations on the resonance frequency and damping of a number of internal visceral body structures determined when the whole body is exposed to vibrations along three axes of the body. The X-ray method used is a modification of the system developed earlier. The results, using anesthetized dogs, are as follows. Along the long axis of the body, (Z), the resonance frequency and damping are the average respectively 4.4 cycles per second and 0.29 of the critical value. However, on axes at right angles to the long axis of the body, i.e., the transverse axis, (Y), and the dorso-ventral axis, (X), the values are respectively 9.1 and 8.9 cycles per second for the resonant frequency and 0.35 and 0.37 for the damping factor along the corresponding axes. Author (TAB)

N67-16201# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.

LEARNING AND SHORT-TERM RETENTION OF PAIRED ASSOCIATES IN RELATION TO SPECIFIC SEQUENCES OF INTERPRESENTATION INTERVALS

Robert A. Bjork 11 Aug. 1966 75 p refs

(Contract Nonr-225(73); Grant NIH G-MH-6154)

(TR-106; AD-641395) CFSTI: HC $3.00/MF $0.65

The dissertation reports a study of short-term retention in paired-associate list learning. One purpose of the study was to ascertain empirically the extent to which short-term memory influences performance during the acquisition of a list of paired associates; a second was to gather evidence with respect to the conceptual relationship of short-term memory and learning. The particular experimental behavior chosen for study was the learning of a list of paired associates by means of a series of anticipation trials. An anticipation trial starts with the presentation of a stimulus to which the subject attempts to anticipate the correct response and ends with a presentation of the correct response. During an experimental session, the trials on any one item (presentation sequence) are characterized by a sequence of interpresentation intervals; that is, any two successive presentations of an item are separated by some number of trials on other items. The experimental design modified the standard anticipation procedure in two ways. (1) The series of trials was generated by a computer-implemented algorithm designed to yield a uniform distribution of interpresentation intervals. (2) All subjects had the same series of trials in the sense that each had the same set of presentation sequences. The confounding of item differences with the effects of the presentation sequences was avoided by counterbalancing across subjects the assignment of items to presentation sequences. Author (TAB)

N67-16216# RAND Corp., Santa Monica, Calif.

CYBERNETICS

5 Oct. 1966 9 p Transl. into ENGLISH from the book "Kul'tura, Nauka, Iskusstvo SSSR" Moscow, Politizdat, 1965 p 97–101

(LT-66-55; AD-640505) CFSTI: HC $3.00/MF $0.65

Translation of Russian research: Cybernetics. Author (TAB)

N67-16243# Polish Academy of Sciences, Warsaw. Committee for the Peaceful Uses of Nuclear Energy.

X-RAY DOSE AND ENERGY DETERMINATION BY PERSONAL FILM MONITORING [BESTIMMUNG DER PERSONENDOSIS UND ENERGIE DER ROENTGENSTRAHLUNG UND NACH DER FILMSCHWAERZUNGSMETHODE]

T. Musialowicz and J. Wysopolski *In its* Nukleonika, Vol. VIII 1966 p 174–183 refs In GERMAN; ENGLISH summary (See N67-16221 06-06) CFSTI: HC $3.00/MF $0.65

or more independent axes. Example design data are presented with respect to (1) display gain, (2) continuous versus on-off control, and (3) one versus two versus three axes. Data were gathered in each case on an acceleration control task in which forcing function amplitude was varied adaptively. The relation[illegible]

N67-16275# Polish Academy of Sciences, Warsaw. Committee for the Peaceful Uses of Nuclear Energy.

Sr-90 IN HUMAN-BONES IN POLAND—RESULTS FOR 1960 AND 1961

J. Liniecki and W. Karniewicz *In its* Nukloenika, Vol. VIII 1966 p 373–382 refs (See N67-16221 06-06) CFSTI: HC $3.00/MF $0.65

The concentrations of Sr-90 per gram of calcium in human bones in Poland over the period from 1960 through 1961 are presented. The peak value in 1960 occurred in bones of ab. 2.5 years old children and amounted to 3.3 pc/gCa. In 1961 the highest mean concentration of Sr-90—2.6 pc/gCa—was found in children ab. 1.5 years old. The concentration of Sr 90 per gram calcium in bones of adults did not vary with age above 30 years and mean values in vertebral bodies in 1960 and 1961 were respectively 1.00 and 1.16 pc/gCa. These values correspond to the average concentration in the skeleton of ab. 0.40 and 0.47 pc/gCa. Author

N67-16340# Naval Radiological Defense Lab., San Francisco, Calif.

EVALUATION OF RADIOPROTECTIVE ACTIVITY OR PROPERTIES OF SELECTED CHEMICAL COMPOUNDS IN LARGE ANIMALS Annual Progress Report, 1 Jul. 1965–1 Jul. 1966

L. J. Cole and E. L. Alpen 1 Jul. 1966 12 p refs

(USAMR&DC-6007; AD-642313) CFSTI: HC $3.00/MF $0.65

The objective of the research was to investigate and evaluate the radioprotective activity and properties of selected chemical compounds in large animals, and to gain insights into their mechanism of action. With respect to chemical radioprotection efforts were directed toward three general areas: (a) Studies on Compound WR-1607 in lethally X-irradiated dogs (beagles as well as mongrels) and the possibilities of combinations of other compounds with WR-1607; (b) The protective effect of small external lead cuffs, alone or in combination with chemicals, in dogs; and (c) Studies on chemical radio-protection in mice, employing hemopoietic colony-forming units (CFU) as the endpoint. Author (TAB)

N67-16341# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

THE EFFECT OF PRIOR EXPERIENCE ON ACQUIRING SKILL ON A SIMULATED INERTIAL CONTROL TASK

Richard Geiselhart Jul. 1966 33 p refs

(AMRL-TR-66-25; AD-641389) CFSTI: HC $3.00/MF $0.65

The performance of test pilots and college student subjects in acquiring the skill to control the attitude of a simulated space vehicle was compared. The purpose of the comparison was to investigate transfer of training to this type of task as a function of prior pilot experience and determine the degree to which one may generalize from students to pilots. There was also a further breakdown of the student group into experimental subgroups to assess the effects of type of control/display relationship and the order of part training on the acquisition of the vehicular control task. The secondary comparisons within the student group were to determine optima training conditions to make the comparison with the pilots as equitable as possible. The conclusions based on the results of the study were (1) there appear to be more positive transfer effects than negative in transitioning from flying aircraft to a simulated inertial control task; (2) the degree to which generalizations can be made from students to pilots depends on the amount of training given the students provided an optimal control/display relationship is used; (3) previously untrained subjects can achieve skill levels comparable to pilots on this type of task, but it takes more trials for the nonpilot to do so; (4) order of part training does not appear to be an important variable in training on this type of task. Author (TAB)

N67-16342# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

EFFECTIVE TECHNICAL COMMUNICATIONS MECHANICAL DESCRIPTION, EXPERIMENT III

Richard M. Davis 1966 91 p ref

(AFIT-TR-66-15; AD-641251) CFSTI: HC $3.00/MF $0.65

The effects of three variables on the effectiveness of a written technical communication were tested in a 3x2x2 factorial experiment. The subject matter was a description of a simple mechanism. The variables were (1) the manner in which the size and shape of the machine were presented (drawings alone, drawings with verbal description, verbal description alone), (2) introduction (present or absent), and (3) internal orienting material (present or absent). The effectiveness of the message was measured by (1) comprehension, (2) reading time, (3) the readers impression of the authors knowledge of the subject matter, and (4) the readers impression of the authors competence as a writer. The two audiences tested were (1) 186 very bright men with known technical interests who had been instructed in technical writing and (2) 112 very bright men with known technical interests who had not been instructed in technical writing. The twelve versions of the reading passage were assigned to the subjects in each audience on a random basis. Each subject read his passage, recorded his reading time, completed the comprehension test, and made the two judgments. TAB

N67-16345# Harvard Univ., Cambridge, Mass. Group Psychology Branch.

OPERANT ELECTRODERMAL CONDITIONING: SOME EFFECTS OF MULTIPLE SCHEDULES OF REINFORCEMENT

David Shapiro and Andrew Crider Nov. 1966 13 p refs

(Contract Nonr-1866(43))

(TR-14; AD-641699) CFSTI: HC $3.00/MF $0.65

The rate of emission of palmar skin potential responses in human subjects can be brought under the control of external stimuli correlated with different schedules of operant reinforcement. Successful discriminations are formed between reinforcement and nonreinforcement conditions, and differential rates of response are observed by alternating the scheduling of intermittent reinforcement. Author (TAB)

N67-16346# Brooke Army Medical Center, Ft. Sam Houston, Tex.

RESEARCH PROJECT: CHROMOSOMA (DAMAGE IN HUMANS PRODUCED BY X-IRRADIATION Annual Progress Report

Jose M. Louro [1966] 21 p refs

(AD-641505) CFSTI: HC $3.00/MF $0.65

The chromosomes of peripheral leucocytes in subjects exposed to more than 2500 R of x-irradiation were compared with those of normal, healthy individuals and several other subjects not exposed to x-irradiation. The results revealed that in the irradiated group there was a marked increase in aneuploidy, polyploidy, endoreduplication and structural chromosomal damage. Author (TAB)

N67-16348# Army Biological Labs., Fort Detrick, Md.
THE USE OF ACRIDINE ORANGE LUMINESCENCE FOR THE STUDY OF THE SECONDARY STRUCTURE OF NUCLEIC ACIDS
O. F. Borisova and L. A. Tumerman Jul. 1965 15 p refs Transl. into ENGLISH from Biofiz. (USSR), v. 10, no. 1, 1965, p 32-36
(TRANS-1483; TT-65-63435; AD-639797) CFSTI: HC $3.00/MF $0.65

Translation of Russian research: the use of acridine orange luminescence for the study of the secondary structure of nucleic acids. Author (TAB)

N67-16351# General Electric Co., Schenectady, N. Y. Research and Development Center.
DEVELOPMENT OF A REVERSIBLY FROSTIBLE TRANSPARENCY FOR A NUCLEAR FLASH EYE PROTECTION SHUTTER Final Report, Jun. 1965–Jul. 1966
C. D. Doyle and S. Aftergut Jul. 1966 63 p refs
(Contract AF-41(609)-2710)
AD-642732) CFSTI: HC$3.00/MF$0.65

The feasibility of a reversibly frostible window for flashblindness protection was investigated. Fluids were studied which frost when electrically charged by either corona or glow discharge. Optical and temporal performance was measured for several such fluids. Under the conditions employed, five frost layers in series were enough to bring about an increase in apparent density in the incident direction to the requisite level of 3. Several of the experimental fluids frosted within the requisite 150 microsec., but they did not do so consistently, primarily because of the capriciousness of the gaseous discharge method of injecting charges into a fluid surface. Eventual success of the frostible window concept hinges on the development of an efficient charging technique. Author (TAB)

N67-16358# System Development Corp., Santa Monica, Calif.
AN EXPLORATORY INVESTIGATION OF PROGRAMMER PERFORMANCE UNDER ON-LINE AND OFF-LINE CONDITIONS
E. E. Grant and H. Sackman 2 Sep. 1966 41 p refs
(Contract AF 19(628)-5166; ARPA Order no. 773)
(SP-2581; AD-640654) CFSTI: HC $3.00/MF $0.65

An experiment conducted at System Development Corporation compared the program debugging performance of programmers working under conditions of on-line and off-line access to a computer. This paper describes that experiment; it is the first known study measuring the performance of programmers under controlled conditions for a standard task. Two groups of six programmers each, comprising a total sample of 12 subjects, debugged two types of programs under on-line and off-line conditions in accordance with a Latin-Square experimental design. The on-line condition was the normal mode of operation for the SDC Time-Sharing System; the off-line condition was a simulated closed-shop with a two-hour turn around time. Statistically significant results indicated faster debugging under on-line conditions. Perhaps the most important practical finding of this study, overshadowing on-line/off-line differences, concerned the large and striking individual differences in programmer performance. Attempts are made to relate observed individual differences to objective measures of programmer experience and proficiency through factorial techniques. In line with the exploratory objectives of this study, methodological problems encountered in designing an conducting this type of experiment are described, limitations of the findings are pointed out, hypotheses are presented to account for the results and suggestions are made for further research. Author (TAB)

N67-16360# School of Aerospace Medicine, Brooks AFB, Tex.
THRESHOLD DISTANCES FOR RETINAL BURNS FROM LOW-YIELD NUCLEAR DETONATIONS
Everett O. Richey Jul. 1966 16 p refs
(SAM-TR-66-49; AD-641188) CFSTI: HC $3.00/MF $0.65

A method is given for predicting the threshold distances at which minimal retinal burns will be produced by nuclear detonations. This method relates calculated retinal exposure to experimentally determined burn threshold data. Predicted threshold distances are determined for the human eye exposed to sea-level, air-burst detonations from 0.01 to 10 kt. yield. The pupil diameter of the human eye is taken to be 2.5 mm. and 6.0 mm., respectively, for day and night conditions, and the effective focal length of the eye is taken to be 17 mm. The threshold distance for a bright daylight exposure with clear air (80 km.) visibility varies from about 1.3 to 11 km. as the detonation yield varies from 0.01 to 10 kt. Comparable distances for night exposures vary from 3.8 to 26 km. Calculations indicate that the use of a fixed filter with 2% transmission will result in retinal exposures more than an order of magnitude below the threshold exposure for these small daylight detonations. For nighttime conditions the retinal exposure is a factor of about 2.5 below the threshold exposure. Author (TAB)

N67-16361# Human Engineering Labs., Aberdeen Proving Ground, Md.
GROUP BEHAVIOR IN CONFINEMENT: REVIEW AND ANNOTATED BIBLIOGRAPHY
Alfreda B. Honigfeld Oct. 1965 116 p refs
(TM-14-65; AD-640161) CFSTI: HC$3.00/MF $0.65

Field and laboratory confinement studies were reviewed to evaluate existing information and to identify areas where future research is needed. The studies reviewed deal with confining two or more people in a restricted space for a prolonged period of time: particular attention was devoted to how such conditions degrade performance. Few of the studies bear on the Armys chief interest in confinement: how men will perform during and after prolonged confinement in armored vehicles. The review concludes by recommending ways to make future studies of confinement more directly relevant to the Army's interest. Author (TAB)

N67-16365# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
WATER RECOVERY FROM HUMAN WASTE DURING PROLONGED CONFINEMENT IN THE LIFE SUPPORT SYSTEM EVALUATOR Technical Report, Jul. 1964–Jun. 1965
Courtney A. Metzger, Albert B. Hearld, and Bobby G. McMullen Apr. 1966 33 p refs
(AMRL-TR-65-170; AD-642053) CFSTI: HC$3.00/MF$0.65

The recovery of water from urine and/or atmospheric condensate was carried out. Each experiment included the confinement of 4 subjects inside the aerospace medical research laboratories life support systems evaluator for a period of 4 weeks. The reclamation equipment included a thermoelectric distillation device, an electro dialysis unit and a dehumidification system. The water recovered was analyzed to determine its suitability for human consumption. Author (TAB)

N67-16408# TRW Equipment Labs., Cleveland, Ohio.
WATER AND CARBON REMOVAL FROM CARBON DIOXIDE REDUCTION SYSTEMS Final Report, Apr. 1965–Mar. 1966
Andrew D. Babinsky, and Stephen J. Derezinski Wright-Patterson AFB, Ohio, AMRL, Jun. 1966 53 p refs
(Contract AF 33(615)-2298)
(ER-6652-5; AMRL-TR-66-83; AD-642594) CFSTI: HC $3.00/MF $0.65

Methods suitable for use in a weightless environment for removing water and carbon from carbon dioxide reduction process systems were investigated. Water removal studies were conducted using a porous metal, plate-type, condenser-separator to remove

the water from the exit gas streams of both Sabatier and Bosch type carbon dioxide reduction reactors. Water remaining in the effluent stream ranged from 0.97 to 2.08 percent by volume with the Sabatier reactor, and 0.78 to 0.92 percent with the Bosch reactor. A regenerative chemical dryer used to increase the reaction rate of the Bosch reactor, resulted in relatively minor changes in the reaction rate in steady state operation. Carbon flow pattern tests were conducted to determine design characteristics of a carbon separator-filter. A combination centrifugal separator and porous metal filter was used to remove carbon from the recycle flow stream and pass approximately 99 percent of the carbon to the carbon collector. Periodic back flow through the filter removes the remaining carbon from the filter. The Bosch reactor utilizes flat iron catalyst plates stacked on a hollow rotating shaft. Carbon is dislodged from the rotating plates by carbon removal fingers projecting between the catalyst plates. Reaction gases flowing through the reactor carry the carbon out of the reactor to the filter-separator. Author (TAB)

N67-16417# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.

VIRAL ANTIBODY PRODUCTION IN ANIMALS EXPOSED TO A SPACE CABIN ENVIRONMENT Progress Report, Jul.–Sep. 1965

David J. Giron and Jerome P. Schmidt Sep. 1966 11 p refs
(SAM-TR-66-82; AD-641566) CFSTI: HC $3.00/MF $0.65

Synthesis of antibody against vaccinia virus was investigated in rabbits exposed to a simulated space cabin environment. The atmospheric pressure in the cabin was equivalent to an altitude of 18,000 feet; the partial pressure of oxygen was approximately that of sea level. The animals were acclimatized for 7 days and then immunized with a series of injections of purified vaccinia virus over a period of 5 weeks. Control animals remained at ground level and received identical injections from the same virus pool. Specific antibody produced by each group was tested for its neutralization titer and distribution of specific activity in fractions separated by column chromatography and sucrose gradients. No qualitative or quantitative differences in antibody produced were noted. Author (TAB)

N67-16424# Naval Submarine Medical Center, Groton, Conn.

THE EFFECT OF FREQUENCY PASSBAND UPON THE INTELLIGIBILITY OF HELIUM-SPEECH IN NOISE Interim Report

Russell L. Sergeant 17 Aug. 1966 13 p refs
(Rept.-480; AD-641960) CFSTI: HC $3.00/MF $0.65

Speech spoken after breathing a mixture of helium and oxygen (80%--20%) was combined with white noise and then passed through a variety of bandpass filters. Intelligibility was determined on 16 different groups of 20 listeners each. While intelligibility did not suffer appreciably when frequencies of 300 cs and below were eliminated, the loss of frequencies below 600 cs caused a marked deterioration. Even with severe filtering restrictions of a 600-1200 cs bandpass and a 1-db Speech/Noise ratio, 38% intelligibility was achieved. This indicates that the intelligibility of speech in a helium mixture, as in air, is quite distortion-resistant. The frequency at which high- and low-pass filtering will have equal effects on intelligibility appears to be lower than 1000, in contrast to approximately 1600 cs for speech in air. Reasons for this downward shift are not known. No condition of filtering helium-speech in noise increased its intelligibility. Author (TAB)

N67-16430# Columbia Univ., New York. Teachers Coll.

TECHNIQUES OF INDUCING COOPERATION BETWEEN ADVERSARIES Annual Status Report

Morton Deutsch Oct. 1966 15 p
(Contract Nonr-4294(00))
(AD-642423) CFSTI: HC $3.00/MF $0.65

Summaries are presented of the following studies: Use of Role-Reversal in Intergroup Competition; Further Research with the Prisoners Dilemma; Strategies of Inducing Cooperation; The International Card game study; Compliance to Threats Directed Against Self and Against an Innocent Third Person. TAB

N67-16434# Centre d'Enseignement et de Recherches des Industries Alimentaires et Chimiques, Brussels (Belgium).

REGULATION OF RNA SYNTHESIS Final Scientific Report

R. Lavalle 30 Sep. 1966 21 p ref
(Grant AF-EOAR-65-16)
(AFOSR-66-2650; AD-642385) CFSTI: HC $3.00/MF $0.65

Measurements of rRNA and tRNA content of E.Coli Ki2 cells have been made in the following situations: (a) exponential growth in media giving rise to different growth rates; (b) shift up from mineral to rich (in amino acids) medium; (c) starvation of a relaxed mutant; (d) chloramphenicol treatment; (e) shift down from rich to mineral medium. The conclusions are that (1) the stringent control, which acts during an amino acid starvation, works on both rRNA and tRNA; and (2) the control mechanism involved in the regulation of RNA content versus chemical environment works differentially on both species. A mutant with a peculiar behavior during a shift up experiment is described, and a new relaxed mutation is described. Author (TAB)

N67-16438# Army Biological Labs., Fort Detrick, Md.

EFFECT OF PLAGUE TOXIN ON BLOOD PROTEINS AND INCORPORATION OF METHIONINE-S^{35} INTO TISSUE PROTEINS

I. V. Domaradskiy, I. M. Klimova, and A. A. Tokareva Dec. 1965 13 p refs Transl. into ENGLISH from Vopr. Med. Khim (Moscow), v. 7, Nov.–Dec. 1961 p 614–619
(TRANS-1712; TT-66-62550; AD-641427) CFSTI: HC $3.00/MF $0.65

In white mice plague microbe toxin disrupts the ratio between the protein fractions of the blood serum. There is a decrease in the content of albumins and an increase in the concentration of globulins. However, it is difficult to say due to which fraction of globulins the lowering of the albumin-globulin coefficient takes place. The stated changes have a stable nature and are detected in surviving animals even after 3 days following the administration of toxin to them. During plague intoxication the total amount of protein is not changed. The influence of the toxin on the blood serum proteins of guinea pigs is doubtful. Plague intoxication changes the rate of incorporation of Methionine-S35 into the blood proteins of white mice and does not influence the rate of incorporation of methionine-S35 into the blood proteins of guinea pigs and the tissue proteins of both species of animals. Author (TAB)

N67-16451# Technology, Inc., San Antonio, Tex.

RESEARCH TOWARD THE DEVELOPMENT OF EYE EFFECTS SAFE SEPARATION CHARTS Final Report, 31 May 1965–31 May 1966

Arthur F. Muller and Patrick W. Wilson, Jr. Brooks AFB, Tex., Aerospace Med. Div., Jul. 1966 89 p refs
(Contract AF 41(609)-2437)
(AD-641191) CFSTI: HC $3.00/MF $0.65

The purpose of this report is to make known the research methods, results, and conclusions involved in a study which was to develop eye safe separation distances from nuclear detonations in terms of yield, altitude, slant range, etc. Under the precept that retinal temperature is the most significant factor in ocular damage, a mathematical model for the prediction of retinal temperature is outlined. Theoretical and empirical fireball source data are input separately to the model in an effort to determine the applicability of the theoretical data by comparing calculated retinal temperature rise. The results of the comparisons are favorable. However, it is concluded that, presently, the model retinal temperature predictions must be used with reservation. Author (TAB)

N67-16475# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
A CIRCADIAN TEMPERATURE RHYTHM IN THE RHESUS MONKEY
Joseph W. Ternes and Donald W. Farrer Nov. 1966 21 p refs
(ARL-TR-66-21; AD-643328) CFSTI: HC $3.00/MF $0.65

A rhesus monkey was restrained and kept isolated from normal laboratory distractions for 4 months. Environmental and subcutaneous temperatures were recorded every 15 minutes throughout this time. A circadian rhythm of subcutaneous temperature, whose frequency was synchronized to the 24 hour light–dark cycle, was demonstrated. The effects of constant illumination and of different feeding times were also studied. It was found that the subcutaneous temperature rhythm can be maintained under constant illumination and also that the shape of the daily curve, for this rhythm, can be effectively modified by manipulating feeding time. Author (TAB)

N67-16481# Illinois Univ., Urbana. Coordinated Science Lab.
A PARADIGM FOR THE INVESTIGATION OF ANTECEDENT PROCESSES IN CONCEPT ATTAINMENT
Steven Henry Schwartz Sep. 1966 102 p refs
(Contracts DA-28-043-AMC-00073(E); Nonr-3985(08); Grant NIH G-MH-06836)
(R-321; AD-641117) CFSTI: HC $3.00/MF $0.65

The purposes of the study were: (1) To examine the utility of the proposed schema for investigating behavior in concept attainment tasks by: (a) Determining the strength of the theoretical hypotheses relating the five stipulated constructs (magnitude, and scope of relations over conditions). (b) Determining the locus of effect of various independent variables (known to affect terminal performance) on the above response variables encompassed by the theoretical hypotheses. (c) Determining the locus of effect of numerous subject-determined variables (such as content--total population of instances, and sequence--order in which instances are tested) on the response variables encompassed by the theoretical hypotheses. (d) Determining the temporal and sequential orderings in behavior involving these constructs prior to attainment of the concept. (2) To explore other interesting relations manifest in the data that have not as yet been incorporated within a formal theory. (3) To compare the theory with other models at points where there exist common terms. Author (TAB)

N67-16484# Mitre Corp., Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. PART XV: RELATIVE LEGIBILITY OF LEROY AND TELETYPEWRITER SYMBOLS
Glennis L. Bell Bedford, Mass., AFSC, Electron. Systems Div., Sep. 1966 80 p refs
(Contract AF 19(628)-5165)
(MTR-265; ESD-TR-66-316; AD-641926) CFSTI: HC $3.00/MF $0.65

The first two studies are reported from a planned series of studies to obtain legibility data on teletyped hourly sequence weather reports. In the first study, subjects were asked to identify symbols, shown singly in a random order with the symbols occurring with equal frequencies. The two teletype fonts, Murray and Long Gothic, were compared with a standard Leroy font. The second study used the teletype fonts only, and the subjects identified symbols shown with symbol frequencies similar to those in typical hourly sequence reports. For these experimental conditions, the teletype fonts were not as legible as the standard Leroy font although the symbol frequencies found in typical hourly sequence reports improved the subjects reading performances. Author (TAB)

N67-16503*# Hazleton Labs., Falls Church, Va.
A STUDY TOWARD DEVELOPMENT OF AN AUTOMATED MICROBIAL METABOLISM LABORATORY Monthly Progress Report
Earl Usdin and George R. Perez 1 Nov. 1966 53 p refs
(Contract NASw-1507)
(NASA-CR-81263; MPR-1) CFSTI: HC $3.00/MF $0.65 CSCL 06M

Development of life detection systems based on phosphate uptake and sulfur uptake is discussed together with an examination of some of the engineering problems associated with instrumentation of these experiments. These life detection systems will consist of the following metabolic experiments: metabolism of radioactive substrates, heterotrophic photosynthesis, autotrophic photosynthesis ATP production, phosphate uptake, and sulfate uptake. Conventional phosphate assays were studied as well as an assay that measures phosphate levels in terms of counts derived from ^{14}C-labeled triethylamine. In the former case, sensitivities down to 3 μ/L of phosphate-P were observed. The ultimate sensitivity has not yet been determined for the radioisotropic assay. The engineering effort was concerned with designing liquid processing systems, studying the proposed single read-out system, and tentatively investigating photomultiplier tube selection. S.P.

N67-16545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EXPERIMENT TO DETECT MICROORGANISMS IN THE UPPER ATMOSPHERE FLOWN ON AEROBEE NASA 4.150
Grace Lee Picciolo, E. M. Powers, and E. Rich, Jr. Dec. 1966 29 p refs
(NASA-TM-X-55642; X-624-66-359) CFSTI: HC $3.00/MF $0.65 CSCL 06C

A cosmic dust collector was modified to collect microorganisms from the atmosphere. Detection was performed on samples from the recovered collector by classical growth methods and by the firefly luciferase assay for adenosine triphosphate. These methods showed no statistically significant results to indicate the presence of microorganisms. Microbiological tests were run to determine best methods of organism removal, recovery, and assay. Sterility effectiveness was determined on the collector, the sampling film, and on procedures for removal and assay. Data are given on flight conditions, preliminary tests, assay, and sample volume. Author

N67-16554*# National Aeronautics and Space Administraton, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY–A CONTINUING BIBLIOGRAPHY WITH INDEXES, NOVEMBER 1966
Dec. 1966 153 p refs
(NASA-SP-7011(31)) CFSTI: HC $3.00/MF $0.65 CSCL 06S

The bibliography with abstracts concentrates on the biological, physiological, psychological, and environmental effects on man during simulated or actual space flight. Similar effects on lower order organisms, and the related topics of sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors are also included. Emphasis is on applied research. N.E.N.

N67-16579*# *Aeronutronic, Newport Beach, Calif.*
STUDY OF THE AUTOMATED BIOLOGICAL LABORATORY PROJECT DEFINITION. VOLUME V: EXOBIOLOGY BIBLIOGRAPHY
Temple W. Neumann 10 Sep. 1965 158 p refs
(Contract NASw-1065)
(NASA-CR-81311; U-3237, Vol. V) CFSTI: HC $3.00/MF $0.65 CSCL 06C

An annotated bibliography dealing with various aspects of the problem of detecting extraterrestrial life is presented. The material is to be used with respect to the automated biological laboratory (ABL) program for exploring life on Mars. The bibliography is divided up into the following sections: (1) general analytical methods, (2) automatic techniques, (3) calorimetry, (4) carbon analysis, (5) chromatography, (6) computer applications, (7) fluorescence studies, (8) gas analysis, (9) instruments and devices, (10) life, (11) macromolecule studies, (12) Mars, (13) mass spectrometry, (14) microbiological studies, (15) optical rotation studies, (16) soil constituent analysis, (17) space probes, (18) spectrometry, and (19) synthesis of organic compounds. The references cited are mainly compiled from September 1964 to April 1965, and the majority of abstracts are those of the authors themselves. An author index is included. L.S.

N67-16580*# Aeronutronic, Newport Beach, Calif.
STUDY OF THE AUTOMATED BIOLOGICAL LABORATORY PROJECT DEFINITION. VOLUME VI: TECHNICAL APPENDICES. PART 1 Final Report, 10 Aug. 1964–10 Aug. 1965
Temple W. Neumann 10 Sep. 1965 382 p refs
(Contract NASw-1065)
(NASA-CR-81308; U-3237) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Detailed technological reference material pertinent to the scientific payload definition and system engineering studies conducted for the automated biological laboratory (ABL) project, are given. A summary analysis of the interviews through which much of the information on scientific payload objectives was obtained is presented. Procedures for the 35 biological and environmental experiments selected, are given. Also described, are various analyses performed on detailed aspects of instruments used in the study. L.S.

N67-16608*# Northrop Space Labs., Hawthorne, Calif.
INVESTIGATION OF PEROGNATHUS AS AN EXPERIMENTAL ORGANISM FOR RESEARCH IN SPACE BIOLOGY Summary Progress Report, 1 Jan–31 Dec. 1966
R. G. Lindberg 31 Dec. 1966 100 p refs
(Contract NASw-812)
(NASA-CR-81351; NSL-64-29-13) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Progress is reported in studies of the temperature regulation in the pocket mouse *Perognathus longimembris*. Abdominal, colonic, and subcutaneous body temperatures were measured in mice exposed to various ambient temperatures. Thermal conductance, physical insulation, and metabolic rate were measured in normothermic, torpid, and dead animals. The mice showed good thermoregulation when not torpid. Mice acclimatized to 22°–24°C showed resistance to change in body temperature when exposed to cold, heat, and continuously changing ambient temperatures. The core-to-subcutaneous temperature gradient varied with ambient temperature in a definite pattern that suggests four zones of regulation. It was found that mice entering and arousing from torpor go through several phases of temperature change. Resting metabolism was 0.53 and conductance was 0.78 of certain mammalian standards, which is consistent with a body temperature reduced below 37°C. C.T.C.

N67-16610*# National Academy of Sciences—National Research Council, Washington, D. C.
XVI INTERNATIONAL CONGRESS OF ZOOLOGY. VOLUME 5: AN ACCOUNT OF THE CONGRESS
John A. Moore, ed. 1964 175 p refs Proc. held in Washington, D. C., 20–27 Aug. 1963
(Grant NsG-364)
(NASA-CR-81349) CFSTI: HC $3.00/MF $0.65 CSCL 06C

An account of the organization, planning, and proceedings of the zoological congress is provided. Reports are included from the various planning committees such as finance, science theater, projection, excursions, public information, biological program, and zoological nomenclature. A list of congress members, suggestions for the preparation of lantern slides, and five additional abstracts of contributed papers are also given. A.G.O.

N67-16613*# Martin Co., Baltimore, Md. BIAS Div.
RESEARCH IN PHOTOSYNTHESIS Quarterly Report, Jun. 6–Sep. 6, 1966
Bessel Kok 6 Sep. 1966 38 p
(Contract NASw-747)
(NASA-CR-81345; QR-13) CFSTI: HC $3.00/MF $0.65 CSCL 06C

Emphasis was placed on the kinetics of the various reactions of dichlorophenol indophenol in illuminated chloroplasts. Experimental work on fluorescence emission included the design and operation of a multi-flash technique which allowed a direct measurement of the ratio of the pool sizes of the primary and secondary reductants of photosystem II. The number obtained agreed quite well with earlier indirect measurements and indicated a ratio of 1–20. New lines of research have been initiated; these concerned the conformational changes occurring in chloroplast particles upon illumination, chemiluminescence, and the possible role of cytochrome b. Author

N67-16643# Aerospace Medical Div. Personnel Research Lab. (6570th), Lackland AFB, Tex.
EVALUATION OF AIRMAN JOBS BY FOUR CATAGORIES OF RATERS
Joe T. Hazel and Douglas K. Cowan Jun. 1966 33 p refs
(PRL-TR-66-3; AD-640567) CFSTI: HC $3.00/MF $0.65

To investigate differences between rater groups in their evaluation of airman jobs, four groups of raters each evaluated a sample of 200 airman job descriptions. The groups consisted of senior NCOs, lieutenants, captains, and field grade officers. The jobs were evaluated in terms of merited grade, merited pay, and the relative importance of five job requirement factors. Within groups each job was evaluated by five raters and across all groups by 20 raters. The raters also indicated their confidence in the grade level ratings they made. The analyses used to compare the four groups were concerned with differences in means, distribution variability, and reliability of ratings and the predictive efficiency of the five job requirement factors. These analyses revealed two statistically significant ($P > .01$) differences among groups. The mean of the field grade officers expressed greater confidence in their assigned grade ratings than the other groups. However, the NCO difference seemed of little practical consequence, and there was agreement among the groups with regard to the reliability and homogeneity of assigned ratings, and the level of predictive efficiency of the five job requirement factors. The present findings support the use of a composite groups of raters to evaluate airman jobs. Author (TAB)

N67-16648# Union Carbide Corp., Tonawanda, N. Y. Linde Div.
MECHANISMS OF FREEZING INJURY TO BIOLOGICAL SYSTEMS Final Report
G. F. Doebbler 30 Sep. 1966 94 p refs
(Contract Nonr-4788(00))
(AD-640995) CFSTI: HC $3.00/MF $0.65

Biophysical and biochemical studies were conducted on red cells, liver mitochondria, and various proteins to determine

the mechanisms of freezing injury to biological systems. The working hypothesis formulated was that freezing resulted in molecular level dehydration leading to changes in proteins in terms of contractile behavior, enzymatic activity, interactions with water, and molecular size or shape. In general the evidence obtained, especially with proteins, and in particular by measurements of desorption-adsorption iso therms for water and gel chromatography showed no freeze related changes. Serum lipoproteins and frozen red cell membranes showed irreversibility in desorption-adsorption of water. Rat liver mitochondria were unaltered in contractile behavior by a variety of freezing conditions, some known to markedly alter function and permeability. Red cells (RBC) sustained cation composition changes (K decrease; Na increase) and ATPase activity increase when subjected to dehydration (without ice or increased salt exposure) which resembled that found with freezing. Kinetics of salt injury to RBCs and the dependence on temperature was found inconsistent with salt as the only agent of freezing injury. Author (TAB)

N67-16650# Lund Univ. (Sweden). Dept. of Histology.
CHOLINESTERASES IN OCULAR AND ORBITAL TISSUES OF SOME MAMMALS
Berndt Ehinger 1966 18 p refs Presented at the Royal Physiographic Soc., 2 Dec. 1965 *Its* Section II, No. 2
(Grants AF-EOAR-14-66; PHS-NB-0536-02; B66-320)
(AFOSR-66-2072; AD-643148)

Cholinesterase-containing nerves in occular and orbital tissues from rats, rabbits, and guinea-pigs were studied. In the corneal stroma, there occurred nerve bundles which contained mainly acetylcholines-terase (ache). In the corneal epithelium, fine fibres containing ache were also found. Ache-containing fibres further reached the sphincter pupillae and the dilator muscle in all species. In the chamber angle, the guinea-pig displayed many fibres containing nonspecific cholinesterase (che) only, whereas few fibres containing either ache and che were found in the chamber angle of the rat or rabbit. Ache-containing fibres occurred in the ciliary muscle of all species. Such fibres were also found in the connective tissue at the limbus, in the iris and in the chorioid. The structure innervated by these fibres is unknown. In the retina, ache was found in the inner plexiform layer, and also in the ganglion cell layer of the rat. In the smooth muscles of the orbit and the eyelid, ache-containing fibres occurred, but they are considerably fewer than the adrenergic fibres. Che-containing fibres occurred to almost the same extent as do the adrenergic fibres in this muscle. Author (TAB)

N67-16653# Northwestern Univ., Evanston, Ill. Auditory Research Lab.
MONAURAL VERSUS BINAURAL DISCRIMINATION FOR FILTERED CNC MATERIALS, THE IMPAIRED AUDITORY MECHANISM, 1 May 1963–15 Dec. 1964
Tom W. Tillman, Paul C. Bucy, and Raymond Carhart Brooks AFB, Tex., School of Aerospace Med., Jul. 1966 26 p refs
(Contract AF 41(609)-2643)
(SAM-TR-66-64; AD-639639) CFSTI: HC $3.00/MF $0.65

Northwestern University Auditory Test No. 4 was altered by: (1) low-pass filtering with a 1480 cps cutoff frequency and a 54 dB per octave slope; and (2) high-pass filtering utilizing an 1830 cps cutoff frequency and a 36 dB per octave slope. By using these filtered materials, a single binaural and two monaural articulation functions were derived for each of 60 subjects with peripheral hearing losses and 7 subjects with unilateral CNS lesions judged to involve the auditory system. In the monaural conditions each subject received either the high-pass or low-pass filtered signal. In the binaural condition the two messages were presented simultaneously, one to each ear. The experimental hypothesis predicted that for the subjects with peripheral impairments, the slope of the binaural function would exceed that of the steeper monaural one. Conversely, it predicted that for the subjects with unilateral central involvement, the binaural function would not differ in slope from the monaural functions. Results only partially confirmed this hypothesis. For both groups, the slope of the binaural function exceeded that of the steeper monaural function; however, the slope of the binaural function for the peripheral lesion group exceeded that of the CNS lesion group. Since the hearing acuity of the latter group was within normal limits, this finding indicates that in unilateral central auditory lesions, the binaural processing of speech signals is incomplete. Author (TAB)

N67-16654# American Inst. for Research, Pittsburgh, Pa.
A REINFORCEMENT ANALYSIS OF GROUP PERFORMANCE
Robert Glaser, and David J. Klaus 1966 25 p refs *Its* Psych. Mon., General and Applied no. 621, v. 80, no. 13
(Contract Nonr-2551(00))
(AD-640624) Available from Am. Psychological Assoc., Inc., Washington, D. C.: $1.00

Two studies investigated response feedback and reinforcement contingencies occurring in a 'team environment.' Study I investigated 3-man series teams under conditions of response acquisition, extinction, spontaneous recovery, reacquisition and reextinction. Feedback to team members was based solely on group output. The results suggest team performance can be manipulated using methods which effectively control the behavior of individual organisms. Study II investigated 3-min parallel teams in which a reinforced team response could occur as a function of correct responding by only part of the team. With continued reinforced practice, performance degraded to a level equal to or below initial team performances. These findings are analyzed in terms of an operant conditioning model of team performance. Author (TAB)

N67-16660# Tufts Univ., Medford, Mass. Inst. for Psychological Research.
HUMAN FACTORS ENGINEERING BIBLIOGRAPHIC SERIES. VOLUME I: 1940–1950 LITERATURE
Paul G. Ronco Aberdeen Proving Ground, Md., Human Eng. Labs., May 1966 1642 p refs
(Contracts Nonr-494(13); DA-18-001-AMC-1004(X))
(AD-639906) CFSTI: HC $3.00/MF $0.65

The bibliography is the first in a planned series of bibliographies of literature pertinent to the field of human factors engineering. It covers literature from the time period of 1940 through 1959. The bibliography consists primarily of: (1) an index to the human factors literature, and (2) the annotated bibliography. Author (TAB)

N67-16661*# Stanford Research Inst., Menlo Park, Calif.
TACTUAL PERCEPTION: EXPERIMENTS AND MODELS
James C. Bliss, Hewitt D. Crane, Stephen W. Link, Phyllis K. Mansfield, James T. Townsend et al Washington, NASA, Jan. 1967 197 p refs
(Contracts NAS2-2752; AF 33(615)-1099)
(NASA-CR-623) CFSTI: HC $3.00/MF 0.65 CSCL 05H

Summarized are results from five different studies on tactual perception, involving airjet stimulators and a computer-controlled facility. Reported are experiments on the effect of display movement on tactile perception; temporal effects in spatial pattern recognition; spatial interaction and memory limitations; reaction time; and tracking with transient and continuous commands. Speculation is made concerning the usefulness of the basic research described in the development of new uses of the tactile channel. S.C.W.

IAA ENTRIES

A67-16276 *
AN OBJECTIVE APPROACH TO THE ANALYSIS OF TILT TABLE DATA.
Fred B. Vogt (Texas Institute for Rehabilitation and Research, Texas Medical Center, Houston, Tex.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1195-1204. 34 refs.
National Institutes of Health Grant No. FR-00254; Contract No. NAS 9-1461.

An objective approach for the analysis of data from tilt table studies is presented. Utilization of minute-by-minute measurements of heart rate and blood pressure during a tilt table procedure forms the basis for definition of measurements and derived values which represent an expression of the tilt response of an individual. The analytic technique utilizes computers to provide graphic displays, tabular displays, and statistical analyses. This analytic approach is an attempt to provide a valid method to define the characteristics of cardiovascular deconditioning resulting from bedrest, water immersion, and space flight. Such objective and statistical expressions of the characteristics of tilt table data provide a means to define the degree of deconditioning for a given test circumstance and allow comparison of various tilt data with control data on the same subjects. (Author)

A67-16277 *
BIOCHEMICAL CHANGES OCCURRING WITH ADAPTATION TO ACCELERATIVE FORCES DURING ROTATION.
James K. Colehour and Ashton Graybiel (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Pensacola, Fla.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1205-1207. 9 refs.
NASA-sponsored research.

The effects of periodically increasing rotational velocity were studied in four young naval officers in the Pensacola Slow Rotation Room. Stress effects originating in the vestibular region as the result of Coriolis forces produced adrenalcortical response, nausea, and mild hyperventilation. Adaptation was virtually complete after two days of rotation at 6.4 rpm, and no further stress effects from rotational forces could be measured although the velocity was increased incrementally each day to 10.0 rpm and then similarly decreased to 3.0 rpm. After adaptation the effects of continued inactivity were measured as decreased excretion of norepinephrine and mild degrees of hypercapnia and hypercalciuria. (Author)

A67-16278 *
DEVELOPMENT AND EVALUATION OF AN IMPEDANCE CARDIAC OUTPUT SYSTEM.
W. G. Kubicek, J. N. Karnegis, R. P. Patterson, D. A. Witsoe (Minnesota, University, Medical School, Minneapolis, Minn.), and R. H. Mattson (Arizona, University, Dept. of Electrical Engineering, Tucson, Ariz.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1208-1212. 8 refs.
VRA Grant No. RT-2; Contract No. NAS 9-4500.

A four-electrode impedance plethysmographic system was developed which apparently monitors right heart ventricular output. Two band electrodes were placed around the subject's neck, a third band around the thorax at the level of the xiphisternal joint, and the fourth around the abdomen. The upper neck electrode and abdomen electrode were excited by a 100-kHz constant sinusoidal current and the resultant voltage (impedance) changes occurring with the cardiac cycle were monitored from the inner two electrodes. Stroke volume was calculated from the impedance change information using a formula relating impedance changes to volume changes in a conducting solid. A comparison study with simultaneous impedance and dye dilution measurements under rest and exercise conditions was carried out on 10 healthy young adult males. Preliminary results indicate that the impedance method predicts relative changes (ratios) in cardiac output with an accuracy of ±16% with 95% confidence. (Author)

A67-16280
EFFECTS OF SUBGRAVITY TRACTION SIMULATION ON THE ENERGY COSTS OF WALKING.
E. C. Wortz and E. J. Prescott (Garrett Corp., AiResearch Manufacturing Co., Los Angeles, Calif.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1217-1222. 7 refs.

A series of experiments was conducted to determine the effects of subgravity traction on metabolic rates during walking on a treadmill. The simulated subgravity tractions were 1/4, 1/6, and 1/8 g on each of two simulators. Systematic reduction in the energy cost of walking was observed with simulated reduction in subject weight and traction. The change in energy expenditure for simulated 1/6 g was found to be a 32% reduction for a 2-mph walk and a 56% reduction for a 4-mph walk for subjects wearing street clothing. A three-dimensional analysis of variance performed on the data revealed a significant interaction effect between the level of traction simulated and the amount of work performed which suggests that the validity of extrapolation of metabolic rate data will be heavily influenced by the adequacy of simulation. (Author)

A67-16281
POTENTIAL MICROBIC SHOCK IN MANNED AEROSPACE SYSTEMS
T. D. Luckey (Missouri, University, Medical School, Dept. of Biochemistry, Columbia, Mo.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1223-1228. 35 refs.

Discussion of postulates on microbial hazards, other than usual infections, of astronauts in prolonged isolation, based on studies with animals with locked flora. In animals, such isolation produces a dramatic decrease in the number of species in the gastrointestinal tract; many organisms, usually considered to be indigenous, disappear. Anticipated morphologic changes include decreased weight of lymph nodes, liver, and intestinal wall and low white-cell count in blood, and decreased plasma cells in tissues. Chemical changes expected would be soft stools, odor changes reflecting the dominant microorganisms, decreased liver enzymes for detoxication, decreased complexity of metabolic products from intestinal putrefaction, and decreased synthesis of B-vitamins and vitamin K. The accumulative deficits might be lethal on return to a microbe-dominated earth. These problems will be intensified for "astro-babies" and subsequent generations either in transit or in colonies of a microbe-hostile planet. These problems may be resolved by oral inoculation to maintain or to reactivate defense mechanisms. M. M.

A67-16282 *
CARDIAC EXCITABILITY IN HIGH MAGNETIC FIELDS.
Vernon R. Reno and Dietrich E. Beischer (U.S. Naval Aviation Medical Center, Aerospace Medical Institute, Pensacola, Fla.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1229-1232. 8 refs.
NASA-sponsored research.

Experimental investigation in which perfused and nonperfused hearts isolated from the turtle Pseudemys scripta were exposed to magnetic fields ranging from 3.4 to 15.6 koersteds and having gradients not exceeding 25 oersteds/cm. Electrograms were taken before, during, and after exposure by means of bipolar needle and contiguous, bipolar surface electrodes from the ventricular myocardium and epicardium, respectively. Simultaneous and separate myograms of isotonic and isometric contractions were recorded either mechanically or electrically. Changes in mechanical activity suggestive of varying degrees of tetanus followed the appearance of and were directly related to the frequency of peaks in electrical potential indicative of depolarization. Both the electrical and mechanical manifestations exhibited temporal latency with respect to th onset and cessation of the field. These changes are believed to be due to alterations of ion transport mechanisms at the membrane level. M. M.

A67-16283
INDEPENDENCE OF CHANGES IN FUNCTIONAL AND PERFORMANCE CAPACITIES ATTENDING PROLONGED BED REST.
G. A. Chase, C. Grave (Boeing Co., Aerospace Group, Space Div.; Washington, University, Dept. of Medicine, Seattle, Wash.), and L. B. Rowell (Washington, University, Dept. of Medicine, Seattle, Wash.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1232-1238. 37 refs.

Eighteen young men were studied before and after 15 and 30 days bed rest to examine the effects of absolute bed rest and recumbent exercise during bed rest on the pulse rate response to submaximal work, cardiovascular functional capacity (max $\dot{V}_{O_2}$), physical work capacity, and orthostatic tolerance. Changes in the submaximal pulse rate as a result of the conditions of this study did not predict the trend in either work capacity or max $\dot{V}_{O_2}$, whereas changes in work capacity occurred independently of changes in max $\dot{V}_{O_2}$ and vice versa. The highest $\dot{V}_{O_2}$ attainable during exercise to exhaustion on a bicycle ergometer underestimated max $\dot{V}_{O_2}$ 4 to 23%. When recumbent exercise was carried out during bed rest, the difference in the highest $\dot{V}_{O_2}$ attainable on a bicycle ergometer and the max $\dot{V}_{O_2}$ was decreased after bed rest by an increment in $\dot{V}_{O_2}$ during the bicycle test. Unless max $\dot{V}_{O_2}$ was increased during bed rest, subjects had decreased adaptability to posture afterward. (Author)

A67-16285 #

LONG-TERM EFFECTS OF AN OXYGEN ENVIRONMENT ON A RAT COLONY AT 210 mm. Hg ABSOLUTE.

William E. Pepelko (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Physiology Branch, Brooks AFB, Tex.).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1244-1247. 12 refs. USAF-sponsored research.

Experimental investigation in which 12 Wistar-strain female albino rats were exposed for a period of 11 months to an environment containing near 100% oxygen at a total pressure of 210 mm Hg absolute. Growth rates, length of pregnancy, size of litters, and number in each litter weaned did not differ significantly from ground-level controls. Offspring of altitude females either remained at altitude or were brought to ground level at 21 days of age. Growth rates of altitude animals and altitude animals brought down at 21 days of age did not differ significantly from ground-level controls, nor did eosinophil and reticulocyte counts, hemoglobin, hematocrit, or white and red cell counts with one exception: control males exhibited a higher red cell count than males born at altitude, but brought down at 21 days of age. It was concluded that the environmental conditions resulted in no important physiological changes to the animals even over long periods of time, and that readaptation to ground-level conditions occurred with no apparent difficulty. M. M.

A67-16286 #

TILT TABLE RESPONSES OF HUMAN SUBJECTS FOLLOWING APPLICATION OF LOWER BODY NEGATIVE PRESSURE.

Michael McCally, Thomas E. Piemme, and Raymond H. Murray (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biomedical Laboratory, Environmental Medicine Div.; Indiana, University, Cardiopulmonary Laboratory, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1247-1249. 5 refs.

Demonstration that exposure to low magnitudes of easily tolerated lower body negative pressure (LBNP) for brief periods (90 min) can improve subsequent orthostatic tolerance in normal subjects and that intermittent LBNP at moderate levels will prevent the orthostatic tachycardia produced by as little as 6 hr of bed rest. These data support the proposal that LBNP exposure may be useful in maintaining the orthostatic tolerance of inactive, confined, and weightless astronauts. S. Z.

A67-16287

DECREMENT IN VISUAL ACUITY FROM LASER LESIONS IN THE FOVEA.

Myron L. Wolbarsht (U.S. Navy, Bureau of Surgery and Medicine, Washington, D.C.).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1250-1252. 11 refs. Navy Contract No. RAE-13-X-047-5031-R004-01-001; DASA Contract No. MIPR-557-66.

The functional loss following destruction of selected areas in the fovea of stump-tail macaque monkeys has been investigated by psychophysical methods. The lesions were produced by radiation from ruby (6943 Å) and neodymium (10,600 Å) lasers in the non-Q-switched node. The ruby laser caused destruction of the pigment epithelium and associated structures while the neodymium laser had its main effect in the neural layers of the retina. Total destruction of the fovea reduces visual acuity from 1.4 to 9'. The laser photocoagulators and the psychophysical equipment are pictured and described. Possible future experiments are discussed. (Author)

A67-16288 #

RENAL RESPONSE TO +Gz GRADIENT ACCELERATION IN MAN.

Thomas E. Piemme, Michael McCally, and Alvin S. Hyde (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biomedical Laboratory, Environmental Medicine Div., Wright-Patterson AFB, Ohio).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1253-1256. 28 refs.

Experimental determination of the effect of high gradient acceleration on the renal clearances of free water and creatinine following a moderate water load. The results imply that acceleration impairs the ability to excrete a water load, and, further, that the response is mediated by antidiuretic hormone. M. F.

A67-16289

PHASE SHIFTS OF THE HUMAN CIRCADIAN SYSTEM AND PERFORMANCE DEFICIT DURING THE PERIODS OF TRANSITION. III.

G. T. Hauty (Delaware, University, Newark, Del.) and T. Adams (Michigan State University, East Lansing, Mich.).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1257-1262. 6 refs.

At periodic intervals throughout the biological day, biomedical assessments were made for a week prior to jet flight to Santiago, for 12 days in Santiago, and for a week following return to Washington, D.C. From a comparison of these data with those obtained from the east-west and west-east flights, the following conclusions were drawn: while the east-west and west-east flights effected a primary shift of phase of circadian periodicity manifested by the physiological functions, the north-south flight did not. This latter flight, however, did produce a significant increment of subjective fatigue as did the other two flights but was not followed by a significant performance deficit. (Author)

A67-16290

EVALUATION OF VASOMOTOR INSTABILITY BY MEANS OF THE BLOOD PRESSURE RESPONSE TO CAROTID SINUS PRESSURE.

Barnett Zumoff (USAF, 903rd Tactical Hospital, McGuire AFB, Ohio) and Scott M. Smith (USAF, Flight Surgeon's Office, Lackland AFB, Tex.).

Aerospace Medicine, vol. 37, Dec. 1966, p. 1262-1266.

The bood pressure response to carotid sinus pressure was studied in normal subjects and in subjects with vasomotor instability, in an effort to delineate quantitative criteria for separating the latter group from normals. It was found that the diastolic blood pressure response was of no diagnostic value whereas a useful distinction could be made on the basis of the systolic blood pressure response. Forty six percent of the abnormals fell outside the normal range (mean ±2 S.D.). It is concluded that any subject whose systolic blood pressure falls 36 mm Hg or more, after pressure on either carotid sinus, can be considered as manifesting vasomotor instability. (Author)

A67-16291 #

TREATMENT OF ALTITUDE DYSBARISM WITH OXYGEN UNDER HIGH PRESSURE - REPORT OF THREE CASES.

R. G. McIver and R. S. Kronenberg (USAF, Washington, D.C.).

(International Society of Biometeorology, International Biometeorological Congress, 4th, New Brunswick, N.J., Aug. 26-Sept. 2, 1966 Paper.)

Aerospace Medicine, vol. 37, Dec. 1966, p. 1266-1269. 16 refs.

Three new cases of altitude decompression sickness not responding to descent to ground level are reported. They were treated effectively with a 100% oxygen breathing at 41.4 psia. Pressure of relief of symptoms for all known instances in which increased barometric pressures were used for treatment are compared. There are indications that other factors in addition to the physical presence of bubbles are involved in the production of symptoms. (Author)

A67-16324 #
REACTIONS OF THE CUPULAR APPARATUS DURING G-LOADING OF AN ORGANISM [REAKTSII KUPULIARNOGO APPARATA PRI POVYSHENNOI VESOMOSTI ORGANIZMA].
E. M. Iuganov and A. I. Gorshkov.
Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia, vol. 31, Nov.-Dec. 1966, p. 816-825. 21 refs. In Russian.

Results of a study of the cupular function of man under acceleration. The latent stage, duration, frequency, and amplitude of the caloric nystagmus are investigated in 28 individuals under loads of 1.2, 3, and 4 g, with biopotentials being transmitted to an electroencephalograph outside the centrifuge. The postrotational nystagmus is also investigated against a steady 1.2-g background. Acceleration is found to activate basic characteristics of the caloric and postrotational nystagmic reactions. The effect is linked to a functional interaction of the cupular and otolith structures. V.Z.

A67-16587
PUPIL DIAMETER AND LOAD ON MEMORY.
Daniel Kahneman (Harvard University, Center for Cognitive Studies, Cambridge, Mass.) and Jackson Beatty (Michigan, University, Human Performance Center, Ann Arbor, Mich.).
Science, vol. 154, Dec. 23, 1966, p. 1583-1585. 9 refs.
National Institute of Mental Health Grant No. 08847-02.

Discussion of the observation that the pupil of the eye serves as an indicator of the load on memory - i.e., the effort involved in storing information for report. Laboratory pilot experiments strongly confirmed the suggestion that in a short-term memory task the pupil dilates while the subject listens to information and constricts as he reports. The experiment was conducted on five female college students with adequate uncorrected vision in both eyes. The main experiment consisted of four blocks of seven trials. In each block the subject heard: (1) strings of digits; (2) a string of four high-frequency monosyllabic nouns presented for immediate recall; and (3) a string of four digits presented for transformation. The results indicate that pupillary diameter provides a very effective index of the momentary load on a subject as he performs a mental task. S.Z.

A67-16072 #
HUMAN ASPECTS IN WELDING PRACTICE.
K. Mahadeva and C. F. Palmer.
British Welding Journal, vol. 13, Dec. 1966, p. 695-698. 7 refs.

Discussion of the importance of quick research into the human factors of welding practice and a review of related studies by earlier workers. The results of a short investigation carried out to correlate human performance with changes in incentive conditions and length of welds, using a simulated welding task, are given. S.Z.

A67-16279 *
FLIGHT RESEARCH PROGRAM. V.
James Roman (NASA, Flight Research Center, Biomedical Program Office, Edwards, Calif.) and Wayne H. Brigden (Volt Technical Corp., Flight Research Center, Edwards, Calif.).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1213-1217.

Discussion of the principles of operation of mass spectrometers which will soon be important to those engaged in physiological research or in medical monitoring. A summary of flight-test data obtained with a small mass spectrometer in a jet aircraft is given. The features of the four types of spectrometers discussed are tabulated. S.Z.

A67-16284 #
A SIMPLE LIQUID TRANSPORT COOLING SYSTEM FOR AIRCREW-MEMBERS.
W. C. Kaufman and J. C. Pittman (USAF, Systems Command, Aerospace Medical Div., Aerospace Medical Research Laboratories, Biomedical Laboratory, Wright-Patterson AFB, Ohio).
Aerospace Medicine, vol. 37, Dec. 1966, p. 1239-1243. 12 refs.

A water-cooled vest through which icewater was circulated was evaluated as a means of reducing thermal strain in aircraft operated in hot humid climates. In 2-hr exposures to an environment of 46.5°C with a water vapor pressure of 15 mm Hg, the vest reduced sweat production by 59%. Relative thermal comfort was provided by melting 2 to 3 kg of ice per manhour. (Author)

A67-16308
EVALUATION OF PROBABILISTIC DISPLAYS.
George N. Ornstein (North American Aviation, Inc., Columbus, Ohio).
IN: SOCIETY FOR INFORMATION DISPLAY, NATIONAL SYMPOSIUM ON INFORMATION DISPLAY, 7TH, BOSTON, MASS., OCTOBER 18-20, 1966, TECHNICAL SESSION PROCEEDINGS. [A67-16305 05-14]
North Hollywood, Calif., Western Periodicals Co., 1966, p. 113-131.

Many situations in which humans are required to act are probabilistic in nature. That is, the human is required to respond in a situation where he is presented with uncertain or fallible information. In such a situation, it may be useful to present information to the human using a display in which the essential probabilistic structure of the information is preserved and explicitly presented. The paper presents a study of four different probabilistic displays. The effectiveness of operators in estimating probabilities using these displays and in making decisions with such displays is evaluated and compared with the effectiveness of operators using a nonprobabilistic (conventional) display. The results support the feasibility of probabilistic information presentation. (Author)

A67-16309
HUMAN FACTORS IN AIRBORNE TELEVISION DISPLAYS.
Beverly Hillman (Radio Corporation of America, Burlington, Mass.
IN: SOCIETY FOR INFORMATION DISPLAY, NATIONAL SYMPOSIUM ON INFORMATION DISPLAY, 7TH, BOSTON, MASS., OCTOBER 18-20, 1966, TECHNICAL SESSION PROCEEDINGS. [A67-16305 05-14]
North Hollywood, Calif., Western Periodicals Co., 1966, p. 133-148
11 refs.

Discussion of electrooptical imaging systems used in military aerial TV displays. Particular attention is given to the variables involved in TV viewing related to visual interpretation. The principal variables considered are: (1) the mission characteristics, (2) the imaging system, including contrast rendition, line coverage, and signal-to-noise properties, (3) human visual capabilities, in terms of resolution and contrast perception and search time, and (4) viewing conditions such as kinescope size and shape and the ambient environment. Performance capability related to the nature of the targets sought, altitude, and velocity conditions is discussed, and data are presented from simulation research showing how visual interpretation is influenced by the resolution and noise characteristics of the display system. Cockpit environmental factors such as the ambient illumination and space limitations are analyzed with respec to their influence on the display requirements. M.F.

A67-17155
BIOENGINEERING AND FOOD PROCESSING; AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, NATIONAL MEETING, 57TH, MINNEAPOLIS, MINN., SEPTEMBER 26-29, 1965, PAPERS.
Chemical Engineering Progress, Symposium Series, no. 69, 1966. 153 p.
Members, $4.50; nonmembers, $15.

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STATISTICS AND DYNAMICS OF MICROBIAL CELL POPULATIONS. J. M. Eakman, A. G. Fredrickson, and H. M. Tsuchiya (Minnesota, University, Minneapolis, Minn.), p. 37-49. 26 refs. [See A67-17156 05-05]

A67-17156 •
STATISTICS AND DYNAMICS OF MICROBIAL CELL POPULATIONS.
J. M. Eakman, A. G. Fredrickson, and H. M. Tsuchiya (Minnesota, University, Minneapolis, Minn.).
(American Institute of Chemical Engineers, National Meeting, 57th, Minneapolis, Minn., Sept. 26-29, 1965, Paper.)
Chemical Engineering Progress, Symposium Series, no. 69, 1966, p. 37-49. 26 refs.
NASA Grant No. 24-005(056).

Description of a model for the growth of a microbially pure culture based on plausible hypotheses concerning cellular growth and reproduction. The model yields predictions for various population statistics, such as the distributions of cell mass, cell age, and the correlations between the lifespans of sister cells. The model reduces in special cases to several simpler models which are proposed. B.B.

A67-17261 #
FOOD QUALITY DESIGN FOR GEMINI AND APOLLO SPACE PROGRAMS.
R. L. Bustead and J. M. Tuomy (U.S. Army, Natick Laboratories, Natick, Mass.).
IN: ANNUAL TECHNICAL CONFERENCE TRANSACTIONS 1966; AMERICAN SOCIETY FOR QUALITY CONTROL, ANNUAL TECHNICAL CONFERENCE, 20TH, NEW YORK, N.Y., JUNE 1-3, 1966, TRANSACTIONS. [A67-17240 05-15]
Milwaukee, American Society for Quality Control, Inc., 1966, p. 849-852. *11 refs.*

Description of research and development work to determine a specification for the food that astronauts require. Factors in obtaining such a specification include morale, weight and available space, weightlessness, stability, mechanical stress, and health. Investigations are being conducted aimed at improving present products, and new feeding concepts are being developed. D.H.

A67-17303
CONTRAST-TRANSFER CHARACTERISTICS OF n TUPLE MODELS OF RETINAL RECEPTIVE FIELDS.
J. J. Kulikowski and J. R. Parks (Ministry of Technology, National Physical Laboratory, Teddington, Middx., England).
Institution of Electrical Engineers, Proceedings, vol. 114, Jan. 1967, p. 156-160. 20 refs.

Contrast-transfer characteristics based on a simplified model of a retinal receptive field using a very limited number ot receptors are described. The model is linear for given luminance levels. Of the many possible methods of switching these models, the one chosen uniformly changes the weighting coefficients associated with all receptors and is expressed as a change in static-transfer coefficient. Contrast-transfer characteristics are given as a function of optical-signal size (or spatial frequency) for various binary patterns. These characteristics may be used to select a compromise condition between the static- and contrast-transfer requirements of a pattern preprocessor, which in turn is a compromise between detectability and processing fidelity of signals. (Author)

A67-17354 #
SOME CONSIDERATION ON THE CONTROLLABILITY LIMIT OF A HUMAN PILOT.
Kyuichiro Washizu (Tokyo, University, Tokyo, Japan) and Katsuyuki Miyajima.
AIAA Journal, vol. 5, Jan. 1967, p. 151-155. 7 refs.

The limit of a human pilot's capability in controlling an unstable second-order system with positive static stability is theoretically investigated. A modified expression is proposed for the transfer function of a human pilot who is aware of the dynamic characteristics of the system. His controllability limit is analyzed by use of the modified transfer function and servomechanism theory. The theoretical results thus obtained are compared with experimental results. The physical interpretation of the theoretical results in connection with experimental results shows good insight into the controllability limit of a human pilot. (Author)

A67-17378
EFFECTIVE MOCKUP UTILIZATION BY THE INDUSTRIAL DESIGN-HUMAN FACTORS TEAM.
Joseph L. Seminara and James K. Gerrie (Lockheed Aircraft Corp. Lockheed Missiles and Space Co., Sunnyvale, Calif.).
Human Factors, vol. 8, Aug. 1966, p. 347-359.

Description of the mockup, a full-scale three-dimensional representation of a hardware system, as one of the most effective tools in providing human factors and industrial design support during the development of manned hardware systems. Some of the ways in which mockups are being employed to support advanced manned system programs are discussed. The interactive roles of the human factors engineer and the industrial designer in applying mockup technology in such varied programs as the conceptual development of a lunar roving vehicle, the design of an earth orbital space station, and the design of the crew compartment for an advanced undersea craft are described. M.F.

A67-17847 *
SPONTANEOUS SPIKE DISCHARGES FROM SINGLE UNITS IN THE COCHLEAR NUCLEUS AFTER DESTRUCTION OF THE COCHLEA.
K. C. Koerber, R. R. Pfeiffer, W. B. Warr, and N. Y. S. Kiang (Massachusetts Institute of Technology, Research Laboratory of Electronics, Cambridge; Massachusetts Eye and Ear Infirmary, Eaton-Peabody Laboratory of Auditory Physiology, Boston, Mass.).
Experimental Neurology, vol. 16, Oct. 1966, p. 119-130. 24 refs.
National Institutes of Health Grants No. MH-04737-06; No. NB-01344; NSF Grant No. GK-835; Contract No. DA-36-039-AMC-03200(E); Grant No. NsG-496.

Comparison of the spontaneous activity in the cochlear nucleus of intact animals with that found in animals with destroyed cochleas. Cochlear destruction results in an immediate disappearance of almost all activity in the ventral cochlear nucleus, while the activity in the dorsal cochlear nucleus is relatively unaffected even in chronic preparations. Thus most of the spontaneous activity in the ventral nucleus appears to be dependent on the spontaneous activity of the auditory nerve. The spontaneous activity in the dorsal nucleus, on the other hand, appears either to be a result of activity in other pathways to the cochlear nucleus or to originate in the units themselves. M.F.

A67-17848 •
ADRENAL CORTICAL ACTIVITY IN PATHOLOGICAL EMOTIONAL STATES - A REVIEW.
Robert T. Rubin and Arnold J. Mandell (California, University, Center for Health Sciences, Neuropsychiatric Institute, Biochemical Correlates Laboratory, Los Angeles, Calif.).
American Journal of Psychiatry, vol. 4, Oct. 1966, p. 387-400. 107 refs.
California Department of Mental Hygiene Grant No. 64-2-40; Grant No. NsG-237-62.

Changes in adrenal cortical activity have been correlated with certain pathological emotional states. Heightened activity occurs concomitantly with depressive reactions of various types and in certain phases of acute schizophrenic reactions. The psychological variable that correlates most closely with increased adrenal cortical secretion is loss of "ego defense strength," that is, absence of denial with awareness of illness. Behavioral observations and biochemical methodologies in the studies reviewed are discussed, and several alternative mechanisms of adrenal cortical activation are postulated. (Author)

A67-17853 *
RENAL LYMPH OXYGEN TENSION DURING GRADED RENAL ISCHEMIA.
Abraham T. K. Cockett, R. T. Kado, M. Kazmin, Raymond S. Moore, and A. P. Roberts (Harbor General Hospital, Dept. of Surgery /Urology; California, University, School of Medicine, Los Angeles, Calif.).

IN: FORUM ON FUNDAMENTAL SURGICAL PROBLEMS; PROCEEDINGS OF THE 52ND ANNUAL CLINICAL CONGRESS.
Chicago, American College of Surgeons, 1966, p. 495, 496.
U. S. Public Health Service Grant No. HE-09834-02; Grant No. NsG-237-62.

Description of the cannulation of renal capsular lymphatics in 10 anesthetized dogs to test the theory that lymph fluid can serve as a means of assessing tissue oxidation. The derived data suggest that oxidative metabolic processes are extremely active within the kidney. Oxygen tension levels in the renal lymph significantly exceeded the arterial levels. B. B.

A67-17872 •
THE INHIBITORY EFFECT OF LIGHT ON GROWTH OF PROTOTHECA ZOPFII KRUGER.
Bernard Epel and Robert W. Krauss (Maryland, University, Dept. of Botany, College Park, Md.).
Biochimica et Biophysica Acta, vol. 120, 1966, p. 73-83. 14 refs.
Grant No. NsG-70-60.

Demonstration that white light from cool-white fluorescent lamps is inhibitory to the growth of an alga, a yeast, and a protozoan. The growth rate for the alga was found to drop linearly with increasing light intensity. Incandescent light of equal intensity was less inhibitory, but radiation from black-light fluorescent lamps was found to be much more inhibitory. The most likely receptor appears to be a cytochrome. F. R. L.

A67-17873 •
INTERACTION OF STREPTONIGRIN WITH DNA IN VITRO.
Helen L. White and James R. White (North Carolina, University, North Carolina State, School of Medicine, Dept. of Biochemistry, Chapel Hill, N.C.).
Biochimica et Biophysica Acta, vol. 123, 1966, p. 648-651. 9 refs.
National Institutes of Health Grant No. AI-06211; National Institutes of Health Contract No. PH-43-64-50; NSF Grant No. GB-957; Grant No. NsG(T)-63.

Description of evidence on the physical interaction of streptonigrin with DNA with resulting degradation when chemically reduced in the presence of DNA. Tabulated data show that streptonigrin raises the thermal denaturation temperature of DNA from salmon sperm and Escherichia coli. The effect of streptonigrin in raising this temperature of DNA shows that streptonigrin associates with DNA in vitro. The decrease in the viscosity and the sedimentation rate of DNA which has been incubated with reduced streptonigrin demonstrates degradation of the DNA under these conditions. The observations made are consistent with the hypothesis that streptonigrin, following intracellular reduction, associates with the DNA and causes single-strand breaks. M. M.

A67-17995 #
OCULAR TENSION IN HYPOXIA - TONOMETRIC AND TONOGRAPHIC INVESTIGATIONS [IL TONO OCULARE IN IPOSSIA - INDAGINI TONOGRAFICHE].
R. Neuschüler and R. Palombi.
Rivista di Medicina Aeronautica e Spaziale, vol. 29, July-Sept. 1966, p. 402-411. 16 refs. In Italian.

Investigation of intraocular tension in hypoxia on 20 subjects. The findings indicated constantly increasing tension. The reason for this increase was investigated by a tonometric and tonographic study of 14 of the 20 subjects. The results indicated an increasing production of aqueous humor, decrease of its outflow, decrease of resistance to outflow, and decrease of scleral rigidity. The general values of the pressure were also investigated. M. M.

A67-17996 #
BEHAVIOR OF SOME SERUM ENZYMES IN RATS RELATIVE TO ANATOMICAL AND PATHOLOGICAL INJURIES CAUSED BY APPRECIABLE VERY SHORT TRANSVERSE DECELERATIONS. III [COMPORTAMENTO DI ALCUNI ENZIMI SIERICI NEL RATTO IN RAPPORTO ALLE LESIONI ANATOMOPATOLOGICHE PROVOCATE DA DECELERAZIONI TRASVERSALI DI NOTEVOLE ENTITA' E BREVISSIMA DURATA. III].
G. Lalli and G. Paolucci.
Rivista di Medicina Aeronautica e Spaziale, vol. 29, July-Sept. 1966, p. 412-426. In Italian.

Evaluation of changes in some serum enzymes in correlation with pathological damages due to deceleration, by extending to lateral-axis impacts previous investigations performed on the chest-back and back-chest axes. The conclusions derived from the investigation are: (1) rat tolerance to the investigated deceleration is appreciably greater than previously reported; (2) the lungs underwent the most severe damage, the right one in the right-to-left impact, the left one in the left-to-right impact, with hemorrhagic phenomena predominating in other organs; and (3) all the serum enzymes investigated in surviving animals increased statistically showed a significant increase in 15 to 16 hr after impact, especially at the highest decelerations used (900 g). M. M.

A67-17997 #
BEHAVIOR OF SOME ENZYMATIC PROCESSES OF SERUM IN DOGS SUBJECTED TO MODERATE IMPACTS. I [COMPORTAMENTO DI ALCUNE ATTIVITA' ENZIMATICHE DEL SIERO IN CANI SOTTOPOSTI AD URTI DI MODESTA ENTITA'. I].
G. Paolucci.
(Società Italiana di Medicina del Traffico, Congresso, 3rd, Rome, Italy, June 6-8, 1966, Comunicazione.)
Rivista di Medicina Aeronautica e Spaziale, vol. 29, July-Sept. 1966, p. 427-441. In Italian.

Investigation of the serum enzymes GUT, GPT, MDH, LDH, SDH, and aldolase, in dogs subjected to impacts of approximately 4 negative g. The dogs did not show any visible impairment, while the enzymes maintained their range of normal values. However, the latter increased immediately after impact and decreased in the two successive days. The enzymes returned gradually to their original values between the third and seventh days. M. M.

A67-18379 •
KILLING AND MUTAGENIC EFFICIENCIES OF HEAVY IONIZING PARTICLES IN ARABIDOPSIS THALIANA.
Taro Fujii, Mituo Ikenaga (National Institute of Genetics, Dept. of Induced Mutation, Sizuoka-ken, Japan), and John T. Lyman (California, University, Donner Laboratory and Lawrence Radiation Laboratory, Berkeley, Calif.).
Nature, vol. 213, Jan. 14, 1967, p. 175, 176. 6 refs.
AEC-NASA-supported research.

Investigation of the killing and mutagenic effects of heavy ionizing particles, helium, carbon, and argon, accelerated by an energy of 10.4 Mev/nucleon. These effects were compared with the effects produced by cesium-137 γ rays. Arabidopsis thaliana was used in this experiment. The frequencies of somatic mutations of γ rays and heavy ionizing particles were compared at 0.5% mutation rates from their dose against frequency curves. About 33 krad of γ rays were necessary to produce the 0.5% mutation rate, and about 0.9 and 6.7 krad of carbon ion and argon ions could produce the same mutation frequency. From the results, the relative biological effectiveness (RBE) for somatic mutation at 0.5% frequency was roughly estimated as 35 for carbon ions and 5 for argon ions. If the mutation rate shown by the 2-krad portion was sustained, the RBE of helium ions for somatic mutation might be about 10. M. F.

A67-18643
THE SITE OF VISUAL ADAPTATION.
John E. Dowling (Johns Hopkins University, School of Medicine, Wilmer Institute, Baltimore, Md.).
Science, vol. 155, Jan. 20, 1967, p. 273-279. 50 refs.
Research supported by the Institute to Prevent Blindness; U.S. Public Health Service Grant No. NB-05336.

Review of several studies which clarify the contribution of photochemical and nonphotochemical factors in visual adaptation and experiments relating these factors and suggested mechanisms to explain adaptation. Some evidence is given, and speculation is made regarding the site and the cells involved in visual adaptation.

B.B.

A67-18774 *
PHYSICAL CHARACTERISTICS OF THE RESIDUAL DNA IN BACTERIAL CELLS AFTER DEGRADATION DUE TO IONIZING RADIATION.
Ernest Pollard, John Swez, and Leo Grady (Pennsylvania State University, Biophysics Dept., University Park, Pa.).
Radiation Research, vol. 28, July 1966, p. 585-596. 7 refs.
Grant No. NsG-324.

Description of experiments to determine the physical characteristics of the residual DNA in bacterial cells after incomplete degradation due to ionizing radiation. It is shown that the residual DNA has approximately the same temperature-dependent hyperchromicity as normal DNA, the same buoyant density as normal DNA, and the same pattern of change of buoyant density on heating and rapid cooling as normal DNA. It is concluded that the residual DNA is double-stranded and therefore that the difference in sensitivity to ionizing radiation is not due to one strand's being more sensitive than the other.

D.H.

A67-18775 *
THE POSTERIOR THALAMIC REGION IN MAN.
W. R. Mehler (NASA, Ames Research Center, Office of Life Sciences, Neurobiology Branch, Moffett Field, Calif.).
(International Symposium on Stereoencephalotomy, 2nd, Vienna, Austria, Sept. 4, 1965, Paper.)
Confinia Neurologica, vol. 27, 1966, p. 18-29. 31 refs.
NASA-supported research.

Delineation of the terminal connections of the spinothalamic in its passage through the upper mesencephalon, including a study of its distribution in the thalamus of man as revealed in Nauta-method selective silver impregnation studies of cases of spinal and medullary tractotomy. An attempt is made to correlate these patterns of distribution with experimental findings in the cat and monkey suggested by neurophysiological studies of the posterior thalamic region and supported by experimental anatomical and clinico-pathological findings.

D.H.

A67-18776
CARDIOVASCULAR DYNAMICS DURING ORTHOSTASIS AND THE INFLUENCE OF INTRAVASCULAR INSTRUMENTATION.
Paul M. Stevens (USAF, Systems Command, Aerospace Medical Div., School of Aerospace Medicine, Internal Medicine Branch, Brooks AFB, Ohio).
American Journal of Cardiology, vol. 17, Feb. 1966, p. 211-218. 22 refs.

Delineation of some of the carviovascular changes due to orthostasis, and evaluation of the influence of intravascular instrumentation on the orthostatic tolerance of normal men. A total of 233 healthy USAF pilots and navigators participated in the study; their responses were measured for 20 min during a 90^{o} upright tilt while suspended in a standard Air Force parachute harness. Orthostatic tolerance of normal subjects is markedly diminished by the use of intravascular instrumentation such as venous catheters and intraarterial needles. The reactions of fainters, nonfainters, and late fainters to orthostasis are described. A discrepancy found in response to central cardiac changes is probably related to the relative effects of the upright posture on cerebral arterial pressure or peripheral vascular receptors.

D.H.

A67-19007
BIOSPHERES.
Peter W. Neurath (Tufts University and New England Medical Center Hospitals, Boston, Mass.).
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 149-153.

Consideration of the terrestrial and other possible biospheres. The planning of space missions and problems relating to detection of life elsewhere in the universe are discussed. Values indicating the probabilities for matching terrestrial biosphere factors are tabulated.

B.B.

A67-19017 *
DETECTION AND EPISTEMOLOGY OF BIOTIC SIGNATURES.
H. Philip Hovnanian (Avco Corp., Research Center, Wilmington, *Mass.; NASA, Office of Space Science and Application, Washington,* D.C.).
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 294-306. 61 refs.

Consideration of the nature of living things, which presupposes that there be self-replication, evolution, and metabolism. These provide the primary signatures, and interaction between similar and dissimilar organisms, characteristic morphology, mobility, and death contribute confirming verification. Theoretical and experimental considerations concerning the atomic and molecular structure of living things on earth and possibly in space are examined. Primitive earth sample studies and the detection of biotic signatures are discussed. Attention is given to the electromagnetic detection of biotic signatures and the particulate field detection of biotic signatures.

F.R.L.

A67-19018
BIOTIC SIGNATURES.
E. A. Botan (Avco Corp., Research Center, Wilmington, Mass.).
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 307-313.

Discussion of biotic signatures as they reflect prebiotic, viable biotic, and postbiotic entities and their distributions. They also reflect the environmental orders in which the organism might be found, such as the geologic, atmospheric, or oceanographic environment. Biotic signatures can be correlated with the biotic entity which they represent and the environments in which they are found or live. A possible Martian organism is postulated based on present knowledge of the environment of the planet. This organism could be quite similar to a terrestrial organism, therefore having similar biotic signatures.

F.R.L.

A67-19030
DENTAL ASPECTS OF MANNED SPACE EXPEDITIONS.
B. Lawrence Shalit.
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 444-448. 6 refs.

Consideration of dental problems which can be foreseen during manned exploration of the bodies and volumes of the solar system interstellar space. Recommended measures are the elimination of all nonvital teeth, suspicious teeth, third molars (if indicated by clinical judgment), and careful examination of implant dentures. It is recommended that missing teeth be replaced with removable appliances rather than fixed bridgework. Emphasis is placed on educating astronauts to prevent caries and peridontal disease.

F.R.L.

A67-19039
SOME IMPLICATIONS OF EXTRASOLAR INTELLIGENCE.
Frederick I. Ordway, III (General Astronautics Research Corp., London, England).
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 653-658. 36 refs.

Discussion of the plausibility of the proposition that extrasolar societies are found throughout the universe. It is pointed out that the most probable way of demonstrating the existence of extrasolar intelligence is by electromagnetic or possibly optical - e.g., laser - communications. Suggestions included are further astronomical research and attempts to detect artificial signals of extrasolar origin. M.F.

A67-19040
THE BIOLOGICAL SIGNIFICANCE OF THE SPACE EFFORT.
Ward J. Haas (Missouri, University, Space Sciences Research Center, Columbia, Mo.).
(New York Academy of Sciences, Conference on Planetology and Space Mission Planning, New York, N.Y., Nov. 3, 4, 1965, Paper.)
New York Academy of Sciences, Annals, vol. 140, Dec. 16, 1966, p. 659-666. 19 refs.

Discussion of some aspects of the biological significance of the space effort. It is pointed out that the drive and purpose behind space exploration is basically biological, and that the long-range practical consequences will have to include colonization and adaptation of man, as a species, to extraterrestrial habitats. Some of the more urgent requirements for research on biological problems which will be required to ensure success in this biologically defined objective are mentioned. M.F.

A67-17998 #
CLOTHING HYGIENE WITH PARTICULAR REFERENCE TO AEROSPACE PROBLEMS. I [L'IGIENE DEL VESTIARIO CON PARTICOLARE RIFERIMENTO AI PROBLEMI AEROSPAZIALI. I].
E. Sulli.
Rivista di Medicina Aeronautica e Spaziale, vol. 29, July-Sept. 1966, p. 459-515. In Italian.

Brief survey of investigations carried out in the field of clothing hygiene from the scientific standpoint. The physical characteristics and functional properties of fabrics and textile fibers are treated from the standpoint of their hygienic and physiological requirements in critical living conditions. M.M.

A67-18533 *
NAMING SEQUENTIALLY PRESENTED LETTERS AND WORDS.
Paul A. Kolers (Massachusetts Institute of Technology, Cambridge, Mass.) and Martin T. Katzman (Yale University, New Haven, Conn.).
Language and Speech, vol. 9, Apr.-June 1966, p. 84-95. 10 refs.
National Institutes of Health Grant No. MH-04737-05; NSF Grant No. GP-2495; Contract No. DA-36-039-AMC-03200(E); Grant No. NsG-496.

Outline of the results of five experiments involved with naming sequentially presented letters and words. The rate at which the letters are presented visually is varied, and the effect of these variations on the ability of college students to name the letters or make words of them is studied. B.B.

LC ENTRIES

A67-80319
SOME NEURO-HORMONAL MECHANISMS OF THE REACTION TO IONISING RADIATION.
A. V. Lebedinskii, L. D. Klimovskaya, and N. P. Smirnova (Inst. of Med.-Bio. Problems, Moscow, USSR).
Physiologia Bohemoslovaca, vol. 15, no. 5, 1966, p. 459–465. 7 refs.

Changes in vasomotor reactions were studied in irradiated animals from the point of view of nervous and hormonal mechanisms involved in the response to ionising radiation. It has been shown that besides changes in the extent and shape of vasomotor reactions elicited by stimulation of sympathetic nerves, hypothalamic stimulation or adrenaline administration, the hormonal activity of hypothalamic extracts and impairment of catecholamine and acetylcholine metabolism in sympathetic ganglia are changed in the irradiated animals. Hypothalamic stimulation which leads to increased antidiuretic activity in the blood plasma and vasoconstriction in healthy animals, evoked in most irradiated animals vasodilatatory effects and was without effect upon the antidiuretic properties of blood plasma. The results may help in explaining the changes taking place in the state of effector systems of the irradiated organism, which often respond to adequate stimuli by reversed or altered reactions.

A67-80320
APPLICABILITY OF THE RADIOPROTECTIVE SUBSTANCE AMINOETHYLISOTHIOURONIUM BR HBR (AET) [POUZITELNOST RADIOPROTEKTIVNI LATKY AMINOETYLISOTHIOURONIA BR HBR (AET)].
J. Pospisil, Z. Dienstbier, and J. Kotako.
Casopis Lekaru Ceskych, vol. 105, 1966, p. 1165–1171. 33 refs. In Czech.

The influence of beta amino-isothiouronia (EAT) was studied on various functions in mice, rats and dogs. The toxicity of the preparations and their radioprotective effect was assessed. Attention is drawn to the marked difference in toxicity on i. v., i. p. and oral administration. The authors found that AET administered before irradiation of experimental animals did not prevent the development of postirradiation damage in peripheral blood nor did it potentiate the regenerative capacity of haemotopoiesis. Electrocardiograms revealed marked damage of the heart muscle (bigeminia due to ventricular extrasystoles, paroxysmal ventricular tachycardia, a negative T wave, a reduced QRS complex and elimination of the sinus node), even after doses which were too small to be therapeutically effective. The blood pressure in dogs rose for a short time and subsequently in some instances hypotension developed which persisted in animals who subsequently died. The authors refuse to use AET in human medicine and consider this preparation suitable only for experimental investigations of the mechanism of postirradiation damage.

A67-80321
TAPPING REGULARITY AS A MEASURE OF PERCEPTUAL MOTOR LOAD.
J. A. Michon (Inst. for Perception RVO–TNO, Soesterberg, The Netherlands).
Ergonomics, vol. 9, Sep. 1966, p. 401–412. 16 refs.

Numerous methods have been devised to measure perceptual load, but the concept itself is ill-defined, which makes different approaches practically incomparable. The central problem is the ordering of tasks of different types, and most methods compare tasks that differ only in one variable, such as speed or input/output uncertainty. One such approach observes the timing of successive actions: load will cause 'traffic control' problems in the central nervous system, so that actions will be executed in an irregular fashion. The use of irregularity as a measure of perceptual load depends on the availability of a 'functional' descriptive system of behaviour, as opposed to current 'phenomenal' systems like those of time and motion study. A convenient substitute is that of measuring the irregularity of a subsidiary performance. Key tapping was found to satisfy certain methodological requirements. Some experiments evaluating this method are discussed.

A67-80322
REMARKS ON COLQUHOUN'S: "THE EFFECT OF 'UNWANTED' SIGNALS ON PERFORMANCE IN A VIGILANCE TASK".
H. J. Jerison (Antioch Coll., Behavior Res. Lab., Yellow Springs, Ohio).
Ergonomics, vol. 9, Sep. 1966, p. 413–416. 5 refs.
(Contract AF 33(615)-1086 and Grant AF-AFOSR-150-66.

Colquhoun's 1961 experiment is interpreted as emphasizing the discrimination phase of a complex task in which the detection of a signal is followed by the discrimination of one of its features. His conclusion that signal probability determines vigilance performance is supported by research from this laboratory with a simple detection task. In our research the probability is redefined as the ratio of signals to attention-eliciting stimuli, and the latter stimuli must be presented at high rates (15 or more times per min.) His results with the complex task suggest an effect of signal probability on search and scanning patterns during prolonged visual work.

A67-80323
THE EFFECT OF 'UNWANTED' SIGNALS ON PERFORMANCE IN A VIGILANCE TASK: A REPLY TO JERISON.
W. P. Colquhoun (Med. Res. Council, Appl. Psychol. Res. Unit, Cambridge, Great Britain).
Ergonomics, vol. 9, Sep. 1966, p. 417–419.

Jerison's remarks (Ergonomics, 1966, vol. 9, p. 413) are discussed in relation to the results of a further experiment on 'unwanted' signals in which (a) the original interaction between the effects of signal probability and signal disc location was not observed, and (b) it was demonstrated that a search requirement is not a necessary condition for eliciting the main effects previously found.

A67-80324
THE "FEEL" OF ROTARY CONTROLS: FRICTION AND INERTIA.
William B. Knowles and Thomas B. Sheridan (Hughes Aircraft Co., Culver City, Calif. and Mass. Inst. of Technol., Cambridge).
Human Factors, vol. 8, Jun. 1966, p. 209–215. 9 refs.

The purpose of this study was to determine the influence of friction and inertia levels on the "feel" of rotary controls. Detection thresholds for changes in friction and inertia were determined and found to be about 10 to 20 per cent of the initial values. Preference ratings obtained for various combinations of friction and inertia increased as a function of inertia level and decreased as a function of friction level. Preferences for viscous friction

were greater than for stick-slip friction. Psychophysical evaluations such as these are related to customer acceptance factors and provide a useful supplement to purely functional design criteria.

A67-80325
OPTIMUM ANGULAR ACCELERATIONS FOR CONTROL OF A REMOTE MANEUVERING UNIT.
Herbert J. Clark (AF Systems Command, Aerospace Med. Div., Aerospace Med. Res. Labs., Wright-Patterson AFB, Ohio).
Human Factors, vol. 8, Jun. 1966, p. 217–223. 8 refs.

Six subjects successfully reoriented the attitude of a simulated remote maneuvering unit (RMU) using an on-off acceleration command control system. RMU attitude was determined solely by viewing the space scene being televised by the RMU. The RMU was controlled under three conditions of angular acceleration; 4, 8, and 12°/sec.^{2}. Four degrees/sec.^{2} resulted in least fuel expenditure and most accurate rate control without a sacrifice in time. These results and subjects' preference data recommended pitch, yaw, and roll accelerations of 4°/sec.^{2} when using an on-off acceleration command control system.

A67-80326
BATCH VS. SEQUENTIAL DISPLAYS: EFFECTS ON HUMAN PROBLEM SOLVING.
James D. Baker and Ira Goldstein (AF Systems Command, Electron. Systems Div., Decision Sci. Lab., L. G. Hanscom Field, Bedford, Mass.).
Human Factors, vol. 8, Jun. 1966, p. 225–235. 11 refs.
(Contracts AF 19(628)-2938 and AF 19(628)-4368.

This study was concerned with problem solving under two display conditions. In one condition ("Sequential"), only those response alternatives permissible at any given time were displayed at that time. Under the other conditions ("Batch"), all response alternatives, permissible at the moment or not, were presented at all times. Significantly greater time was found to be required to learn solutions using the "Batch" display. This requirement was attributed to the significantly greater display search-time which was found to be required in that condition. No significant difference in number of trials to reach the criterion of learning solutions was found, indicating that the additional material displayed in the "Batch" condition carries no significant amount of useful information. It is concluded that displaying data which has only potential relevance is not only ineffective but actually degrades performance.

A67-80327
HORIZONTAL VERSUS VERTICAL DISPLAY OF NUMBERS.
C. M. Williams (Bell Telephone Labs., Inc., Murray Hill, N. J.).
Human Factors, vol. 8, Jun. 1966, p. 237–238.

A task was constructed to compare performance on a horizontal to that of a vertical array of 3-digit numbers. Sixteen subjects were required to scan arrays of pairs of numbers and mark the pairs that contained nonidentical members. The average time required to complete the vertical array was 73 sec. and 44 sec. for the horizontal. The finding that an average of 66% more time was spent on the vertical than on the horizontal array is significant at the .005 level.

A67-80328
SIMPLE REACTION TIME AND RESPONSE SETS.
Stanley M. Moss (Mass. U., Amherst).
Human Factors, vol. 8, Jun. 1966, p. 239–243. 6 refs. NIMH supported research.

The study was concerned with the effects of induced response inhibition on simple visual reaction time. Ten subjects were confronted with up to four response alternatives (fingers of the right hand), one of which was the required response. Each of these responses was associated with a specific stimulus. Three response ensembled conditions were used: 1-within a block of trials only one light appeared, II-within a block of trials one of two possible lights appeared, III-within a block of trials one of the four possible lights appeared. Under all conditions subjects were given more than adequate time to extract the appropriate response from the remaining responses in the ensemble prior to the time that they were required to make the response. A significant interaction was found between the individual responses and response ensembles. These results were explained in terms of the contextual effects of the unused responses within the different ensemble conditions. Additional data indicated that these effects reflect a spatial relationship to responses being measured. Unused responses that are more proximal to the measured response depress the reactions to that response as compared to unused responses that are more distant.

A67-80329
MARTIAN ATMOSPHERE AND CRUST.
S. Miyamoto (Kyoto U., Kwasan Obs., Japan).
Icarus, vol. 5, Jul. 1966, p. 360–374. 29 refs. N. Y. Acad. of Sci., Ore. U., and Dr. James Q. Gant supported research.

The Martian atmosphere in its average condition is inactive and transparent to long-wave radiation. It is activated when moisture is supplied by the evaporation of the polar cap in spring time. As typical examples, the great yellow cloud in 1956, the Neith-Casius cloud, and the Propontis cloud are described. It is shown that we can derive some knowledge about surface relief indirectly from cloud observations. In the Martian summer, energy flows from the summer hemisphere to the winter hemisphere and the prevailing wind over middle latitudes turns from spring westerlies to summer easterlies. This prediction has been confirmed through the following observations: a springtome polar front and associated dark fringe, some peculiar behavior of the polar cap shrinking, and the summertime diagonal cloud layers. A tentative picture of the circulation pattern in the northern hemisphere is proposed on the basis of our cloud data. Crater morphology revealed by the Mariner IV photographs suggests that craters are one of the characteristic features of the original crust of terrestrial-type planets and that Martin deserts and maria correspond to the terra and maria of the Moon and the continents and oceans of our Earth, respectively. Canals are interpreted as tectonic lines. It may be shown how wind erosion destroys most of the tectonic lines but develops some of them into canals when they are properly located along the courses of vapor migration.

A67-80330
SOME RECENT WORK ON PREBIOLOGICAL SYNTHESIS OF ORGANIC COMPOUNDS.
Cyril Ponnamperuma (NASA, Ames Res. Center, Exobiol. Div., Moffett Field, Calif.).
Icarus, vol. 5, Jul. 1966, p. 450–454. 23 refs.

The experimental approach to the question of the origin of life is based on the Oparin-Haldane hypothesis that life is a special property of matter which arose at a particular period in the existence of our planet and resulted from its orderly development. The simple working hypothesis has been adopted that the molecules which are important now were important at the time of the origin of life. Starting with the Earth's primordial atmosphere and the various forms of energy which may have existed at the time, we are endeavoring to retrace the origin of the constituents of the nucleic acid and protein molecules. Current results indicate that many of the biological molecules can be synthesized under conditions which may be considered to be genuinely similar to those which prevail on the prebiotic Earth.

A67-80331
VESTIBULAR ANALYZER AS A CRITICAL ORGAN FOR THE EVALUATION OF RADIATION HAZARDS IN SPACE FLIGHTS. THE EFFECT OF IONIZING RADIATION IN A WIDE DOSE RANGE ON PHYSIOLOGICAL FUNCTIONS OF CUPULA APPARATUS [VESTIBULIARNYI ANALIZATOR—KRITICHESKII ORGAN PRI OTSENKE RADIATSIONNOI OPASNOSTI KOSMICHESKIKH POLETOV (VLIIANIE IONIZIRUIUSCHEGO IZLUCHENIIA V SHIROKOM DIAPAZONE DOZ NA FIZIOLOGICHESKIE FUNKTSII KUPULIARNOGO APPARATA)].
Iu. G. Grigor'ev (USSR, Inst. of Med.-Biol. Problems, Moscow).
Physiologia Bohemoslovaca, vol. 15, no. 4, 1966 p 372–377. 7 refs. In Russian.

The experiments were carried out on rabbits and dogs in order to study the effect of coriolis acceleration of the vestibular apparatus at various stages of radiation sickness. Rabbits received doses of 50–10,000 r as a single gamma total body exposure. The dogs were exposed to x-radiation by three different methods: (1) single total body exposure of 200 r; (2) daily exposure to 9 r for 22 days; (3) exposure to 130 Mev protons in total dose of 500 rad. The animals were subjected to various tests, such as; vibration, noise and reduced ambient pressure, and coriolis acceleration. In a series of experiments the otolith function was suppressed by an application of radio-isotope. The results showed that the otoliths have a direct relationship to those somatic and vital function responses which arise from the stimulation of vestibular apparatus by the radial acceleration. A depression of vestibular function was noted after 50–100 r. Larger doses, however, led to the stimulation of the vestibular function.

A67-80332
A CONTRIBUTION TO THE STUDY OF THE RADIOPROTECTIVE EFFECT OF CYSTAMINE ON HAEMATOPOIETIC STEM CELLS.
L. Tkadleček and Věra Juráškov´ (Czechoslovak Acad. of Sci., Inst. of Biophys. and Hradec Králové, Mil. Inst. of Med. Res. and Postgraduate Study, Brno).
Folia Biologica, vol. 12, no. 4, 1966, p. 278–282. 11 refs.

The protective effect of cystamine on hematopoietic stem cells in the spleen of X-ray irradiated mice was studied. By the method of analyzing colonies of hematopoietic tissue cells it was found that at an exposure rate of 192 R/min. the protective effect depends significantly on the interval between intraperitoneal injection of cystamine and irradiation. The highest effect was found when 160 mg. of cystamine/kg. body weight were injected at an interval of 3 min. before irradiation, where the DRF (dose reduction factor) was 2. When the interval was extended to 7 and 11 min. the DRF decreased to 1.8 and 1.7. At an interval of one hour between injection of 120 mg. of cystamine/kg. body weight and irradiation the DRF was 1.24.

A67-80333
EFFECT OF INCREASED AND REDUCED AFFERENTATION UPON MAN FROM THE VIEWPOINT OF SPACE PSYCHOPHYSIOLOGY [NEKOTORYE OSOBENNOSTI VOZDEISTVIIA NA ORGANIZM CHELOVEKA POVYSHENNOI I PONIZHENNOI AFFERENTATSII V ASPEKTE KOSMICHESKOI PSIKHOFIZIOLOGII].
F. D. Gorbov, F. P. Kosmolinskii, and V. I. Miasnikov.
Voprosy Psikhologii, no. 5, Sep.–Oct. 1966, p. 67–71. 15 refs. In Russian.

Adaptation of the human being to space flight environments is closely related to afferentation developing under these new conditions. During a simultaneous and independent change of usual afferentation on a level of both sensory input and inner afferentation channels, difficult though surmountable states may develop due to significant emotional, adaptive and autonomous shifts. A study of man's responses to the increased or reduced afferentation was carried out under simulated and actual flight conditions. Development of difficult states accompanying sensory deprivation is related to the total deficiency of afferentation while that accompanying excess information (in the biological aspect) is associated with specific afferentation typical of the analyzer involved. Research permits to outline certain preventive measures that may help avoid fundamental emotional stress under the conditions of sensory (information) over- and underload. In this respect, special training including development of necessary posture and locomotor habits is of utmost significance.

A67-80334
EFFICIENCY OF PROCESSES OF TRACKING AS AFFECTED BY THE KIND OF INPUT SIGNAL [EFFEKTIVNOST' PROTSESSOV SLEZHENIIA V ZAVISIMOSTI OT VIDOV VKHODNOGO SIGNALA].
M. A. Kremen'.
Voprosy Psikhologii, no. 5, Sep.–Oct. 1966, p. 83–92. 7 refs. In Russian.

The accuracy of the process of tracking is higher when the human-operator perceives the acceleration of the moving mark. As the speed of the movement of the mark increases, the extent of "internal noises" in the human-operator decreases. The efficiency of the tracking system, of which the human-operator is a part, is optimal when the structure of the guidance system is equivalent to the amplifier link. The quality of tracking random signals can be improved only when the human-operator is informed before training trackings which of the parameters of tracking is the determining one. If the accuracy of tracking is the determining factor, then the control must be established in such a way that its movements are brought about "toward oneself–from oneself" and if the smoothness of tracking is the main factor, then it would be better to establish the control in such a way that its movements are brought about "to the right–to the left".

A67-80335
QUANTITATIVE ESTIMATION OF TRAINEDNESS OF PILOTS WITH THE HELP OF TRAINING-AIDS [O KOLICHESTVENNOI OTSENKE OBUCHENNOSTI PILOTOV NA TRENAZHERAKH].
V. A. Taran and A. D. Korotkov
Voprosy Psikhologii, no. 5, Sep.–Oct. 1966, p. 93–101. 6 refs. In Russian.

An equation is presented for evaluating a subject's progress in training as an airplane pilot. A simulated aircraft instrument panel is utilized. The system contains additional units for the electronic piloting, an oscillograph for a photographic record and a loop oscillograph for recording the functions of behavior. The trainee was given a task in a simulated performance of some phase of flight, such as take-off or landing. His performance is recorded, computerized and presented on a visual curve. The study of pilots' performance permits instructors to appraise the pilots' ability, and the system of training as well.

A67-80336
CIRCULATORY RESPONSES TO BREATH HOLDING IN MAN.
A. Jarrell Raper, David W. Richardson, Hermes A. Kontos, and John L. Patterson, Jr. (Va. Med. Coll., Dept. of Med., Richmond).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 201–206. 14 refs. NHI supported research.
(Grants NIH H-3361, HTS-5573, PO 7 FR 00016-04, and HTS-5573.

Human circulatory responses to voluntary breath holding were studied following preparation with prolonged hyperventilation or 10 min. of 100% oxygen breathing. Heart Rate (HR), mean arterial blood pressure (MBP), chest circumference, end-tidal carbon dioxide tensions, and bilateral forearm blood flow (FBF) were recorded continuously before and during voluntary breath holding in the resting end-tidal chest position. One forearm received 10 mg. intra-arterial phenoxybenzamine. Arterial blood samples analyzed with electrodes demonstrated that hypoxia alveolar oxygen tension (PA_{O_2} 19–50 mm. Hg) occurred during breath holding after oxygen breathing. HR, MBP, and FBF were not significantly altered by the breath holding either with or without development of hypoxia, nor was there a significant difference between the response of the intact and phenoxybenzamine-treated arms. Marked transient increases in HR and FBF followed initiation of hyperventilation, and breath holding at the peak of this response was associated with a large decrease in FBF and heart rate. Thus no evidence was found of oxygen-conserving reflexes when brief hypocapnia and large changes in intrathoracic pressure were avoided.

A67-80337
HEMODYNAMIC AND METABOLIC EFFECTS OF BETA-ADRENERGIC BLOCKADE IN EXERCISING DOGS.
Robert F. P. Cronin (McGill U., Dept. of Physiol. and Montreal Gen. Hosp., Dept. of Med., Div. of Cardiol., Canada).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 211–216. 22 refs. Quebec Heart Found. supported research.

Twelve dogs were trained to run on the motor-driven treadmill at speeds of 3–9 km./hr. up a 5% incline. After training, chronic indwelling catheters were placed in the aorta and pulmonary artery. Each animal was studied at rest and after 8 min. of exercise at 3, 6 and 9 km./hr. and the studies repeated after beta-adrenergic blockade had been induced by intravenous administration of 0.25 mg./kg. propranolol. Beta-adrenergic blockade had been induced by intravenous administration of 0.25 mg./kg. propranolol. Beta-adrenergic blockade caused no significant alteration in mean aortic or pulmonary artery pressure at any exercise level, but rise in heart rate and increase in cardiac output (measured by the dye-dilution technique) were significantly less at the highest exercise level. By sampling arterial and mixed venous blood it was shown that the reduction in cardiac output following adrenergic blockade was almost entirely compensated for by a widening of the arteriovenous O_2 difference. Beta-adrenergic blockade had no effect on the response of arterial pH and carbon dioxide tension to graded exercise. The rise in arterial free fatty acid and lactate concentrations and in the lactate pyruvate ratio, which occurs normally in dogs during exercise of this length and severity, was completely abolished by beta-adrenergic blockade.

A67-80338
CARDIOVASCULAR RESPONSES TO CARBON DIOXIDE BEFORE AND AFTER BETA-ADRENERGIC BLOCKADE.
Michael G. Wendling, John W. Eckstein, and Francois M. Abboud (Iowa, U. Coll. of Med., Dept. of Internal Med., Cardiovascular Res. Labs., Iowa City).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 223–226. 13 refs.
Grants NIH HE-02644, HE-09835, and NHI HE-K6-4626, HE-K3-17013; Iowa Thoracic Soc. supported research.

Measurements of circulatory responses to breathing 10% CO_2 were made on 30 dogs anesthetized with chloralose and urethan. Breathing CO_2 for 10 min. caused peripheral vasoconstriction, increased arterial pressure, and decreased cardiac output in the first group of seven dogs. Observations were made in a second group of 14 dogs after treatment with hexamethonium to inhibit cardiovascular reflexes. In these, CO_2 caused peripheral vasodilatation, decreased arterial pressure, and increased cardiac output. Observations were made in a third group of nine dogs treated with hexamethonium after having administered propranolol (Inderal), a beta-adrenergic blocking agent. The dose of propranolol employed was sufficient to block the vascular and cardiac effects of large intravenous infusions of isoproterenol and the cardiac effects of electrical stimulation of the stellate ganglion. This dose of propranolol did not block the vasodilatation and increased cardiac output which occurred in response to carbon dioxide suggesting that these responses are not mediated through stimulation of beta adrenergic receptors.

A67-80339
RESPIRATORY MECHANICS AND PULMONARY DIFFUSING CAPACITY WITH LOWER BODY NEGATIVE PRESSURE.
Fred W. Zechman, F. Story Musgrave, Richard C. Mains, and Jerome E. Cohn (Ky. U., Med. Center, Depts. of Physiol. and Biophys. and Med., Lexington).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 247–250. 14 refs.
(Contract AF 33(615)-3311 and Grant PHS HE 08932-03.

Negative pressure (40 mm. Hg) was applied below the level of the iliac crests in five human subjects. The following measurements were made: changes in body weight measured at the head and foot, lung volumes, relaxation pressures (Pr), and pulmonary diffusing capacity (DL_{CO}) at two levels of inspired oxygen for calculation of diffusing capacity of the pulmonary membrane (Dm) and volume of the pulmonary capillary bed (Vc). The Pr at 100% vital capacity (VC) was unchanged by lower body negative pressure (LBMP) but shifted to the left (10–15 mm. Hg) as percent VC approached zero. Expiratory reserve volume increased during LBNP. Vital capacity and residual volumes were unchanged. By the end of one min. LBNP, DL_{CO} decreased from an average of 36 to 28 ml./min. per mm. Hg and Vc decreased from 89 to 60 ml. DL_{CO} and Vc remained near these levels until LBNP was removed at six min., whereupon both approached control values by the fifth min. of recovery LBNP produced a decrease in weight at the head of 600 g. Factors contributing to this change include: diaphragm displacement, compression of soft tissues, and the redistribution of blood to the lower body. Study suggests postural changes in DL_{CO} may be more related to changes in pulmonary capillary blood volume than alteration in distribution of flow.

A67-80340
TISSUE OXYGENATION DURING HEMORRHAGE IN DOGS BREATHING 1 AND 3 ATMOSPHERES OF OXYGEN
Stephen M. Cain and John M. Connolly (USAF School of Aerospace Med., Physiol. and Exptl. Surg. Branches, Brooks AFB, Tex.).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 255–259. 14 refs.

In order to see whether oxygen at high pressure (OHP) really benefited tissue oxygenation during hemorrhagic shock, two groups of eight dogs were bled to 50 mm. Hg mean arterial blood pressure after control measurements were made while both groups breathed oxygen at ambient pressure. One group remained at ambient pressure and the other was compressed to three atm. Experimental samples were taken after one hr. of hemorrhagic shock. Oxygen tention (PO_2), glucose, lactate, and pyruvate were measured in blood drawn simultaneously from a femoral artery and from femoral, hepatic, portal, and renal veins. The control data of the two groups did not differ significantly. With hemorrhage, all measurements of venous PO_2 were significantly lower than control in both groups. Arterial "excess lactate" was present in both groups during shock and was not significantly decreased by OHP. The conclusion was made that without other treatment to support perfusion, OHP did not prevent the stagnant hypoxia of hemorrhagic shock.

A67-80341
MATHEMATICAL ANALYSIS AND DIGITAL SIMULATION OF THE RESPIRATORY CONTROL SYSTEM.
Fred S. Grodins, June Buell, and Alex J. Bart (Rand Corp., Math. Dept., Santa Monica, Calif. and Northwestern U., Med. School, Dept. of Physiol., Chicago, Ill.).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 260–276. 37 refs.
Grants NIH 4-K6-HE 14,187, 5-ROI-HE 01626, and GM-09608-04.

The basic material balance relationships for the lung-blood-tissue gas transport and exchange system were expressed in a set of differential-difference equations containing a number of dependent time delays. Additional equations were written to define the chemical details of transport and acid-base buffering, concentration equilibria, and blood flow behavior. Finally a control function was written defining the dependence of ventilation upon CSF (H+) and oxygen tension at the carotid chemoceptors. A Fortran program was written for convenient digital stimulation of the dynamic system responses to a wide variety of forcings including CO_2 inhalation, hypoxia at sea level, altitude hypoxia, and metabolic disturbances in acid-base balance. Both dynamic and steady-state behavior was reasonably realistic.

A67-80342
EFFECT OF O_2 IN HIGH CONCENTRATION ON LUNG N_2 CLEARANCE CURVE IN PATIENTS WITH CHRONIC BRONCHITIS.
Gordon Cumming and J. Gareth Jones (Birmingham U., Queen Elizabeth Hosp., Dept. of Med., Great Britain).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 277–281. 17 refs.
Contract AF 61(052)775.

Lung nitrogen clearance curves have been prepared in two ways on six patients suffering from chronic bronchitis. In one study the lung nitrogen was washed out with pure oxygen; in a second study, up to four hr. later, lung nitrogen was washed out with a gas mixture containing 20% oxygen and 80% argon. Mixed expired nitrogen was measured in each breath using a mass spectrometer and analogue computer, while the ventilatory pattern was followed with a bag-in-a-box spirometer system. Comparison of the clearance curves made in the two situations was difficult, so a method was used in which the volume of nitrogen leaving the lungs after a defined quantity of ventilation was measured. Using this as an index of difference, the possible causes of difference have been analyzed. The conclusion was that it is valid to prepare lung nitrogen clearance curves using pure oxygen as the eluting gas. Differences between the pairs of curves using pure oxygen as the eluting gas. Differences between the pairs of curves were due to random variations in the tidal volume, independent of the inspired oxygen tension.

A67-80343
RESPIRATION OF DEHYDRATING MEN UNDERGOING HEAT STRESS.
Leo C. Senay, Jr. and M. L. Christensen (St. Louis U. School of Med., Mo.).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 282–286. 31 refs.
(Grants NIH HE-07075 and HE-25, 110.

Five resting nude male subjects were exposed to 43°C. DB, 28–29°C. WB for 12 hr. for one rehydration and two dehydration experiments. Body weights were taken hourly; venous blood pH, plasma osmolarity, oral temperatures (T1), respiratory rate (f), and minute volumes (VE) were obtained every two hr. No significant changes were noted for f. A significant correlation was established between ΔT_o and %ΔcH. For rehydration $\%\Delta cH = -8.96\Delta T_o - 4.05$, for dehydration, $\%\Delta\ cH = 10.39 \Delta T_o - 4.34$. No significant correlations were established for plots of %ΔVE versus %ΔcH or ΔT_o versus %ΔVE. Plots for %Δ osmolarity versus %ΔVE gave regression coefficients of −6.91 for rehydrating subjects and 5.96 for dehydrating subjects. These data on heat-exposed subjects who progressively lose approximately 5% of their body weight in 12 hr. did not support existence of an entity known as "dehydration acapnia." Observed alkalosis in these studies can be accounted for by temperature effects on respiratory mechanisms similar to those operating in hydrated individuals.

A67-80344
SWEAT INHIBITION BY CUTANEOUS COOLING IN NORMAL SYMPATHECTOMIZED AND PARAPLEGIC MAN.
Robert O. Rawson and James D. Hardy (John B. Pierce Found. Lab., New Haven, Conn.).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 287–291. 13 refs.
Grant NIH NB04516.

This study was undertaken to elucidate nervous pathways involved in inhibition of general body sweating when localized cooling is applied to the skin. A normal, lumbar sympathectomized, and paraplegic man (T-12) were heat stressed to steady-state sweating at 65–85 kcal./m^2 per hr., and their legs cooled while circulation was arrested. Trunk sweating was depressed in normal man and in the sympathectomized man with intact somatic sensory afferents 20% but not in the low-lesion paraplegic, whose sympathetic innervation was intact but who was without somatic sensation in the legs. It was concluded that the intact somatic sensory afferents are essential for the sweat inhibition demonstrated in these experiments.

A67-80345
METABOLIC REACTIONS TO WORK IN THE DESERT.
K. Klausen, D. B. Dill, E. E. Phillips, Jr., and Don McGregor (Ind. U., Dept. of Anat. and Physiol., Bloomington).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 292–296. 11 refs.
Grant PHS CD 000 56.

Oxygen consumption (VO_2) and ventilation (VE) during submaximal and maximal work were measured in comfortable environments and in dry heat. In submaximal work there was no significant change in VO_2 in heat, although it showed a trend to be lower than in a comfortable environment. In maximal work VO_2 was significantly decreased in hot environments. Blood lactate concentration 5 min. after maximal performance did not show any significant correlation with air temperature. However, a highly significant correlation was found between work time and blood lactate and between maximum VO_2 and blood lactate. In dry heat the decrease in VO_2 in maximal work and probably also in higher levels of submaximal work very likely reflects an insufficient blood supply to the working muscles.

A67-80346
PLASMA ENZYMES IN RELATION TO ALDOSTERONE ADMINISTRATION AND HEAT ACCLIMATIZATION IN RATS.
E. Bedrak, R. Hammer, and S. Goldberg (Negev Inst. for Arid Zone Res., Dept. of Environ. Physiol. and Kupat Cholim Hosp., Dept. of Clin. Biochem., Beersheva, Israel).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 297–300. 22 refs.

Acclimatization of mammals to a hot environment is accompanied by an increased output of aldosterone and enhanced activity of several blood enzymes, yet the role of aldosterone in activation of the blood enzymes has not been fully elucidated. In this investigation the activity of several plasma enzymes was studied in groups of rats treated separately with 2 μg D-aldosterone monoacetate per gram body weight, 0.6 μg

adrenaline per gram body weight, exposure to heat stress, or acclimatization to a hot environment without physical activity. A single injection of aldosterone produced a rise in the level of glutamic oxalacetic transaminase (GOT), ($P<0.05$) and glutamic pyruvic transaminase (GPT) ($P<0.01$) with insignificant changes in lactic dehydrogenase (LDH). While the enzymic responses in rats exposed to heat stress were lower than those observed in animals treated with a single aldosterone injection, a single adrenaline administration elevated ($P<0.01$) the values of GOT, GPT, and LDH. Prolonged administration of aldosterone elicited a marked rise in GOT and only a slight one in LDH which was similar to the value of GOT ($P<0.05$), GPT ($P<0.01$), and LDH observed in heat-acclimatized animals. Electrophoretic studies revealed that chronic aldosterone treatment and heat acclimatization did not produce abnormal plasma LDH isoenzyme pattern.

A67-80347
EFFECTS OF DRUGS ON HEAT ACCLIMATIZATION BY CONTROLLED HYPERTHERMIA.
R. Goldsmith, R. H. Fox, and I. F. G. Hampton (Natl. Inst. for Med. Res., London, Great Britain).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 301–304. 13 refs.

Experiments were performed to investigate the influence of aspirin, hyoscine, and pilocarpine, administered orally, on the process of heat acclimatization. Forty male subjects took part. Heat acclimatization was effected by a series of controlled hyperthermia sessions during which sweat and pulse rates were measured under the influence of the drugs. Acclimatization status was assessed at the beginning and end of the experiments by comparing the effects of a standard work-in-the-heat test on sweat and pulse rates and rises in body temperatures. The administration of aspirin (1 g.) had no significant effect on either sweat or pulse rates. Pilocarpine (16 mg.) did not significantly effect sweat rate, though it did increase the pulse rate at raised body temperature. Hyoscine (2 mg.) depressed the sweat rate significantly during controlled hyperthermia, and consequently retarded the development of heat acclimatization.

A67-80348
LOCAL XENON 133 CLEARANCE FROM THE QUADRICEPS MUSCLE DURING EXERCISE IN MAN.
Gunnar Grimby, Egil Häggendal, and Bengt Saltin (Goteborg U., Dept. of Clin. Physiol., Sweden).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 305–310. 17 refs. Swed. Natl. Assn. against Heart and Chest Diseases and Forenade Liv (United Life Group Insurance Co.), Stockholm, Sweden supported research.

Muscle blood flow (MBF) in the lateral portion of m. quadriceps was measured at rest and during exercise on a bicycle ergometer at three submaximal and one maximal work loads in 15 young males, 7 untrained (V_{O_2} max 3.3 liters/min.) and 8 trained (V_{O_2} max 4.5 liters/min.) subjects. The flow was measured by the local injection technique and the injections of ^{133}Xe were repeated for every flow calculation. The elimination rate was recorded for 15 min. at rest and during submaximal loads, and for at least 4 min. during maximal work. The elimination curves during exercise were usually evaluated using two exponential functions. The fast component contained an average 83% of the injectate and has been considered a function of the blood flow to the muscle fibers. The muscle blood flow increased gradually with increasing work levels, but when approaching maximal work levels, there was a tendency to a declining rate in flow increase. Trained and untrained subjects had identical MBF at equal relative work loads. Mean values for MBF were 15, 28, 43, and 49 ml./(100 g. X min.) at work loads corresponding to 24, 48, 75 and 99% of individual maximal oxygen uptake.

A67-80349
CATHETER-TIP MANOMETER FOR MEASURING BLOOD PRESSURE DURING G CHANGES.
Heinz P. Pieper (Ohio State U., Dept. of Physiol., Columbus).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 352–353. 6 refs.
Grant PHS HE-06593-05.

A catheter-tip manometer is attached to a no. 7 cardiac catheter and contains two independent differential transformer systems. While both systems are affected by acceleration, only one system responds to blood pressures. Thus, the difference in the output of the two systems results in a pressure reading unaffected by g changes.

A67-80350
MINIATURE PELTIER EFFECT HEAT EXCHANGER FOR EXTRACORPOREAL CIRCULATION.
John Krog and Robert E. Smith (Ky. U., Dept. of Physiol. and Biophys., Lexington).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 354–357. 9 refs.
Contract AF 41(609)2684.

A miniature heat exchanger for extracorporeal circulation system is described which utilizes Peltier effect semiconductors as heat pumping devices, in contrast to the traditional use of circulating water as heat source or sink. This unit has proven capable of providing rapid heating and cooling of circulating blood with minimal thermal lag. It is capable of precise control, immediate reversal of direction of heat flow, and is readily adapted to automatic control. It introduces a minimum of dead space into the extracorporeal circulatory system and is readily cleaned.

A67-80351
MEASUREMENT OF CARDIAC OUTPUT BY TWO METHODS IN DOGS.
F. Norman Hamilton, J. C. Minzel, and Richard M. Schlobohm (Providence Hosp., Anesthesia Res. Labs., Seattle, Wash.).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 362–364. 20 refs.
Grants NIH NB 03996-03 and HE 05959-03; Wash. State Heart Assn. and Eli Lilly Co. supported research.

The cardiac outputs in seven dogs were compared as measured by the indocyanine green dye-dilution method and the chronically implanted probes of the electromagnetic flowmeter. A total of 75 outputs was recorded at widely varying cardiac outputs. Results indicated that the coefficient of variance of the differences was 20%. The inherent errors of the two methods are discussed.

A67-80352
POLYGRAPH MEASUREMENTS OF RESTRAINED RODENTS.
Charles G. Maresh, Fred J. Weibell, Charlotte A. Vivonia, and William G. Clark (Veterans Admin. Hosp., Western Res. Support Center and Psychopharmacol. Res. Labs., Sepulveda, Calif. and Calif. U., Center for Health Sci., Dept. of Biol. Chem., Los Angeles).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 365–371. 233 refs.
Grants NIH MH-03663-06 and ALP 843; Veterans Admin. supported research.

Simultaneously recorded physiological parameters of as many as 20 unanesthetized animals are demonstrated in a specially designed constant-temperature chamber which isolates the subjects visually, acoustically, and electrically from the external environment. It is exemplified by an instrument described

for recording temperature and heart rates. Improved plastic restraining devices for rats and mice and suture clip electrodes are described and pictured. Circuit diagrams and electronic data for the internal wiring of the chamber and for a cardiotachometer, which has a range of 100–1,000 beats/min. and is actuated by the R wave of the electrocardiogram, are explained in detail.

A67-80353
A VERSATILE SYSTEM FOR MEASURING OXYGEN CONSUMPTION IN MAN.
Robert E. Johnson, Frances Robbins, Renold Schilke, Paul Mole, Janet Harris, and Diane Wakat (Ill. U., Dept. of Physiol. and Biophys., Human Environ. Res. Unit, Urbana).
Journal of Applied Physiology, vol. 22, Feb. 1967, p. 377–379.
NASA Grant 14-005-050 and Ill., U. supported research.

A system is described for measuring the oxygen consumption of men at rest, during moderate work, or during heavy work. Expired air, measured and sampled from a suitable respirometer, is collected in metalized poly-ethylene bags. Carbon dioxide does not diffuse measurably from these in several hours. For analysis, gas is drawn successively through a drying column, a paramagnetic oxygen meter, and a thermal conductivity CO_2 meter. Alveolar air may be analyzed directly. Calculation sheets suitable for computer programs are given for respiratory exchange and the metabolic mixture.

A67-80354
A DIURNAL RHYTHM IN PLASMA RENIN ACTIVITY IN MAN.
Richard D. Gordon, Lawrence K. Wolfe, Donald P. Island, and Grant W. Liddle (Vanderbilt U., School of Med., Dept. of Med., Nashville, Tenn.).
Journal of Clinical Investigation, vol. 45, Oct. 1966, p. 1587–1592. 20 refs
Grants NIH 5-K6-AM-3782. 8MO1-FR-95. T1-AM-5092. and 5-RO1-AM-05318.

Plasma renin activity of recumbent normal subjects exhibits a diurnal rhythm that is not dependent upon diurnal variations in posture or diet. Highest values are observed between 2 a.m. and 8 a.m. and lowest values between noon and 6 p.m. A change from recumbency to upright posture leads to a greater increase in plasma renin activity in the forenoon than it does in the afternoon. The posturally induced increase in plasma renin activity can be prevented by bandaging the lower abdomen, hips, and lower extremities. When a normal subject rises at 8 a.m., his plasma renin activity increases to peak values at 10 a.m. or noon and then falls despite continuation of upright posture. The afternoon fall in plasma renin activity is not dependent upon changes in adrenocortical function, nor is it entirely dependent upon retention of salt and water during the forenoon. In subjects who are upright during the day, the diurnal rhythm mechanism appears to work in combination with postural factors to elevate plasma renin activity in the forenoon and to work in opposition to postural factors to depress plasma renin activity in the afternoon.

A67-80355
THE EFFECTS OF DIET AND STOOL COMPOSITION OF THE NET EXTERNAL ACID BALANCE OF NORMAL SUBJECTS.
Edward J. Lennon, Jacob Lemann, Jr. (Milwaukee County Hosp., Wis.), and John R. Litzow (Marquette U., School of Med., Clin. Res. Center and Dept. of Internal Med., Milwaukee, Wis.).
Journal of Clinical Investigation, vol. 45, Oct. 1966, p. 1601–1607. 7 refs.
Grants PHS RO1 AM 08924, 5 MO1 FR00058, and 2 T1 AM 5023 (e).

To determine whether total effective fixed acid production could be measured in subjects eating whole food diets, sixteen metabolic balance studies were carried out using three types of diets during periods when blood pH and serum bicarbonate were normal and stable. Urinary inorganic sulfate and organic acid salts were measured as indices of acid production. In addition, organic anions in excess of organic cations, or the converse, in both the diet and the feces were estimated as the difference between the sum of inorganic cation ($Na^+ + K^+ + Ca^{++} + Mg^{++}$) and the sum of inorganic anion [$Cl^- + 1.8P$ (mmoles)]. Excess organic anions or cations in the diet were assumed to represent potential alkali or acid, respectively. The excess organic anions present in all stools were assumed to represent loss of potential alkali. Total effective acid production was calculated as the sum of urinary inorganic sulfate and organic acid salts minus diet organic anions less fecal organic anions. Good agreement was found when acid production calculated in this way was compared with the quantity of acid simultaneously excreted by the kidney, measured as urinary titratable acid plus ammonium minus bicarbonate.

A67-80356
THE EFFECTS OF CHRONIC ACID LOADS IN NORMAL MAN: FURTHER EVIDENCE FOR THE PARTICIPATION OF BONE MINERAL IN THE DEFENSE AGAINST CHRONIC METABOLIC ACIDOSIS.
Jacob Lemann, Jr. (Milwaukee County Hosp., Wis.), and John R. Litzow (Marquette U., School of Med., Clin. Res. Center and Dept. of Internal Med., Milwaukee, Wis.).
Journal of Clinical Investigation, vol. 45, Oct. 1966, p. 1608–1614. 10 refs.
Grants PHS RO1 AM 08924, 5 MO1 FR-00058, and 2 T1 AM5023 (e).

Metabolic balance studies were performed in normal subjects to investigate the nature of the buffers utilized in the defense against chronic ammonium chloride acidosis and to determine the mechanisms responsible for the ultimate disposal of the administered acid. Initially, as in studies of acute metabolic acidosis, acid was retained and appeared to titrate extra- and intracellular buffer systems. As acid retention continued, intracellular and bone buffers and, finally, bone mineral alone, appeared to provide additional buffer reserves. When the acid load was stopped, extra- and intracellular buffers appeared to be promptly restored, but less than one-third of the observed calcium losses was replaced during observations that lasted as long as 42 days after NH_4Cl loading was stopped. The constant whole food diets used in these experiments provided a significant quantity of potential alkali as combustible anions, and during acid loading the fecal excretion of organic anions declined significantly. During NH_4Cl loading, net fixed acid production was increased by an average of 3,425 mEq. Most of this acid load was excreted by the kidneys, but at the end of 12 recovery days an average of 193 mEq of the acid fed had not been excreted in the urine, despite the return of the serum bicarbonate to stable control levels. The simultaneous calcium balances averaged −185 mEq, supporting the previous suggestion that bone mineral is an important buffer reservoir in the defense against chronic metabolic acidosis.

A67-80357
STANDARDS OF PHYSICAL FITNESS OF AIRCREW.
(Am. Coll. of Cardiol., First Bethesda Conf., Bethesda, Md., Nov. 6 and 7, 1965).
American Journal of Cardiology, vol. 18, Oct. 1966, p. 630–636.

Recommendations on the aircrew selection based on the cardiac and circulatory state of each individual are presented as reflecting a discussion at The First Bethesda Conference of the

American College of Cardiology, November 1965. With an increase in the pilots' upper age limit for commercial licenses the incidence of potential cerebral and cardiac accidents is increasing. Therefore, it would be necessary to initiate a closer supervision of pilots' health by a regular system of physical check-ups in order to prevent any air accidents due to health failure. Particular attention should be paid to the various forms of coronary artery diseases, cardiac arrhythmias, hypertension and cardiac murmurs. Exceptions to the proposed recommendations may be permitted, a properly chosen panel should review cases and make decisions. Valuable aid can come from the participation of Federal Air Surgeons, Federal Aviation Agency and certain international organizations in order to supervise the non-American pilots, as well as the American crews.

A67-80358
USE OF NICOTINIC ACID IN COLD INJURY: AN EXPERIMENTAL STUDY.
J. R. Talwar, S. M. Gulati, B. M. L. Kapur, and M. V. Sood (All India Inst. of Med. Sci., Cold Injury Res. Lab., New Delhi, India).
Journal of Surgical Research, vol. 6, Oct. 1966, p. 435–440. 19 refs.
Indian Council of Med. Res. supported research.

Cold injury was produced by immersing the rabbits' hind limbs in a mixture of ice and alcohol at a temperature of −5°C. to −10°C. for two hours. The limb was thawed slowly at the room temperature. Extent of damage was classified into six degrees, depending upon tissue survival. The efficacy of nicotinic acid, 10 to 20 mg. per kilogram of body weight, administered orally in three divided doses, was studied in different groups of rabbits. Nicotinic acid proved useful in reducing or preventing the damage caused by local cold injury in rabbits. Some possible explanations for this beneficial effect are discussed.

A67-80359
EFFECTS OF CONTINUOUS EXPOSURE OF 0.8 PPM NO_2 ON RESPIRATION OF RATS.
G. Freeman, N. J. Furiosi (Stanford Res. Inst., Dept. of Med. Sci., Menlo Park, Calif.), and G. B. Haydon (Palo Alto Med. Res. Found., Calif.).
Archives of Environmental Health, vol. 13, Oct. 1966, p. 454–456. 9 refs.
Grant HEW OH 00084.

Rats were exposed during their natural lifetimes to 0.8 p.p.m. of NO_2 and examined for clinical and anatomical changes. They grew normally and their behavior was similar to that of controls, except for a sustained elevation in respiratory rate of about 20%. Tachypnea began almost immediately upon exposure and became exaggerated during the latter part of life. Occasional minimal changes in morphology of bronchiolar epithelial cells were not accompanied by either microscopic or gross criteria of obstructive disease. The persistent tachypnea suggests, however, that exposure of a species with a longer life span might develop lesions like those in the rat breathing concentrations greater than 0.8 p.p.m. Also, adjunctive pollutants and diseases in man may enhance the effects of low concentrations.

A67-80360
NEUROPHYSIOLOGICAL CORRELATES OF BRIGHTNESS DISCRIMINATION IN THE LATERAL GENICULATE NUCLEUS OF THE SQUIRREL MONKEY.
Barbara A. Brooks (Yerkes Lab. of Primate Biol., Orange Park, Fla.).
Experimental Brain Research, vol. 2, Aug. 2, 1966, p. 1–17. 27 refs.
Grants PHS H-5691, FR-00165, FR-05235, FR-00164, and NB 04951-01.

Incremental brightness thresholds (DI) were psychophysically determined at several background illumination intensities for three squirrel monkeys. Gross asymmetrical electrodes were then chronically implanted in the lateral geniculate nucleus of the same animals, and activity was recorded in stimulus conditions identical to behavioral testing. Overall activity, recorded through an integrating voltmeter, showed (1) a tendency to decrease as steady background illumination increased, and (2) an abrupt transient increase at both onset and offset to DI test flashes, directly proportional to test flash intensity. Background illumination in proportion to its intensity, depressed response to a superimposed test flash. Test flashes below intensity DI at the various levels of background illumination produced no measurable response. The quantity DI was shown to be a function of the depressive or inhibitory effect of background illumination on the capacity of the system to respond to transient stimulation. A secondary determinant of DI appeared to be the amount of variability in ongoing neural activity upon which the DI flash is imposed.

A67-80361
SOME EFFECTS OF CHLORAMPHENICOL ON THE METABOLISM OF CHLORELLA. I. THE EFFECT ON PROTEIN, POLYSACCHARIDE AND NUCLEIC ACID SYNTHESIS.
I. Morris (London U. Coll., Dept. of Botany, Great Britain).
Archiv für Mikrobiologie, vol. 54, Jul. 26, 1966, p. 160–168. 11 refs.

Chloramphenicol at concentrations of 1–3 mg. per ml. does not show specific inhibition of protein synthesis in *Chlorella pyrenoidosa*. Thus, although incorporation of ^{14}C-labelled phenylalanine, carbon dioxide and glucose into the protein fraction is inhibited by chloramphenicol, the antibiotic also prevents incorporation of ^{14}C-carbon dioxide and ^{14}C-glucose into polysaccharide, together with incorporation of ^{14}C-adenine into RNA and DNA fractions. The inhibitory effects are not specific for macromolecule biosynthesis since incorporation of ^{14}C-carbon dioxide and ^{14}C-phenylalanine into an alcohol-soluble fraction, and that of ^{14}C-adenine into a cold acid-soluble fraction are also inhibited. Incorporation of ^{14}C-glucose into the alcohol-soluble fraction, and incorporation of ^{14}C-uracil into the cold acid-soluble and RNA fractions are sensitive to the antibiotic. The respiration of ^{14}C-glucose is inhibited by only 20% with a chloramphenicol concentration of 3 mg. per ml.

A67-80362
SOME EFFECTS OF CHLORAMPHENICOL ON THE METABOLISM OF CHLORELLA. II. THE EFFECT ON PERMEABILITY AND ON THE INTERNAL CONCENTRATION OF ADENOSINE TRIPHOSPHATE (ATP).
I. Morris (London U. Coll., Botany Dept., Great Britain).
Archiv für Mikrobiologie, vol. 54, Jul. 26, 1966, p. 169–176. 16 refs.

A chloramphenicol concentration of 3 mg. per ml. inhibits uptake of ^{14}C-labelled phenylalanine, lysine, and adenine by *Chlorella pyrenoidosa* cells. Incorporation into both the free "pool" and the TCA insoluble fraction is inhibited. The inhibition is not related to inhibition of protein synthesis since cycloheximide (a specific inhibitor of protein synthesis in *Chlorella*) does not inhibit uptake of the ^{14}C-labelled amino acids. Uptake of ^{14}C-uracil is not inhibited by chloramphenicol. Both chloramphenicol and 2.4-dinitrophenol stimulate endogenous respiration of *Chlorella*, but whereas the latter reduces the internal concentration of ATP, the former (in concentrations of 1–3 mg./ml.) stimulates it about two-fold. Similar concentrations of chloramphenicol decreases slightly the concentration of ADP, and it therefore suggested that in *C. pyrenoidosa* chloramphenicol concentrations of 1–3 mg./ml. inhibit some energy-linked reactions by preventing ATP utilization.

A67-80363
RETINAL DAMAGE BY LIGHT IN RATS.
Werner K. Noell, Virgil S. Walker, Bok Soon Kang, and Steven Berman (N. Y. State U., School of Med., Dept. of Physiol. and Neurosensory Lab., Buffalo).
Investigative Ophthalmology, vol. 5, Oct. 1966, p. 450–472; discussion, p. 472–473. 23 refs.
Grant NIH NB 06027-01 and Buffalo Eye Bank, Inc. supported research.

Eyes of anesthetized rats were exposed diffusely to either the light from a 100 w. zirconium arc passing through filters or monochromatic light of various wavelengths. Irreversible reduction in ERG amplitudes and degeneration of visual cells and pigment epithelium indicated the severity of the light damage. The effect was very dependent upon the body (eye) temperature during exposure. Hyperthermia greatly accelerated and intensified the damaging action of light and for this reason most experiments reported in this paper were performed at a high body temperature. At a body temperature around 104°F. severe damage was produced with exposures to 5 to 10 μw per square centimeter of retina for one hour. The minimal damaging dose at a high temperature was estimated to be about 1 μw per square centimeter. The action spectrum of the damaging effect approximated that of visual excitation as measured by the ERG. Hooded (pigmented) animals were no more affected than albinos of different strains. Recovery in the dark from a just subliminally damaging dose of light at a high body temperature required about 24 hours and was preceded by a period of time during which the retina was "sensitized" to an additional dose. During or following exposure to light at a high body temperature visual cell and pigment epithelial damage developed about simultaneously and was first indicated by pyknosis and cell swelling followed rapidly by the dissolution of nuclei and cytoplasm.

A67-80364
RUBY LASER EFFECTS ON THE MONKEY EYE.
Arthur E. Jones and Alan J. McCartney (U. S. Army Med. Res Lab., Fort Knox, Ky.).
Investigative Ophthalmology, vol. 5, Oct. 1966, p. 474–483. 14 refs.

Laser pulses of moderate energy but of large retinal subtense produce significantly different retinal lesions than a clinical type of exposure of high energy density and small retinal subtense. A retinal photocoagulation that leads to a satisfactory retinal adhesion, whether produced by white light or laser, is characterized by sharp boundaries, coagulation necrosis of the entire retinal exposure area, and migration of pigment into the area of insult. A low energy density retinal burn of large retinal area is frequently not visible ophthalmoscopically. Histologically, the lesion is not demarcated by sharp boundaries, little coagulation necrosis is seen, and eventually the entire retina becomes involved. Pulsed ruby laser radiation was presented in Maxwellian view to the intact monkey eye. The pulse duration was about 2.0 msec. and the flash energy was varied between 1 and 250 joules. Gross damage to the globe was characterized by corneal pitting, lenticular disruption, bubbles and hemorrhage in the vitreous, and loss of light reflex. Energy levels above 100 joules produced a marked degree of periorbital edema. Histological observations revealed extensive primary damage in the pigment epithelium and choroid and secondary retinal detachment and degeneration peripheral to the area exposed. Progressive retinal detachment and dedifferentiation secondary to the laser lesion are found to occur for a considerable time post exposure.

A67-80365
HOW TO KEEP HAPPY AND HEALTHY IN SPACE.
Angela Croome.
New Scientist, vol. 32, Oct. 20, 1966, p. 76–77.

Observations on the effects of spaceflight on man as reported at the 17th International Astronautical Federation Congress in Madrid show significant changes involving the cardiovascular, hematopoietic, and musculoskeletal systems. A new spaceflight problem was encountered during extravehicular activity (EVA) associated with the Gemini series (G-9 and G-11). American astronauts with EVA experience reported that work involving any task outside the orbiting spacecraft was roughly four times as hard as the same task performed in a pressurized suit on the ground. Further, body stabilization problems experienced during actual space-walks proved more severe than those encountered during simulation exercise. Energy expenditure was higher and heart rates reached 180 beats per min. Mention is made of changes in techniques and equipment for future space flights and the difficulties to be encountered by the Apollo lunar surface excursion scheduled for 1969. The Russians reported their interest in drug use for radiation protection and alleviating some physiological reactions.

A67-80366
CURRENT CONCEPTS OF CORONARY ARTERY DISEASE IN A YOUNG AIRCRAFT POPULATION: A SURVEY OF THE LITERATURE.
J. Gordon Webster and A. A. Hoffman (USAF Hosp. Andrews, Malcolm Grow USAF Clin. Center, Washington, D. C.).
American Journal of Cardiology, vol. 18, Oct. 1966, p. 637–640. 10 refs.

Compilation of data from aircraft accident fatalities at the Armed Forces Institute of Pathology together with those fatalities studied by Mason in the RAF leads to the conclusion that, although underlying coronary artery atherosclerosis and myocardial fibrosis may be found at autopsy following an air crash, the degree of disease present may permit continued function and may be in no way the cause of death. Furthermore, association of completely occluded coronary artery and sudden death in a yound man must not be considered necessarily cause and result. The authors reviewed point out that great caution must be exercised on the part of the pathologist in the interpretation of cardiac findings in aircraft accident cases. The material studied so far does not indicate that the significance of coronary artery disease in "young" men involved in accidents is any greater than that of chance association. The data do not support a contention that large numbers of young men with some degree of subclinical coronary artery disease should be eliminated from duties as aircrew members. In reinforces the concept that an early attempt should be made to establish, by electronic or chemical means, baseline values such as electrocardiographic criteria, in flying personnel in order that progression in subclinical disease may be detected early in those aircrew members who shoulder great responsibility in their operational duties.

A67-80367
THE SPECTRAL SENSITIVITY OF THE HUMAN ELECTRORETINOGRAM DURING THE TEMPORAL COURSE OF DARK-ADAPTATION.
Allen M. Granda and William R. Biersdorf (Walter Reed Army Inst. of Res., Washington, D. C.).
Vision Research, vol. 6, Oct. 1966, p. 507–516. 16 refs.

Threshold curves derived from the b-wave of the electroretinogram show similarities to analogous psychophysical data. There is an immediate decrease in threshold for the first minute and then a leveling off at about 8–12 min., depending on the color of the stimulus light. For shorter wavelengths there is a clear break in the curve, the threshold decreasing again and becoming asymptotic between 22 and 30 min. This total change of threshold covers a range of over 3 log units. With longer wavelengths, the break in the curve is scarcely evident. Peak latency curves of threshold responses show pronounced breaks for all tested wavelengths. The a-wave at this time shows scotopic

plus elevated middle and long wavelength activity. For both waves, with more time in the dark, the longer wavelength processes tend to diminish in sensitivity. The spectral curves here tend to conform more closely to the scotopic function.

A67-80368
HORMONE-FUEL INTERRELATIONSHIPS DURING FASTING.

G. F. Cahill, Jr., M. G. Herrera, A. P. Morgan, J. S. Soeldner, J. Steinke, P. L. Levy, G. A. Reichard, Jr., and D. M. Kipnis (Harvard Med. School, Depts. of Med. and Surg., Elliott P. Joslin Res. Lab., Peter Bent Brigham Hosp., and Diabetes Found., Inc., Boston, Mass.).

Journal of Clinical Investigation, vol. 45, Nov. 1966, p. 1751–1769. 82 refs.

Grants DA-49-139-MD-2337, PHS AM-9584-01, AM-09748-01, 8 MOI-FR-31-05, TI-AM-5077-10, and 5-ROI-AMO-2657; Adler Found., Inc. and John A. Hartford Found, supported research.

Levels of insulin, growth hormone, and various metabolic fuels were followed throughout a one-week fast in six normal subjects and two patients with maturity-onset diabetes. The data from the normal individuals are compatible with the hypothesis that the glucose-insulin feedback mechanism may be the primary control process regulating the release of peripheral fuel to provide energy for metabolism during fasting. Marked variabilities in growth hormone levels and lack of correlation of growth hormone with other parameters diminish its apparent importance in the fasting process. Metabolic balances and glucose turnover studies were performed and demonstrate again the predominance of lipid as fuel and emphasize the diminution of glucose metabolism, which, in turn, spares nitrogen stores as gluconeogenesis decreases.

A67-80369
PULMONARY VASCULAR DISTENSIBILITY AND LUNG COMPLIANCE AS MODIFIED BY DEXTRAN INFUSION AND SUBSEQUENT ATROPINE INJECTION IN NORMAL SUBJECTS.

Carlo Giuntini, Attilio Maseri, and Romano Bianchi (Pisa U., Natl. Res. Council, Inst. of Med. Clin., Center of Nucl. Med. and Group of Clin. Physiol., Italy).

Journal of Clinical Investigation, vol. 45, Nov. 1966, p. 1770–1789. 89 refs.

Contract AEC AT(30-1)-2648.

The distensibility of the pulmonary circulation was studied in 17 subjects, all but one of whom had normal pulmonary circulation. They were studied in the supine position after dextran infusion and subsequent atropine injection. In a separate group of five subjects, lung mechanics were investigated under the same conditions. An average of 1,100 ml of a 6% solution of dextran in saline was infused into each subject at a mean rate, of 54 ml per minute. The variations of pulmonary vascular distensibility and lung compliance after dextran infusion and subsequent atropine injection are mainly due to changes of the pulmonary vascular and parenchymal smooth muscle tone. By exclusion of other possible mechanisms, we may advance the hypothesis that a reflex may be responsible for the above changes. Accordingly, and since no direct muscular or parasympatholytic dilating action of atropine on the pulmonary vasculature is at present recognized, we suggest that the effect of atropine on the pulmonary vasculature is at present recognized, we suggest that the effect of atropine on the pulmonary vessels is mediated through a reduction of the intravascular pressure, which is ascribed, in turn, to the parasympatholytic action of the drug that apparently improves the ventricular performance under these experimental circumstances.

A67-80370
REDUCTIONS IN CARDIAC OUTPUT, CENTRAL BLOOD VOLUME, AND STROKE VOLUME WITH THERMAL STRESS IN NORMAL MEN DURING EXERCISE.

Loring B. Rowell, Herbert J. Marx, Robert A. Bruce, Robert D. Conn, and Fusako Kusumi (Wash. U., Dept. of Med., Div. of Cardiol., Seattle).

(Am. Heart Assn., 38th Sci. Sessions, Miami Beach, Fla., Oct. 155, 1965).

Journal of Clinical Investigation, vol. 45, Nov. 1966, p. 1801–1816. 34 refs.

Grants PHS HE-00908-C14, FR-37, and T1-HE-5281.

Cardiac output, central blood volume (CBV), oxygen consumption, and heart rate were determined in six normal young men unacclimatized to heat in response to exercise at 25.6°C. (78°F.) and 43.3°C (110°F.). Seven measurements of cardiac output were made in each man during each of four intensities of exercise at 25.6°C. and repeated three to four weeks later in the same men at 43.3°C. Oxygen consumption during exercise was unaffected by ambient temperature; heart rates were markedly elevated at 43.3°C. During each 15-min. period of exercise cardiac output showed a small but highly significant increase with time. Heart rate also increased with time, but oxygen intake stayed constant. Cardiac output was very significantly decreased by high ambient temperature. At the two lower work loads the decrease was very small. With increasing severity of exercise the reduction in caridac output became more pronounced (1,130 to 1,240 ml. per min.). At the two lower levels of exercise at 43.3°C., CBV was reduced 16% below control values at 25.6°C. Decrements in CBV were closely paralleled by percentage decreases in stroke volume (also 16%). Reduction in CBV was related to decrements in mean transit time rather than to changes in cardiac output. At the two higher work loads CBV and stroke volumn were still reduced, but reduction in the latter became more pronounced.

A67-80371
A "CIRCANNIAN" RHYTHM IN HIBERNATING SPECIES OF THE GENUS CITELLUS WITH OBSERVATIONS ON THEIR PHYSIOLOGICAL EVOLUTION.

E. T. Pengelley and K. H. Kelly (Calif. U., Dept. of Life Sci., Riverside).

Comparative Biochemistry and Physiology, vol. 19, Nov. 1966, p. 603–617. 34 refs.

Grant NSF GB-2155; Riverside County (Calif.) Heart Assn., Kaiser Found., and Calif. U. supported research.

Continuous hibernation or estivation in the ground quirrels, *Citellus lateralis, C. mohavensis, C. tereticaudus, C. variegatus* and *C. beecheyi* never exceeds about two weeks. The frequency of arousal is a function of the ambient temperature, through in the latter four species not necessarily a direct one. A theory is proposed to explain this phenomenon. An endogenous rhythm, termed "circannian", of about a year's duration is demonstrated in all five species. The physiological evolution of this rhythm and hibernation are discussed, and Zeitgebers speculated upon. The adaptive value of such a rhythm in the ecology of the various species is demonstrated. Neither the length of the hibernation period nor the active period seems to be affected by castration, thus arguing against gonadal atrophy or hypertrophy being a causative factor in the onset or termination of hibernation. There is a marked cyclic rise and fall in body weight of at least three species, and the whole hibernation periods are closely related to this. It is thought that this cycle is a reflection of a deeper endogenous rhythm probably functioning in the central nervous system. Subspecies of *C. lateralis* from the most northern and most southern part of its range show no difference in their physiological behavior with respect to hibernation.

A67-80372
THE AVIATION PHYSICAL.
J. F. McCluskey.
Approach, vol. 12, Nov. 1966, p. 1–8.

The annual aviation physical is essentially a thorough general examination with particular attention to the eyes, ears, and cardiovascular system. Laboratory tests are made of the blood and urine, and chest X-rays are studied to determine any active or past lung disease, conditions of the heart, windpipe, upper spine, diaphragm and ribs. In addition to recording body weight, blood pressure and pulse are taken, and their response to exercise is tested. An audiogram is made to measure hearing acuity, the degree of any present hearing damage, and the area damaged within the hearing apparatus. The eye examination includes tests of visual acuity, phorometry, prism divergence, and accommodation.

A67-80373
DIFFERENCES IN THE ACTION OF SEROTONINE, ATROPINE, AMINAZINE (CHLORPROMAZINE) AND THIOPENTAL UPON ECG OF THE RABBIT [RAZLICHIIA V DEISTVII SEROTONINA, ATROPINA, AMINAZINA I TIOPENTALNATRIIA NA ELEKTROKORTIKOGRAMMU KROLIKA].
A. Mitskis, R. Basevichius, V. Miliukas, G. Rimshene, and A. Urmonene
(Kaunas Med. Inst., Dept. of Pharmacol. and Lab. of Electroencephal., USSR).
Farmakologiia i Toksikologiia, vol. 29, Sep.–Oct. 1966, p. 543–546. 19 refs. In Russian.

In acute experiments on curarized rabbits, the action of atropine (5 mg./kg.), chlorpromazine (5 mg./kg.), serotonine (500μg.) and sodium thiopental (20 mg./kg.) was studied upon the electro-corticogram (ECoG) in the occipital region. All these substances were injected intravenously, except for serotonine, which was introduced into the brain ventricles. During development of a high-amplitude slow activity, which remained unchanged in a certain period of time, the number of extremes in all instances continued to be decreased in the following order: atropine, chlorpromazine, thiopental. In this way it was possible to detect differences in the action exerted by the studied substances on the level of the low-amplitude high-frequency high-frequency ECoG fluctuation, which, otherwise, were not amenable to visual recording.

A67-80374
EFFECT OF PHARMACOLOGICAL AND SURGICAL EXCLUSION OF DIFFERENT SEGMENTS OF THE NERVOUS SYSTEM ON THE ACTIVITY OF DRUGS PROTECTING AGAINST RADIATION SICKNESS [VLIIANIE FARMAKOLOGICHESKOGO I KHIRURGICHESKOGO VYKLIUCHENIIA RAZLICHNYKH OTDELOV NERVNOI SISTEMY NA AKTIVNOST' RADIOPROTEKTOROV]
R. B. Strelkov L. A. Parasochko, V. I. Reshetniak (USSR, Acad. of Med. Sci., Inst. of Exptl. Pathol. and Therapy, Sukhumi).
Farmakologiia i Toksikologiia, vol. 29, Sep.–Oct. 1966, p. 571–576. 37 refs. In Russian.

The action of radioprotective drugs, cystamine (150 mg./kg.) and mexamine (75 mg./kg.) was studied in experiments on albino mice under exclusion of different segments of the nervous system (by way of anesthesia, decapitation, sympatho-and medullotomy, administration of sympatholytic and cholinolytic agents). Anesthesia and removal of the brain cortex and the adjacent subcortex were shown not to influence the radioprotective action of cystamine and mexamine, whereas the separation of sympathetic trunks and of the spinal cord, as well as introduction of the central sympatholytic agent, chlorpromazine (12.5 mg./kg.), were seen to materially reduce the antiradiation activity of mexamine, without affecting that of cystamine.

A67-80375
NERVE CONDUCTION VELOCITY DURING HYPOTHERMIA IN MAN.
Rudolph H. de Jong, William N. Hershey, and Irving H. Wagman (Calif U., Biomech. Lab., San Francisco).
Anesthesiology, vol. 27, Nov.–Dec. 1966, p. 805–810. 15 refs. Grants NIH GM-08013 and 5T1-GM-63-06.

Conduction velocity was determined for the fastest conducting fibers of the peroneal nerve supplying the extensor digitorium brevis muscle of seven surgical patients during hypothermia. Mean nerve conduction velocity prior to induction of hypothermia 49.6±0.9 m./sec. at a mean nerve temperature of 35.5°C. The association between conduction velocity and temperature was linear above 23°C. ($P<0.001$). Conduction velocity fell 1.84 m./sec. per degree fall in temperature between 36° and 23°C. Threshold stimulus strength remained constant down to 23°C. Below this temperature, stimulation threshold rose sharply and the nerve-muscle system became apparently inexcitable between 18° and 20°C. Conduction velocity could therefore not be studied below 20°C., although extrapolation of the data to 0 m./sec. indicated that complete conduction block presumably occurred at 9°C. Changes observed in conduction velocity during cooling and rewarming are attributable to thermal effects on the neural membrane.

A67-80376
NEW NOSOLOGIC CONCEPTS IN WEIGHTLESS MAN.
Constantine D. J. Generales, Jr. (N. Y. State Med. Soc., Sect. on Space Med., New York City).
(Med. Soc. of the State of N. Y., 159th Ann. Meeting, New York City, Feb. 16, 1965).
New York State Journal of Medicine, vol. 66, Oct. 15, 1966, p. 2646–2657. 15 refs.

In directing attention into the arcane mechanisms of organic life in the weightless (W°) state, the search for a proper definitive concept has become necessary. Thus, after considerable thought the author has arrived at "the order of static action." This apparently contradictory expression has a simple definition: "the behavior of all matter, animate and inanimate, free from the effects of gravitional forces." In agreement with Isakov, Yuganov, and Kas'yan, the author stresses again the need for a theory concerned with the effects on the body of both acceleration and W°. However, to study variable results on the constantly accelerated earth-bound man, it is quite obvious that the "normal" values of the W° state should be acquired first. How difficult it becomes to work out a theory of this nature because of the number and complexity of the factors involved is only too clear. The question whether man will need the full equivalent, a fraction of the terrestrial gravitational force, or can dispense with it completely without ill-effects, or whether he should still grow up in W° from birth on is a moot question that will take at least a generation to answer. By that time most medical textbooks will be in the process of revision to include the knowledge gained from the exploration of space and especially from prolonged residence in W°.

A67-80377
SEMICIRCULAR CANAL NERVE EYE AND HEAD MOVEMENTS.
Bernard Cohen, Kohji Tokumasu, and Kazuyoshi Goto (Mount Sinai Hosp., Dept. of Neurol., New York City, N. Y.).
Archives of Ophthalmology, vol. 76, Oct. 1966, p. 523–531. 14 refs.
Grant PHS NB-00294.

Semicircular canal nerves were electrically stimulated in alert cats and monkeys. The plane of the induced head and eye movements was compared to the plane of the canals whose nerves were stimulated. Despite variations in the initial position

of the eyes in the orbit or of the head on the neck, the induced eye and head movements lay in planes parallel to the plane of the semicircular canal whose nerve was activated. From these data it appears likely that eye rotation parallel to canal planes was maintained in different eye positions by changes in the functional insertion and planes of action of the activated muscles. This suggests the importance which the spatial planes represented by the semicircular canals must have in determining the physical structure of the oculomotor apparatus.

A67-80378
HORIZONTAL EYE MOVEMENTS STUDIED WITH THE ON-LINE COMPUTER.
G. Cook (USAF Acad., Frank J. Seiler Res. Lab., Colorado Springs, Colo.), L. Stark, and B. L. Zuber (Ill. U., Dept. of Inform. Eng., Chicago).
Archives of Ophthalmology, vol. 76, Oct. 1966, p. 589–595. 8 refs.
Grants Nonr-1841(70), AF-49(638), PHS NB-3055-04, NB-3090-04, and MH-06175-02.

An on-line computer has been used to study the dynamic behavior of horizontal eye movements. The computer was used to present to the subject quasi-random target movements in a horizontal plane and to record and store his responses for processing. Averaging techniques were used extensively and increased the repeatability of the data markedly.

A67-80379
IRRADIATION INDUCED DISORDERS OF ERYTHROPOIESIS AS INFLUENCED BY HYPOXIA OR HYPOXIA ACCOMPANIED BY BLOOD LOSS [PORUCHA ERYTHROPOEZY PO OZARENI A JEJI OVLIVENI HYPOXII A HYPOXII SE ZTRATOU KRVE].
T. Travnicek, J. Neuwirt, J. Taborsky, and E. Taborska.
Ceskoslovenska Patologie, vol. 2, Aug. 1966, p. 169–176. 12 refs. In Czech.

The authors studied the influence of daily hypoxia (6000 m) lasting for eight hours and of its combination with a four ml. blood loss upon the erythropoiesis of normal rats as well as of those receiving a single whole-body dose of 600 r. Rats exposed daily to a period of hypoxia lasting for eight hours each deprived, moreover, of 4 ml of blood display maximal stimulation of erythropoiesis according to all indices. Hypoxia exerts a stimulating influence upon erythropoiesis in the rats exposed to irradiation with a dose of 600 r until the seventh day following irradiation in comparison with the rats subjected to irradiation only. Regeneration of erythropoiesis as occurring between the seventh and fourteenth day after irradiation with a dose of 600 r can be infavourably influenced by hypoxia accompanied by blood loss. Rats subjected to irradiation only exhibit higher levels of hemoglobin and higher red blood cell counts at the end of a two weeks period following irradiation than those subjected to irradiation, hypoxia and blood boss. The utilization of iron is also larger in the irradiated rats as compared with those subjected to irradiation, hypoxia and blood loss.

A67-80380
THE EFFECT OF THYROXINE, CORTISONE AND EXPOSURE TO COLD ON THE LIVER GLYCOGEN LEVEL.
Maria Farkas (U. Med. School, Inst. of Pathophysiol., Pécs, Hungary).
Acta Physiologica Academiae Scientiarum Hungaricae, vol. 30, no. 1, 1966, p. 31–38. 24 refs.

In a cold environment liver glycogen decreased temporarily, then it approached the normal value. During chronic thyroxine treatment liver glycogen remained low throughout. The decrease in liver glycogen caused by thyroxine was blocked by cortisone at room temperature, but not in the cold environment. Liver weight increased to a significantly greater extent in response to cortisone, than in response to thyroxine or cold. Thyroxine and cold reduce liver glycogen by different mechanisms, and the effect of cortisone on liver glycogen depends to a great extent on ambient temperature.

A67-80381
INTERACTION OF MUSCLES-ANTAGONISTS OF THE HUMAN TRUNK AT REST AND IN POSTURAL ACTIVITY [O VZAIMODEISVII MYSHTS-ANTAGONISTOV TULOVISHCHA CHELOVEKA V USLOVIIAKH POKOIA I PRI POZNOI AKTIVNOSTI].
Ia. M. Kots (USSR, Acad. of Sci., Inst. of Biophys., Theoret. Div., Moscow).
Biulleten' Eksperimental'noi Biologii i Meditsiny, vol. 12, Oct. 1966, p. 7–11. 199 refs. In Russian.

Under the equitonometric conditions of rest man is found to have a predominance of the muscular tone of the trunk flexors, which is manifested by the anterior bending of the trunk (bending "posture" of rest). This predominance is connected in the main with the resilent traction of iliac-lumbar muscles. The length of "rest" for the iliac-lumbar muscles is attained at a coxal angle of about 120°. It is presumed that in postural activity the system of reflex to extension of the spine extensors is activated through the receptors of the extended iliac-lumbar muscles. This activating influence is ended upon attainment of the length of "rest" for the iliac-lumbar muscles, i.e. at a coxal angle of about 120°. This mechanism is used for explaining the electrical silence in the spine extensors occurring in the standing and sitting posture at a coxal angle of about 120°. A special case is the "flexor relaxation" of the spine muscles described by Floyd and Silver.

A67-80382
CHANGE IN SERUM PROTEINS IN RATS WITH RADIATION LESIONS [IZMENENIE SYVOROTOCHNYKH BELKOV PRI LUCHVOM PORAZHENII KRYS].
K. P. Kashkin and S. V. Aleksandrova (USSR, Acad. of Med. Sci., Inst. of Med. Radiol., Dept. of Gen. Radiobiol., Obninsk).
Biulleten' Eksperimental'noi Biologii i Meditsiny, vol. 12, Oct. 1966, p. 57–61. 7 refs. In Russian.

Immunoelectrophoretic analysis of serum proteins in rats irradiated with gamma-rays in a dose of 630 r showed an increase in the heterogenity of B_2B- and B_3B-globulins with the appearance of electro-phoretically "faster" or "slower" fractions retaining (B_3B) or slightly changing (B_2B) their antigenic properties. Beginning with the seventh day after irradiation the serum of irradiated animals was found to contain a new "radiation antigen" migrating during electrophoresis together with slow a_2-globulins and indicated by a_2x-protein. This protein failed to appear after irradiation of sera in vitro and was absent both in healthy and artifically infected nonirradiated animals.

A67-80383
THE INFLUENCE OF PHOTOSYNTHETIC FACTORS AND METABOLIC INHIBITORS ON THE UPTAKE OF PHOSPHATE IN P-DEFICIENT SCENEDESMUS.
Anders Kylin (Agr. U., Lab. of Plant Physiol. Res., Wageningen, The Netherlands).
Physiologia Plantarum, vol. 19, no. 3, 1966, p. 644–649. 12 refs. Nat. Sci. Res. Council, Sweden supported research.

The cells used in the present investigation had a phosphate content of about 20% as compared with normal cultures. The uptake of phosphate during a period of four hours was determined at a pH 6.5. In the absence of CO_2, light increased the uptake of phosphate with saturation around 14,000

erg/cm^2. With 5% CO_2 in the air the relationship was more complicated, and the uptake of phosphate must be related to more than one process during active photosynthesis. The inhibiting effect of CO_2 in air was noticeable already at low concentrations both in light and in darkness. With the system used, this supports earlier indications for internal recycling of orthophosphate. CO_2 was inhibiting also in nitrogen in the light. Selenate in a concentration of 2 mM gave a slight and rather irregular inhibition. Anaerobiosis had no effect in the light but gave a large decrease in the dark, while DNP (0.1 mM) was somewhat more active in the dark than in the light. The lower concentrations tested had no effect in either case. Menadione (0.1 mM) inhbiited strongly, and more in illuminated than in non-illuminated cells.

A67-80384
THE HEAT REACTIONS OF BANTU MALES IN VARIOUS STATES OF ACCLIMATIZATION. I. THE SWEAT RATE/ RECTAL TEMPERATURE RELATIONSHIP.
C. H. Wyndham, N. B. Strydom, C. G. Williams, J. F. Morrison, and G. A. G. Bredell (Transvaal and Orange Free State Chamber of Mines, Human Sci. Lab., Johannesburg, South Africa).
Internationale Zeitschrift für angewandte Physiologie, vol. 23, Sep. 12, 1966, p. 63–78. 17 refs.

Acclimatized and unacclimatized Bantu worked continuously for four hours at an oxygen consumption of 1.0 l./min. at 72, 82, 86 and 90°F. Effective Temperatures (E.T.). Rectal-temperatures of the acclimatized men plotted against time showed that at 72 and 82° E.T., rectal temperatures rise from resting levels to a new steady level of 99.7°F. within one hour and remain at that level for four hours; at 86° and 90° E.T. new, higher steady levels were reached but it took longer to do so. The steady level of rectal temperature of unacclimatized men at 72° E.T. was higher, 100.1–100.3°F.; at 82° E.T. a new, higher level was reached only after two hours and at 86 and 90° E.T. rectal temperature continued to rise, throughout the period. Sweat rates plotted against time showed the expected maximum value in the second hour with a rapid fall-off thereafter, especially at severe heat conditions. The levels of the unacclimatized men were all lower.

A67-80385
THE HEAT REACTIONS OF BANTU MALES IN VARIOUS STATES OF ACCLIMATIZATION. II. THE LIMITS OF HEAT STRESS FOR A MODERATE RATE OF WORK.
C. H. Wyndham, N. B. Strydom, C. G. Williams, J. F. Morrison, and G. A. G. Bredell (Transvaal and Orange Free State Chamber of Mines, Human Sci. Lab., Johannesburg, South Africa).
Internationale Zeitschrift für angewandte Physiologie, vol. 23, Sep. 12, 1966, p. 79–92. 12 refs

Acclimatized and unacclimatized Bantu worked continuously at 1.0 l./min. oxygen consumption at 72, 82, 86 and 90°F. Effective Temperatures (E.T.). The "average" acclimatized Bantu maintained a constant rectal temperature for the work rate up to 85° E.T.; the "average" unacclimatized Bantu did this up to 80° E.T. These E.T.'s are the limits for "easy" work based upon the criterion of a steady level of rectal temperature for a moderate rate of work. A different limit for "easy" conditions and a limit for "difficult" conditions was arrived at by plotting of the rectal temperatures of the acclimatized men in one graph and unacclimatized Bantu in another graph against E.T.'s. One-sided tolerance limits were fitted to these data from which it was possible to estimate the E.T.'s at which 1:10, or 1:100, or 1:1000 men exceed: rectal temperature of 101°F., which was proposed as the physiological limit for "easy" conditions. Ten acclimatized men exceed 101°F. at 88.4° E.T.; 1:100 at 84° E.T., and 1:1000 at less than 72° E.T. 1:10 acclimatized men exceed 101°F. at less than 72°E.T. Rectal temperature of 102.5°, is proposed as the limit of "difficult" conditions. 1:10 acclimatized men exceed a rectal temperature of 102.5°F. at 92.9° E.T.; 1:100 at 92° E.T.; and 1:1000 at 91.2° E.T. 1:10 unacclimatized men exceed this rectal temperature at 86.4° E.T., 1:100 at 83.0° E.T. and 1:1000 at 76.4° E.T.

A67-80386
EFFECT OF INTERMITTENT COLD EXPOSURE ON WHITE RATS.
K. S. Scaria, N. T. Joseph, and M. R. L. Sundar (Defence Inst. of Physiol. and Allied Sci., Madras, India).
Indian Journal of Experimental Biology, vol. 4, Oct. 1966, p. 224–225. 9 refs.

Rats exposed to cold by immersion in cold water at 15°C. for two hr. daily developed maximum increased capacity for heat production in about ten days, as judged by the measurement of colonic cooling and rewarming time. In the cold adapted rats, the resting colonic temperature was less than in normal rats, and the resting metabolic rate was not significantly different from the control values. The metabolic rate was elevated during cold exposure and rewarming period. Oxygen consumption of cold exposed animals during shivering was 2-1/2 times that of controls. Thereafter the latter decreased rapidly and at rest it is less than that of controls. The tendency for decreased respiratory quotient of cold-exposed rats in association with increased metabolism after cold exposure strongly implied a greater utilization of fat as substrate for heat production.

A67-80387
PERSONALITY AND AROUSAL CORRELATES OF SPECIFIC GALVANIC SKIN RESPONSES.
Robert Roessler, Neil R. Burch, and Harold E. Childers (Baylor U., Coll. of Med., Dept. of Psychiat. and Houston State Psychiat. Inst., Psychophysiol. Div., Houston, Tex.).
Psychophysiology, vol. 3, Oct. 1966, p. 115–130. 28 refs.
Grant AFOSR-727-65 and Hogg Found. for Mental Health supported research.

Basal skin resistance (BSR) and galvanic skin responses (GSR) to five intensities of sound and light were recorded on four occasions in 32 student subjects. These occasions were assumed to include unfamiliarity and basal and real life stress conditions. All subjects completed the MMPI, California Personality Inventory, Wechsler Adult Intelligence Scale, Clyde Mood Scale and Examination Anxiety Scale. GSR amplitude was greater during the presumed stress period. High ego strength-high Barrier score subjects showed a greater GSR amplitude than low ego strength-low Barrier subjects. Test indices of anxiety generally were not related to GST amplitude, nor were other personality and mood variables.

A67-80388
NOCTURNAL EEG PROFILES AND PERFORMANCE.
Harold L. Williams and Cindy L. Williams (Okla. U., School of Med., Oklahoma City).
Psychophysiology, vol. 3, Oct. 1966, p. 164–175. 16 refs.

Statistical analysis of baseline nocturnal electroencephalogram profiles identified two groups of subjects (a restless and quiet set) who differed in their performance efficiency under acute sleep deprivation. The restless group with less slow-wave sleep, more body movements, more awakenings, more transitions from stage to stage, and longer sleep latencies showed greatest sleep-loss decrement. On the first night of recovery sleep, the sleep profiles of the two groups were virtually identical, but by the third recovery night, the restless group was again showing signs of disturbed sleep. Within each group, all subjects had highly systematic stage-of-sleep cycles, forming Markov chains of at least order one.

A67-80389
OPERANT CONDITIONING OF HEART RATE SLOWING.
Bernard T. Engel and Stephen P. Hansen (Calif. U., San Francisco Med. Center, Cardiovascular Res. Inst.).
Psychophysiology, vol. 3, Oct. 1966, p. 176–187. 6 refs.
Grants PHS FR-00122, 5T1-MH-7082, and HE-06285.

The purpose of this study was to see if heart rate (HR) slowing could be operantly conditioned. Ten experimental subjects and five yoked-control subjects were studied. Experimental subjects were positively reinforced for slowing their HR on a beat-by-beat basis, whereas yoked-control subjects were reinforced in a pattern based on the performance of paired experimental subjects. The data showed that: some subjects can be taught to slow their HR by means of an operant conditioning procedure; subjects appear to learn better when they do not infer correctly what the response is that they are controlling; the conditioned HR response is apparently not mediated by changes in breathing; and reinforcement, per se, is not adequate to lower HR.

A67-80390
AVOIDANCE CONDITIONING OF HEART RATE IN HUMANS.
Thomas W. Frazier (NASA Manned Spacecraft Center, Houston, Tex.).
Psychophysiology, vol. 3, Oct. 1966, p. 188–202. 13 refs.

An avoidance conditioning technique was employed to obtain external control over heart rate. A contingency was set up between heart-rate maintenance and punishment avoidance. During periods of time signified by a visual stimulus, punishments were dispensed when the total number of beats per minute decreased from the previous minute's total. Subjects performed an instrument-panel-monitoring task without awareness of the biological avoidance contingency, but they were correctly informed that shocks were available only when the visual stumulus was present. After punishments had been dispensed on the basis of the contingency for several periods, punishment was discontinued and the visual stimulus was used alone as a conditioned aversive stimulus, in order to shape predetermined response patterns. Results included: clear evidence of heart-rate control over all subjects after training periods; maintenance of heart-rate control over continuous 40-min. periods through continuous presentation of the visual stimulus, and shaping and replication of three prespecified response patterns. These findings demonstrate that punishment avoidance contingencies can be used to impose effective control over cardiovascular functioning.

A67-80391
PHYSICAL WORK CAPACITY AS INFLUENCED BY AGE.
M. S. Malhotra, S. S. Ramaswamy, G. L. Dua, and J. Sengupta (Defence Inst. of Physiol. and Allied Sci., Madras, India).
Ergonomics, vol. 9, Jul. 1966, p. 305–316. 10 refs.

Studies were carried out on 879 healthy soldiers of ages ranging from 18–45 years to assess the effect of age, if any, on physical work capacity. These subjects were in a fairly controlled state of nutrition and physical training. A battery of tests were administered under outdoor conditions as well as in the laboratory. It was found that all the physical functions tested, such as speed of running, abdominal muscle strength, agility, arm and shoulder muscle strength and capacity for short bursts of activity, started to show deterioration after 30 years, and the process was progressive thereafter. Judged from these performances the subjects seemed to fall into three distinct age groups, viz. 18–20, 31–37 and 38–43. The subjects above 43 years were too few to be considered for analysis. The mean maximum oxygen consumption was found to be 47.7 ml./kg./min. in the 18-30 years group, and it was reduced to 45.8 and 42.1 ml./kg./min. for the two higher age groups respectively. Excess lactic acid build-up die to a standard stepping exercise was also found to increase with age, and the tolerance time in endurance tasks was found to reduce with increasing age. Performance in the running test correlated highly with the values for maximum oxygen consumption and endurance stepping, thereby indicating that even simple outdoor tests like running can be effectively used for assessing the physical work capacity, especially under field conditions.

A67-80392
THE EFFECTS OF ALCOHOL AND OF VARYING AMOUNTS OF VISUAL INFORMATION ON A BALANCING TEST.
G. H. Begbie (U. Med. School, Dept. of Physiol., Edinburgh, Great Britain).
Ergonomics, vol. 9, Jul. 1966, p. 325–333. 14 refs.
NRC, Canada supported research.

A new kind of dynamic balancing test has been devised. Eight subjects carried out experiments in which the effects of alcohol and the effects of varying amounts of visual information on sqay and oscillation were studied. It was concluded that peripheral vision was a crucial factor in the effective performance of the test, and it was noted that quite modest amounts of alcohol could produce a deterioration in performance. The provision of extra visual information about the effectiveness of response had a beneficial effect.

A67-80393
TOXIC AND DEPRESSANT EFFECTS OF ALCOHOL GIVEN ORALLY IN COMBINATION WITH GLUTETHIMIDE OR SECOBARBITAL.
K. I. Melville, G. E. Joron, and D. Douglas (McGill U., Depts. of Pharmacol. and Med., Montreal and Montreal Gen. Hosp., Quebec, Canada).
Toxicology and Applied Pharmacology, vol. 9, Sep. 1966, p. 363–375. 20 refs.

General central depressant and toxicologic effects were compared in dogs after oral administration of (a) alcohol alone, in a succession of three doses of 1 ml./kg. of 50% ethanol at hourly intervals, (b) glutethimide (200, 300, or 500 mg./kg.), either alone or with the third dose of alcohol, and (c) secobarbital sodium (25 mg./kg.), either alone or similarly with alcohol. Blood alcohol and blood barbiturate levels after the various treatments were compared at hourly intervals, and blood gluthethimide levels at six-hourly intervals in some experiments. It was observed that the onset, intensity, and duration of central depressant effects and toxicity were strikingly enhanced in all experiments with alcohol-glutethimide or alcohol-secobarbital combinations, as compared with responses to similar doses of glutethimide levels at six-hourly intervals in some experiments. levels recorded hourly up to six hours were not significantly different in the three groups of experiments but subsequently blood alcohol levels declined significantly more slowly in the experiments with the combinations. Blood glutethimide and barbiturate levels also decreased significantly in the experiments with added alcohol. It is therefore postulated that a rapidly increased absorption of glutethimide or secobarbital, due to the presence of alcohol in the stomach, might be one of the factors involved in the enhanced central nervous system depression induced by the combinations.

A67-80394
EFFECT OF INJECTED MONOMETHYLHYDRAZINE ON PRIMATE PERFORMANCE.
Herbert H. Reynolds and Kenneth C. Back (Aeromed. Res. Lab., Holloman AFB, N. Mex. and Aerospace Med. Res. Lab., Wright-Patterson AFB, Ohio).
Toxicology and Applied Pharmacology, vol. 9, Sep. 1966, p. 376–389. 11 refs.

Nine macaque monkeys were injected intraperitoneally on two occasions with either 2.5 or 5.0 mg./kg. of monomethylhydrazine (MMH). Operant task performance was measured, and clinical signs were noted. No difference in performance resulted from the two dosages, but there was a greater incidence of clinical signs in those subjects receiving 5.0 mg./kg. In over half of the cases, a performance decrement preceded clinical signs, but in no instance did clinical signs precede a performance decrement. When initial 2.5 or 5.0 mg./kg. injections are made, one might predict that performance decrements will occur between one and two hours and clinical signs between 2 and 2.5 hours in about half of the subjects. A second exposure might be expected to produce performance decrements between one and two hours, and clinical signs between two and three hours in the majority of subjects. If a subject is influenced by MMH, clinical signs will likely disappear between three and nine hours after injection, and performance should return to a baseline level between 3 and 30 hours.

A67-80395
EFFECTS OF STIMULUS-NUMEROSITY UPON DISTANCE ESTIMATES.
John C. Baird (Walter Reed Army Inst. of Res., Washington, D. C.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 133–134. 5 refs.

A psychophysical approach was used to evaluate the results of reducing the number of stimuli in the visual field upon distance estimates. It was expected that decreases in numerosity would be accompanied by decreases in the magnitude of distance estimates. Numerosity reduction did have a slight but significant effect in the expected direction.

A67-80396
EFFECTS OF STIMULUS-HETEROGENEITY UPON DISTANCE ESTIMATES.
John C. Baird (Walter Reed Army Inst. of Res., Washington, D. C.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 135–136.

The results of a reduction in the number of types of stimuli (heterogeneity) in the visual field upon distance estimates is evaluated. Heterogeneity reduction led to significantly shorter distance estimates when a standard consisted of unequal numbers of stimulus-types, but not when they were equally represented.

A67-80397
SENSORY CONTRAST EFFECTS IN THE JUDGMENT OF LIFTED WEIGHTS.
Maureen Y. Williams, John Ross, and Vincent Gi Lollo (Western Australia U., Perth).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 137–138. 5 refs.
Grant AF-AFOSR-968-65.

Contrast effects based on changes in the sensory characteristics of lifted weights were demonstrated. Two groups of ten subjects were trained to select three reference weights. Subjects then lifted either a heavy "shift" series (Group H) or a light "shift" series of weights (Group L), and were then required to reproduce the original reference weights. After the shift Group H selected heavier weights and Group L lighter weights than in the pre-shift settings.

A67-80398
INCUBATION OF ANXIETY: EFFECT ON TEMPORAL GENERALIZATION.
Otello Desiderato, Judith M. Foldes, and Joan S. Gockley (Conn. Coll., New London).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 139–140. 6 refs.

Temporal generalization gradients were obtained, either immediately after training or after a six-hr. delay, from subjects exposed to either aversive or innocuous reaction time signals. Smaller generalization decrements were found for subjects receiving delayed testing, and signal aversiveness did not affect the magnitude of the decrement. Instead of finding support for an "anxiety-incubation" hypothesis, it was concluded that non-emotional factors associated with elapsed time produce flattened generalization gradients.

A67-80399
SOME GEOMETRIC BASES FOR PERCEIVED SLANT.
B. E. Dunn (Calgary U., Canada).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 147–148. 11 refs.
Grant NSF B1781.

Fifty-seven trapezoids varying along dimensions of length, height, and shape were presented to 16 subjects. Each subject estimated the slant of the stimulus in three dimensions which produced each trapezoidal two-dimensional projection. A multiple regression equation was derived from the data showing that the preceived slant around a vertical axis was a function of the difference between the width of the long vertical end and the short vertical end, the length of the stimulus and relative monocular height. Other possible formulations were discussed.

A67-80400
THE EFFECT OF FOOD DEPRIVATION AND EXPECTANCY OF HEART RATE.
Robert Buckhout and Terrence Grace (Washington U., St. Louis, Mo.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 153–154. 6 refs.

Subjects fasted for 24 hr. after being on a controlled diet. Group A was expected to fast for 24 hr. and had heart rate (HR) measured with food cues present. Group B was expected to fast for 36 hr. and was tested without food cues. At the 24 hr. mark, Group A showed significantly higher heart rate. It was concluded that significant HR arousal occurs in deprived human beings anticipating immediate satiation.

A67-80401
FAST GUESSES IN CHOICE REACTION TIME.
Robert Ollman (Pa. U., Philadelphia).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 155–156.
Grant NSF GB-1462.

A model which describes the effect fast guesses must have on observable choice latencies and probabilities is developed, strengthened, and tested with encouraging results. With the model, it is possible to estimate "true" decision times and probabilities without requiring error-free performance in discrimination reaction time.

A67-80402
REACTION TIME AS A FUNCTION OF AROUSAL AND ANXIETY.
Shizuhiko Nishisato (McGill U., Montreal, Canada).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 157–158.

In a visual discrimination task the subject's momentary arousal, reflected by spontaneous changes in skin potential (GSR), contributed significantly to the intra-individual fluctuation of reaction time; chronic anxiety level, measured by an inventory scale, contributed significantly to inter-individual fluctuation. Both high anxiety and arousal were associated with longer reaction time. The present negative relation between response speed and GSR arousal and the previously reported positive relation between response speed and electrocephalogram desynchronization may result from different phases of arousal.

A67-80403
TEST OF DUOPROCESS PAIRED-ASSOCIATE LEARNING MODEL IN A SIMULTANEOUS PRESENTATION SITUATION.
Irwin D. Nahinsky (Mo. U., Columbia).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 165–166.

The predictive powers of two all-or-none paired associate learning models were tested in a simultaneous presentation situation. A duoprocess model which assumed all-or-none elimination of errors proved superior to the model which did not postulate error elimination. A tendency to match each alternative to one stimulus was found.

A67-80404
COMPARISON OF THREE PRESENTATION METHODS IN PAIRED-ASSOCIATE LEARNING.
Janet P. Moursund and Catherine M. Chape (Mich. State U., East Lansing).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 167–168. 8 refs.
Mich. State U. supported research.

Three methods of presentation of a ten-member paired-associate list were compared. These consisted of the standard anticipation method, a list available method, and a list study (simultaneous observation) method. An analysis of variance indicated significant differences among the three methods; inspection of the data suggests that these differences were due to significantly faster learning in the list study group.

A67-80405
WORK AND NONSENSE ANAGRAM SOLUTION WITH TACHISTOSCOPIC STIMULUS PRESENTATION.
Harry Beilin and Harold L. Levine (New York, City U., Brooklyn Coll., N. Y.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 171–172. 5 refs.
Grant NICHHD HD 00925-05.

Word and nonsense anagram stimuli were tachistoscopically presented (1 sec., 1/2 sec.), in two presentation orders, to four groups totalling 80 subjects. Word anagrams took longer to solve than nonsense anagrams. There was also a significant interaction between exposure time and presentation order. The results are interpreted as supporting a cognitive analysis of anagram problem solving.

A67-80406
PRESENTATION RATE AND AGE EFFECTS ON PAIRED-ASSOCIATE RECALL OVER VERY BRIEF INTERVALS.
Mary W. Laurence (Toronto U., Canada).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 185–186.

Two and four second presentation rates were used to test recall of paired associates over five brief delay interval conditions in ten year old subjects. Both presentation rate and length of delay interval had significant effects upon retention. A significant interaction showed faster loss of retention as delay interval increased at the two sec. rate. Twelve elderly subjects were also tested at the two sec. rate. Their inferior recall at very brief delay intervals is discussed in terms of initial processing difficulties.

A67-80407
COMPLEX STIMULI AND APPARENT MOTION.
T. S. Ball and W. E. Wilsoncroft (Pacific State Hosp., Pomona, Calif.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 187–188.
Grant Calif. SDMH 63-14-39.

A novel type of apparent motion was encountered when subjects were shown a single light alternating with four other lights arranged in the form of a diamond. Subjects reported the loss of one light in the array as the entire diamond form appeared to move back and forth.

A67-80408
HUMAN LEARNING IN A SIMPLIFIED CONTINGENT DISCRIMINATION SITUATION.
Mymon Goldstein (Long Island U., Brooklyn, N. Y.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 189–190.

Human subjects attempted to master discrimination tasks involving four displays containing nonsense forms, here schematized as ab, ba, cd and dc. The tasks proved difficult when position was reinforced in a way that made the distinction ab-ba vs. cd-dc relevant.

A67-80409
TEST OF A PROCEDURE TO CONTROL INTER-PAIR LEARNING AND THE EFFECT OF REPEATED, POST-CRITERION TEST TRIALS ON RETENTION.
Willliam E. Montague and Harold O. Kiess (Ill. U., Urbana).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 191–192. 7 refs.
Grant AFOSR 802-65.

A test was made of the effectiveness of Battig's (1965) "correction" method in controlling inter-item associative strength. The latter involved a drop-out modification of the recall or learn-test method to control inter-item associative strength and to eliminate the confounding of learning and testing inherent in the anticipation method. Since no reliable differences were found between item recall frequencies at criterion, the method achieves its purpose. After several post-criterion tests (Ts), however, significant inter-item differences were found which may necessitate a modification of the method. The repeated Ts, contrary to previous findings, revealed no increase in associative strength and had no effect on recall after three days.

A67-80410
RECORDING OF TACTILE OBSERVING RESPONSES FOR THE STUDY OF SELECTIVE ATTENTION.
S. Rydberg, R. Kashdan, and T. Trabasso (Calif. U., Los Angeles).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 197–198.
Grants NSF 145 and NIH 5 R01-MH-08741-03.

An apparatus is described, complete with circuit diagram, which provides continuous measurement of selective attention to spatially separate, tactile stimuli. Tactile and other responses to physical objects are recorded electrically. This permits direct observation of each observing response throughout the duration of a trial. An ink-on-paper record yields types, durations, frequencies, patterns, latencies and correctness of responses. This device has potential usage in both learning and psychophysical experimentation, particularly on the direction and/or degree of attention. Some preliminary data in a discrimination learning task are given which show that subjects spend less time touching irrelevant stimuli near terminal learning.

A67-80411
LEARNING A VISUAL PATTERN DISCRIMINATION WITH, AND WITHOUT, KOR.
Louise B. Miller (Louisville U., Ky.).
Psychonomic Science, vol. 6, Oct. 5, 1966, p. 199–200. 7 refs.

Using the differential methods, 168 college students learned two visual pattern discriminations of equivalent difficulty—one under a no knowledge-of-results (NKOR) condition and one with knowledge-of-results (KOR) for correct responses. Subjects required more trials in the KOR condition than in the NKOR condition on first task. KOR by order was significant at the .001 level. Males were more adversely affected than females, although the patterns were previously established as equivalent

in difficulty for the sexes. KOR by sex was significant at the .025 level. Results are discussed in terms of the nature of the task and transfer effects.

A67-80412
OBSERVATIONS ON MOUNTAIN SICKNESS IN THE COLOMBIAN ANDES.

J. C. Waterlow (Trop. Metab. Res. Unit, Jamaica, British West Indies) and H. W. Bunjé (Med. Res. Council, London, Great Britain).

Lancet, vol. 2, Sep. 24, 1966, p. 655-661. 33 refs.
U. S. Army, USAF, Roy. Geograph. Soc., and Wellcome Trust supported research.

A series of expeditions to the Colombian Andes provided an opportunity for investigating mountain sickness symptoms first appearing at about 12,000 ft., in relation to the biochemical picture and to potassium metabolism in particular. In one expedition volunteers were given potassium supplements (group K) or lactose (group O) with a view to testing the hypothesis that potassium deficiency is one of the factors contributing to mountain sickness. Group O had lower serum-potassium levels but there was no confirmation that losses of body potassium were higher in group O than in group K. More detailed consideration of the body's handling of potassium leads to the concept that some degree of "functional potassium deficiency" could exist even where the ion was not deficient; but it is not clear how far this concept is associated with the respiratory alkalosis and symptoms. In spite of technical difficulties and the limited amount of data that could be obtained in the field it seems justifiable to recommend (1) that where men are exposed, without acclimatization, to high altitudes a high intake of potassium should be assured and (2) that it may be wise to limit sodium intake since there is sodium and water retention under these conditions.

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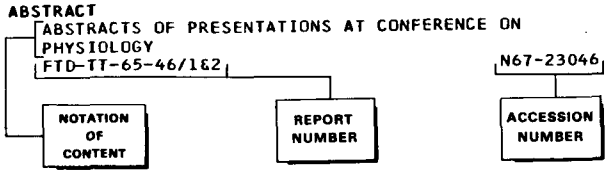

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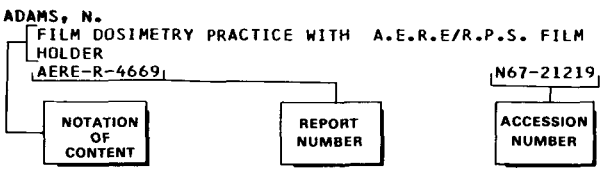

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