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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 96)

DECEMBER 1971
ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges:

STAR (N-10000 Series)  N71-34001 - N71-36397
IAA (A-10000 Series)   A71-39969 - A71-42888
AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 96)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA Scientific and Technical Information System during November 1971.
NASA SP-7011 and its supplements are available from the National Technical Information Service (NTIS). Questions on the availability of the predecessor publications, *Aerospace Medicine and Biology* (Volumes I - XI) should be directed to NTIS.
INTRODUCTION

This Supplement to Aerospace Medicine and Biology (NASA SP-7011) lists 441 reports, articles, and other documents announced during November 1971 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The first issue of the bibliography was published in July 1964; since that time, irregular supplements have been issued.

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 is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied by an abstract. The listing of the entries is arranged in two major sections: IAA Entries and STAR Entries, in that order. The citations and abstracts are reproduced exactly as they appeared originally in IAA or STAR, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Two indexes—subject and personal author—are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1971 Supplements.
AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A71-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche(1) are available at the rate of $1.00 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., A71-10613, when requesting publications.

STAR ENTRIES (N71-10000 Series)

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Avail: AEC Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of U.S. Atomic Energy Commission reports, usually in microfiche form, are listed in Nuclear Science Abstracts. Services available from the USAEC and its depositories are described in a booklet, Science Information Available from the Atomic Energy Commission (TID-4550), which may be obtained without charge from the USAEC Division of Technical Information.

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GENERAL AVAILABILITY

All publications abstracted in this bibliography are available to the public through the sources as indicated in the STAR Entries and IAA Entries sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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TABLE OF CONTENTS

IAA Entries (A71-10000) ........................................... 557
STAR Entries (N71-10000) ......................................... 607
Subject Index .......................................................... 1 1
Personal Author Index ............................................... 1 53

TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT
NASA ACCESSION NUMBER N71-11094*# Yeshiva Univ., New York
TITLE A STUDY OF THE STABILITY OF SLEEP PATTERNS IN
YOUNG ADULTS FOR SEQUENTIAL NIGHTS OVER A THREE WEEK PERIOD Final Report, 15 Jun. 1968-15
Jun. 1970
AUTHOR Elliot D. Weitzman 15 Jun. 1970 27 p refs
CONTRACT OR GRANT (Grant NGR-33-023-032)
REPORT NUMBER

TYPICAL CITATION AND ABSTRACT FROM IAA

NASA SPONSORED
DOCUMENT
IAA ACCESSION NUMBER A71-10513 *# Influence of perturbing effects on a manual
TITLE rendezvous system. Alan M. Schneider, Howard M. Koble, and Eric
T. Wilson (California, University, La Jolla, Calif.). In: The role of
in navigation; Institute of Navigation, Anniversary Year
Meeting, 25th, U.S. Air Force Academy, Colorado Springs, Colo.,
TITLE OF PERIODICAL

In the study reported each subject had a three week baseline
nocturnal sleep period, followed by three weeks of sleep during the
day, followed by a re-inversion period of three weeks sleeping at
night. The data obtained from these studies are described. Author

A system for navigation, guidance, and control of a spacecraft to
rendezvous with an orbiting target, based entirely on observations by
handheld, unpowered instruments, and computations done entirely
by hand, has been developed. This paper describes results of an
interactive digital simulation of this system through a selected set of
rendezvous missions. A previously reported study to evaluate the
influence of error sources on the system is extended to two new test
cases. In addition, several perturbing influences not covered hereto-
fore are examined, specifically: errors in the method of star sight
averaging made to compensate for nonsimultaneity of a pair of
sightings, incorrect knowledge of the interceptor spacecraft's orbital
period, and astronaut computation error. An activity chart is
included which shows the apportionment of two astronauts' time in
carrying out rendezvous using the manual system. It is shown that
rendezvous is achieved on all error missions without undue increase
in fuel and/or time relative to an 'error-free' mission. —(Author).
attention should be directed toward the forces which normally hold the system in equilibrium, as the gravitational force will change very little from its value at the surface of the earth. The forces which normally produce equilibrium tend to be reduced to zero in satellite motion. Even in the weightless environment of a satellite a finite-sized system will have to sense very small stresses to hold its geometric configuration so that threshold values of stimuli should be considered. In an experiment it was found that plants have a lower limit to their ability to sense gravity.


Effects of gravitation on the properties and behavior of living matter. Among the topics dealt with are physical and physiological phenomena associated with geotropism; the responses of invertebrates and vertebrates to gravitation; gravimorphism in plants and animals; and the effects on organisms of 'weightlessness,' both simulated and actual.

G.R.


In favorable examples it has been shown that the test organisms sense an accelerating force, loosely called g, as a vector, whether acceleration arises from gravitational, centrifugal, or other inertial forces, separately or in combination. The experimental evidence strongly supports the conclusion that the intensity of g can be the organism's guide to function and to development. A widely distributed ubiquitous g-sensing device of animals is the statocyst. The sensing devices which plants use for gravity perception are not well understood. A number of questions to be investigated by means of biological researches in space are pointed out.

G.R.


In studying geotropic responses in a satellite experiment


It is shown by mathematical analysis that it would be pointless to expect any effect of gravity to introduce perturbations in the action of diffusion unless the cell exceeded about 10 micron in diameter. The theoretical conclusions are confirmed by experiments on bacteria at 50,000 g. Physical considerations regarding a 'gravity receptor' are discussed together with effects of stress on membranes and the influence of gravity on the enzymatic transport.

G.R.


In living organisms the detectable response to a gravitational stimulation often lags behind the stimulus. This time lag must be introduced into the equations describing gravitational compensating movements in plants. In the sunflower plant, Helianthus, large oscillatory movements occur. These movements can be described satisfactorily by a differential equation. Experimental findings are found to be in good accordance with the theory after a 'memory' function with respect to gravitational stimulation is introduced.

G.R.


To discuss the physical forces involved in graviperception, several assumptions about the nature of the sensor are made. Accepting the hypothesis of a cellular statolith particle mechanism, a subdivision of the geostimulation is proposed. A method is described to test correlations between microscopically visible cell particles and the direction of geotropic bending. Within the framework of the starch statolith hypothesis, evidence is presented that the sensor does

The gravity receptors of lower plants have been analyzed in detail only in two cases involving the sporangiophores of phycomycetes and the rhizoids of Chara. The negatively orthogeotropic sporangiophores possess two different kinds of georeceptors. Their specific nature is still unknown. The rhizoids of Chara foetida are not stimulated by mere presence at the lower membrane but by some "mechanical" action dependent on gravitational force. Features of auxin transport in corn coleoptiles are discussed.


The sporangiophore responds to gravity in two distinct ways. In the transient response, the physical distortion of the cell causes a brief but rapid bending in the opposite direction. In the long-term response, some intracellular mechanism, not related to mechanical distortion of the cell surface, responds to lateral acceleration and triggers a steady but slow bending that continues until the cell axis is lined up with the resultant acceleration vector. The cell surface distortion could be largely removed in experiments in which the sporangiophores were centrifuged while immersed in a fluid whose density is equal to that of the sporangium.


On the basis of their behavior in geotropically sensitive organs it appears that the movable amyloplasts in certain cells are the particles whose interaction with gravity initiates the geotropic reaction chain. Experiments conducted with Lepidium roots furnish strong support for the starch statolith hypothesis. Most of the existing evidence can be reconciled with the view that amyloplasts function as statoliths. The suspension of gravity, however, can evidently also take place in the absence of statolith starch, at least in certain organs as shown by the results of Pickard and Thimmann (1966) on wheat coleoptiles. Starch-free, but still elongating, Lepidium roots, on the other hand, did not respond even to several hours of gravitational stimulation.


Current evidence suggests that different georeceptive tissues may transduce acceleration in different ways. Based on starch depletion, a strong case can be made in favor of the function of amyloplasts as statoliths in the roots of Lepidium. It is pointed out that, nevertheless, the kinetics of the Lepidium root response can probably be explained without reference to statolith behavior, though they seem also to be compatible with it. Current kinetic evidence must thus be viewed as contributing a great deal to the knowledge of geotropism without providing proof for a functional role for statoliths in roots.


Some objections are raised regarding conclusions drawn by Larsen (1962, 1965) that his research findings support a statolith theory of gravitational perception. It is pointed out that of the various cell organelles and inclusions only starch grains (or amyloplasts) seem capable of serving the statolithic function. A list of cases is presented in which plant organs perceive gravity apparently without the benefit of mobile starch. Certain additional lines of evidence that speak against statoliths are also mentioned. The question is raised of whether it is likely that more than one means of gravitational perception exists within a single plant.


The relationship between auxin transport and the geotropic response of roots and shoots is analyzed on the basis of a broad review of theoretical and experimental results. Geotropic responses are examined in three broad mechanistic categories, depending on whether curvature is brought about by the development of different rates of growth of the upper and lower halves of the organ which is already growing by irreversible expansion of cells in its subapical region (root and shoot); or by initiation of growth on one side of an essentially nongrowing region of an organ (glass node); or by differential increase in turgidity of cells in the upper and lower halves of an organ which is nongrowing and has no potential for further growth (pulvinus of Phaseolus).


The notions that the Cholodny-Went theory, which implies a supraoptimal content of auxin in roots, is not valid, and that indoleacetic acid is not the growth regulator functioning in roots, are critically examined. Experimental evidence obtained with wheat roots is presented to support the concept of a supraoptimal auxin content as well as the presence of indoleacetic acid in roots.


It is shown that the classical type of explanation of geotropic curvature may well occur in many cases, and that lateral auxin distribution may occur through the gravity alteration of lateral auxin...
transport. On the other hand, there exist several alternatives for geotropic mechanisms, including redistribution of auxin following alterations in the polar transport system and involving other growth substances, such as ethylene, or even by qualitative changes which do not require differential cell enlargement on one side of the stem. V.P.


In view of the diversity of structure in organs which detect and respond to gravity, the probability that different linkage mechanisms may operate for different organs is considered. In the root, it may be accepted as reasonably certain that amyloplast statoliths in the root cap are the gravity sensors. Evidence is presented to support the theory that the lateral redistribution of these amyloplasts sedimenting under gravity, coupled with an intrinsic radial polarity of some ultrastructural/biochemical organization of the root cap cells, causes the differential production of a 'message' from the upper and lower halves of the root cap. The message, which may be electrical or hormonal in nature, could induce the production of a greater amount of a growth inhibitor in the lower tissues of the growth zone, thus causing a positive geotropic response. The coupling mechanism between gravity sensing and hormone distribution in the tip is likely to be induction of a lateral polarity in the statocyte cells themselves, resulting in a lateral transport of auxin and a differential release into the growth zone. Auxin redistribution seems to result from both a lateral movement and an augmented longitudinal transport on the lower side. Here, the linkage mechanism will depend strongly on what the gravity sensor proves to be in those organs.


The older theories on the origin of the geoelectric effect (GEE) are reviewed, and its role in the geotropic reaction of plants is considered. It has long been known that an electrical potential develops across a plant shoot which is placed horizontally. Since the validity of the older theories was questioned by many physiologists, the GEE has been investigated in detail during the last few years. New measuring techniques have been developed without the drawbacks of earlier methods. With these techniques it was found that theories of the generation of the GEE and its role in the geotropic reaction chain were incorrect, and that the GEE was not a primary result of the action of gravity on the plant. Instead, it derives from the asymmetric distribution of plant hormone which takes place as a consequence of the effect of gravity on the plant. The precise reactions leading the GEE are not yet known.


Data are presented that reveal some of the effects of externally applied indole-3-acetic acid (IAA) on elongation and geotropic bending of Avena coleoptiles which relate to auxin-induced electrical responses. The data presented suggest that, contrary to the belief held by some researchers that the action of auxin elicits a geoelectric effect, it is somewhat premature to relate auxin-induced electrical responses to the geoelectric effect.


Some of the known reflex mechanisms by which insects maintain stable flight are discussed, and an explanation of how these reflexes interact with the preprogrammed flight command is attempted. The most nearly pure gravity receptor organs in insects are shown to be the neck proprioceptors involved in the optomotor reaction that corrects both yawing and rolling errors and probably helps to control pitch, too. Other discussed flight orientation organs include wind-sensing hairs, companiform sensillae, and hairlets. All of these organs are believed to interact with a central nervous program both by contributing to its overall state of excitation and by modulating details of its output pattern when such modulation is necessitated by organismal or environmental irregularities. M.V.E.


The effect of gravity on flying animals is considered, and their gravity and lift perception is examined. Except for very small insects, flying animals make use of ordinary airfoil action and are constructed so that the aerodynamic cross forces balance the pull of gravity. When the pull of gravity is compensated for, the animal is accelerated in a direction perpendicular to its normal path, the adjustment of the angles of attack may then seem upset and the wings unusable as airfoils. Effective aerial locomotion in the ‘weightless’ state would require a symmetrical construction which resembles a fish more than a winged animal. Some unpublished experiments have shown that the detection of lift in flying desert locusts seems to depend on a forward movement of the hindwings during the first two-thirds of the downstroke. In contrast to the movement of the forewings, this forward movement is a passive consequence of the aerodynamic lifting force, making it possible for the insect to differentiate between wind and mass forces. M.V.E.


Proprioceptive hair plates on several joints are shown to act as gravity receptors in ants and bees. The experimentally determined relative importance of different joints for graviception is found to be correlated with the development of hair plates at the respective joints. Owing to gravity, the positions of an ant’s body are altered relative to each other when the animal’s position in space is changed. Although these deflections are large enough to be measured, they are still kept under feedback control by the ant. Ants and bees can be trained to run a constant-angle course with regard to gravity and thus to find their way in the dark on a vertical or inclined surface.


Two alternative interpretations, differing in the signal used for gravity orientation, are proposed to explain the observation that the elimination of proprioceptive hair plates in several joints of bees and ants reduces their gravity orientation capability. In view of their connection through a feedback loop, both hair plates and strain receptors are accepted as possible gravity receptors. The experiments with stick insects show that the linear component of the body pressure on the legs is an adequate stimulus for gravity receptors in the legs.
A71-39991


Discussion of gravity receptor evolution in invertebrates with special attention to the role of cilia in gravity reception and transduction into responses. It is shown that motile cilia are mechanically sensitive and that many lower animals have specialized nonmotile cilia on mechanoreceptor cells which may act as underwater vibration receptors. In all cases accessible to studies the mechanical sensitivity of the sensory cilium was directed at right angles to the line joining the central pair of fibrils. It was also found that the rootlets, ciliary shafts and stereocilia were not essential in mechanical transduction.

V.Z.

A71-39992


The relations between the statocyst function and the motor activity of Crustacea are discussed at various levels of complexity, covering basic anatomy of the statocyst and the mechanism of stimulation, statocyst input and compensatory eye movements, integration of the statocyst and proprioceptor information, and locomotion orientation of intact animals with respect to the gravitational field. Sensory hairs are found to be stimulated when they are bent by the shear component of statolith weight. Electro-physiological tests indicate that the conversion of a mechanical input into nervous activity in the receptor system is linear and that the equilibrium reactions and the compensatory eye movements depend on the statocyst input. Spiny lobsters are used to study the compensatory eye movements during the interaction between the statocyst and a proprioceptor. It is also found that orientation in shrimps under various g is controlled by a feedback loop in which the statocysts are the recording devices.

V.Z.

A71-39993


The integrative role of the central nervous system of Homarus americanus in converting the gravity sensation into equilibrium reactions is discussed on the basis of published studies. Covered among the reactions are compensatory responses by which the animal adapts to tilted positions and righting responses seeking to restore the upright position. Details are given on the righting responses of abdominal swimmerets and uropods which are controlled exclusively by statocyst receptors. It is indicated that either the right or the left statocyst can alone control the righting responses of the appendages of both sides, even though the afferent responses of the two statocysts to roll in one direction are opposite. Neutral models based on the biologically reciprocal organization of statocyst influences are proposed to account for these findings. It is contended that these results may be applicable to higher animals.

V.Z.

A71-39994


Discussion of the otolith function in spatial orientation in the light of various studies and theories. The anatomy of the otolith organs and sensory cells and the hair cell topography and function in the elasmobranch labyrinth are considered. Details are given on work by the author et al. (1968) on the labyrinth of lamprey Lampetra fluviatilis. It is concluded that the otolith organs of the vertebrate labyrinth respond to linear accelerations in general and, consequently, may be viewed as potential gravity receptors. They may also respond to linear translation, centrifugal stimuli, and rotating linear vectors at constant speed as well as to linear oscillatory accelerations in the form of vibrational and acoustic stimulation.

V.Z.

A71-39995


Discussion of the existence of true statoctopes in the vestibule. The main index for receptors responding to gravity is indicated as lack of accommodation of the evoked activity, or at least as the presence of only a partial accommodation over an indefinite period of time of constant linear acceleration. Various observations show that true statoctopes are found in the vestibule according to the accommodation standard. The basic characteristics of the statoctopes do not seem to vary significantly in mammals in comparison with lower vertebrates. The sensory coding by which the statoctopes send information to the primary analyzers is also discussed. The origin of the randomness of firing is classified as due to two factors, one intrinsic to the cell, and one extrinsic. It is pointed out that one of the most important extrinsic factors is the vibration of the head following the heart beat (head ballistocardiogram).

M.M.

A71-39996


Discussion of four different types of fish angular orientation behavior: the dorsal light reaction, the gravity reaction, the maintenance of an internally commanded position, and the semicircular canal reaction. It is shown how these behaviors may be plausibly, but not unambiguously, interpreted in terms of their underlying sensory structures. Mittlestaedt's bicomponent theory is criticized, and the search for alternative models and new tests for that theory are advocated. It is stressed that the experiments made reflect an attempt to establish the semicircular canal response alongside the gravity response as an essential feedback loop in the orientation of fish.

M.M.

A71-39997


Discussion of an additional uncertain area of sensitivity in central nervous tissue involving the possibility of a direct sensing of certain accelerational stimuli when these have a vibratory character. It is pointed out that orientation in the weightless state requires consideration not merely of vestibular mechanisms and closely related ocular coordination but of the whole hierarchy of functions in focusing of attention and visual discrimination. The former constitute the basic platform in a pyramid of increasingly complex central integration. The latter involve the interplay between cortical
sensory systems and subcortical structures that are profoundly influenced by limbic activity. Limbic controls, particularly in the hippocampal system, appear essential to the fine focusing of attention necessary for laying down memory traces about spatially organized stimuli. Interference with such controls leads to degradation of spatial discriminative abilities in subtle but important ways that have particular relevance to problems of space flight, where gravitational cues no longer provide a key segment of environmental information and where compensatory mechanisms for this loss might evolve in prolonged space flight.

Discussion concerning the function of the vestibular apparatus and related neuronal activities in the central nervous system. The influence of the vestibular apparatus on the core of the brain, such as the reticular formation, is considered, and certain findings concerning the possibility of vestibular inhibition of brainstem activities are evaluated, showing that a postsynaptic commissural inhibition may act as a compensatory mechanism for vestibular-induced oculomotor or postural adjustment. It is also shown that, together with the vestibular influences on the somatic activity in the brainstem, inhibitory and excitatory effects on the autonomic functions mediated through the medulla may occur.

Description of research on the influence of gravity on linear growth, lateral bud and shoot development, apical dominance, the initiation of flower buds, orientation of plant organs, and flower morphology. Some of the generalizations made are: (1) unramified shoots, coleoptiles, or roots inclined from the vertical toward the horizontal grow at a slower rate; (2) buds on a horizontally oriented shoot develop asymetrically. Those located on the upper side form vigorous laterals, whereas those on the underside form only short shoots or do not develop at all; (3) apical dominance depends on the sort of a shoot in relation to gravity: (4) fruit bud-set is often influenced by limbic activity. Limbic controls, particularly in the hippocampal system, appear essential to the fine focusing of attention necessary for laying down memory traces about spatially organized stimuli.
A71-40004 Simulated weightlessness studies by compensa-

Examination of the properties of plants subjected to continuous reorientation of field direction by clinostat, with discussion of two of the areas investigated: the effects of gravity compensation on tropism and the forces required for geotropic response. It was found that oat seedlings can perceive accelerations of the order of one ten-thousandth that of gravity, which indicates that any postulate as to the identity of the sensor must be compatible with sensitivities of this order. It may be inferred that the displacements induced in the geosensor by unidirectional continuous accelerations of such minute magnitude are not nullified by thermal motion or by protoplasmic movements such as streaming or localized sol-gel transitions. F.R.L.


The horizontal clinostat was used in studies of auxin transport and distribution for the purpose of gaining information on the evolutionary mechanisms by which the typical terrestrial plant grew tall and spread its foliage for efficient capture of radiation. Clinostat speed was kept low enough to avoid the introduction of stress and vibrational factors. The reduction of basipetal transport reported by Shen-Miller and Gordon for coleoptiles is in agreement with the stunning effect on internodal length that appears when plants are made to grow for weeks without the additive effect of gravity on such transport. Gravity is found to equalize the downward movement of auxin in the stems of plants which are held erect by negative geotropism that depends on a lateral, downward transport of auxin. T.M.

A71-40006 Effect of net zero gravity on the circadian leaf movements of pinto beans. Takashi Hoshizaki (California, University, Los Angeles, Calif.). In: Gravity and the organism. Edited by S. A. Gordon and M. J. Cohen. Chicago, University of Chicago Press, 1971, p. 439-442; Discussion, p. 442. Experimental research on the effects of simulated weightlessness on the circadian rhythms of leaf movements in pinto beans shows that the time at which the rotational treatment is started (in relation to the phase of the circadian rhythm) has a profound effect on leaf movements. Initiation of the simulated weightless environment during one phase of the rhythm has little effect on the leaf movements. If simulated weightlessness is initiated in another phase, the leaf movements cease; they do not resume until two or three days have passed. The results have significance for the performance and analysis of biological experiments in space. T.M.


Thirteen experiments performed on board Biosatellite II were designed to study (1) the influence of weightlessness on various biological processes and (2) the interaction of weightlessness with radiation produced by an on-board strontium-85 gamma ray source. Additional post-flight tests were performed to distinguish the effects of gravity from other flight factors. Findings which are considered to be indicative of weightlessness effects include abnormal chromosome translocations in larvae, death of Tradescantia microspores, and cellular changes in wheat seedlings. T.M.


The varied responses of plant organs to the gravitational stimulus are examined from the viewpoint of the main functions and strategy of the higher green plant, and the patterns of response are discussed for specific ontogenetic stages. The geotropic response is broken down into components of sensing, transduction, amplification, and growth regulation. Experimental results obtained in an analysis of the movement of pea tendrils in response to mechanical stimulation are described, and a hypothesis of tendril movement is related to geotropism. T.M.


Discussion of current trends in the study of mechanisms responsible for gravity perception in animals. The advisability of considering animal phenomena in terms of only molecular mechanisms is debated, and recent results on gravity sensor cells and intracellular conduction mechanisms are reviewed. Contradictory hypotheses about the function and construction of the hair cell in the labyrinth are delineated. T.M.

A71-40073 A fifth modality of taste. H. T. Andersen and G. Hartmann (Oslo, University, Oslo, Norway). Acta Physiologica Scandinavica, vol. 82, Aug. 1971, p. 447-452. 13 refs. The possibility is investigated of identifying specific taste modalities - e.g., the four basic modalities of bitter, salty, sour, and sweet - by applying a factor analysis technique to a suitable set of data. The technique is based on a correlation matrix between independent stimuli calculated from data recorded from chorda tympani single fibers in rats and on the assumption that specific taste sensation may be explained by an 'across-fiber pattern' input into gustatory primary afferents. The analysis procedure used strongly supports the idea that there are specific and independent taste modalities. M.V.E.


To investigate intrapulmonary gas mixing, the expiratory pO2 and pCO2 curves have been followed simultaneously and continuously by mass spectrometry in 10 subjects. The curves were plotted against tidal volume during breathing of the following gas mixtures: 79%N-21%O2, 79%He-21%O2, and 79%Ar-21%O2. The results indicate that the differences in the volume of gas expired for a given change in partial pressure may be attributed to variations in diffusion and convection in the central parts of the lung, whereas the differences in the alveolar plateaus of the partial pressure curves can be explained by diffusion in the peripheral parts of the lung and by the shape of the dissociation curves of O2 and CO2. M.V.E.
The type-338 programmed buffered display consists of an 8K PDP8 computer and a display subsystem controlling a 16-in. diameter CRT. The display can provide almost any combination of points, lines, or symbols, with control of intensity and scale. The picture can be static, moving, or steerable in the sense that the entire display area can appear to be steered over a larger potential display diameter CRT. The display can provide almost any combination of picture that can be static, moving, or steerable in the sense that the entire display area. Lightpen and keyboard controls are provided, and joystick and rolling ball controls can be adapted. The operation of the system is explained for psychological experiments involving interception tasks, tracking tasks, steering exercises, climbing arrows tasks, and memory and calculation tasks.


Study of the structure of the nerve cell (the neuron) and the electrical phenomena of which it is the seat. Much knowledge has been gained by electronic microscopy and refinements of electrophysiology. Biochemical analytical methods have penetrated to the heart of the most complex molecular mechanisms. The simultaneous use of these three approaches has made it possible better to understand the transmission of nervous influx, a functional characteristic of the nervous system. This phenomenon sets chemical substances in play, the study of which has opened a new chapter of pharmacology.


The results of neurophysiological studies of the effects of vibration on the human body are briefly reviewed, along with the status of attempts to determine safe limits of human exposure to vibration, to formulate specific preventive or prophylactic measures, and to devise therapeutic applications of vibrations. The vestibular origin of motion sickness is discussed, and some of the techniques are outlined that make it possible to determine the threshold of vestibular effects induced by low-frequency oscillations. Following an explanation of the worst deietious biomechanical effects produced by oscillations close to frequencies of 4 or 5 Hz, muscular responses to vibrations are considered, and human safety requirements are examined. In conclusion, the perception of high-frequency vibrations and the possibilities of therapeutic vibration utilization are discussed.


A neosynthesis of alpha-glycerophosphate and 2,3-diphosphoglycerate was found in a human extraocular muscle. The mechanism of action of these substances as regulators of muscular metabolism is discussed. While with alpha-glycerophosphate no differences were found in the neosynthesis of muscles of patients with normal muscular equilibrium, a significant increase in 2,3-diphosphoglycerate radioactivity was observable in the extraocular muscle of squinting persons. A possible connection between ATPase deficiency and a stimulated 2,3-diphosphoglycerate synthesis is shown.

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A71-40184


Catecholamine output, heart rate, and performance efficiency were examined in 28 Ss during two contrasting stimulus conditions, one of understimulation, and one of overstimulation. During understimulation the subject spent 3 hr performing a vigilance task, and during overstimulation he was exposed for the same time period to a complex sensorimotor test. Both understimulation and overstimulation produced a significant increase of adrenaline and noradrenaline release as compared with a control condition involving a medium amount of stimulation. Subjects who excreted relatively more adrenaline performed significantly better during understimulation, whereas subjects with relatively lower excretion rates of adrenaline tended to perform better under overstimulation. When performance efficiency was related to heart rate it was shown that high-heart rate subjects performed better during understimulation, while low-heart rate subjects performed better during overstimulation. (Author)

A71-40184


A simple, compact and inexpensive biopotential transmitter suitable for telemetry is described. The transmitter has a low noise figure, a wide frequency response, a weight of 5 g and operability over a very wide range of electrode impedances. The circuit and performance characteristics, and representative EEG and single unit potential recordings obtained with the transmitter are given. V.Z.

A71-40185


An R 35F Galileo polyphysiograph with a catheter was used for continuous measurement of blood pressure in the brachial artery during spontaneous night sleep in 8 normotensive subjects 38 to 68 years old. EEGs, horizontal eye movements, electromyograms, EKGs, pneumograms, cardiographgrams, and digital plethysmograms were all recorded simultaneously. The arterial pressure was lower during the first period of sleep, increased gradually during the later hours and tended to be slightly higher during rapid eye motions. V.Z.

A71-40213 *


Study of the effect of carbon dioxide and oxygen on the lag period of chemosynthetically grown Hydrogenomonas eutropha. Minimum lag periods and high growth rates were obtained in shaken flask cultures with a prepared gas mixture containing 70% H2, 20% O2, and 10% CO2. However, excessively long lag periods resulted when the same gas mixture was sparged through the culture. The lag period was shortened in sparged cultures by decreasing both the O2 and CO2 partial pressures, indicating that gas medium equilibration had not occurred in shaken cultures. The lag period was completely eliminated at certain concentrations of O2 and CO2. The optimum O2 partial pressure was 0.05 atm, but the optimum CO2 partial pressure varied according to the pH of the medium and the physiological age of the inoculum. The changes in CO2 partial pressure required to compensate for the pH changes of the medium had the net effect of maintaining a constant bicarbonate ion concentration. Initial growth of H. eutropha was therefore indirectly related to the CO2 partial pressure and was directly dependent on a constant bicarbonate ion concentration. A.B.K.

A71-40225 *


Perceptual masking was studied under binocular and dichoptic conditions in order to separate peripheral and central interference effects. Under binocular conditions, when the test flash (TF) and the blanking flash (BF) fell on both retinas, both retroactive and proactive masking were demonstrated. Under dichoptic conditions, when the TF fell on one eye and the BF on the other eye, thus eliminating opportunity for intraretinal interference, there was partial retroactive perceptual masking and no proactive masking. These results suggest that binocular proactive masking is due to peripheral light adaptation, that binocular retroactive masking is due both to peripheral and central effects, and that dichoptic masking is due solely to central retrochiasmal interference. It is proposed that dichoptic retroactive perceptual masking affords a method of investigating central perception time, i.e., the time to consolidate a perceptual experience. (Author)

A71-40247 *


Study of mechanisms of arousal and activation which involve reticulo-thalamo-cortical systems. Thought, worry, and anxiety reflect emotional arousal at the cortical level; weeping, sweating, intestinal and other visceral activities regulated by the autonomic nervous system reflect cortical, diencephalic, and brain stem arousal; facial expression, muscle tension, and tremors manifest somatomotor arousal. Mechanisms of arousal and activation are especially identified with the reticular formation of the lower brainstem. Upward extensions, including the ascending reticular activating system and its subsystems are closely related to, and interactive with, diencephalic and limbic systems which control emotional expression and emotional-motivational behavior. The concept of an activation theory of emotion is discussed in the light of early and more recent supporting evidence. F.R.L.

A71-40250

Automaticity and automatic rhythms. Mario Vassalle (New York, State University, Brooklyn, N.Y.). *American Journal of Cardiology*, vol. 28, Sept. 1971, p. 245-252. 32 refs. Research supported by the American Heart Association, the New York Heart Association, and PHS.

The nature of the automatic process in cardiac pacemakers is discussed with special reference to the mechanism of diastolic depolarization in cardiac Purkinje fibers as investigated by the use of the voltage clamp technique. The major factors controlling cardiac automaticity - the sympathetic nerves, the vasm and overdrive suppression - are analyzed. Under different conditions, both sympathetic and vagus nerve stimulation can lead to a slowing or acceleration of cardiac pacemakers. The mechanism by which the sympathetic nerves can slow and the vagus nerve accelerate the

The physical nature of the artificial gravity field produced by rotating a spacecraft in earth orbit is examined from the point of view of an astronaut living inside. He will experience an unusual environment which is caused by (1) a much larger Coriolis force, relative to the nominal gravity strength, than on earth, and (2) a larger head-to-toe gravity gradient. We examine the detailed kinematics of freely-falling particles and the dynamics of typical tasks performed by men inside the spacecraft. The results are discussed in terms of the ratio h/R, where h is the height above the floor at which the activity occurs and R is the radius of spacecraft rotation. It is found that if h/R exceeds about 0.1, the rotation effects become noticeable. Objects falling downward drift away from the rotation direction, and objects thrown upward drift in the opposite direction. Tasks requiring dynamic manipulative skill, such as hammering nails and walking, will require a significant amount of relearning if h/R is greater than 0.1. These unusual phenomena are particularly important inside the hub of a rotating space station, since its effective radius is small. (Author)


Discussion of the flight of the space vehicle 'Soiuz-9,' which had a duration of 18 days and was undertaken in connection with the program for solving problems of manned orbital space stations. One objective of the flight was the investigation of changes regarding the astronauts and their ability to perform work upon long term exposure to conditions of weightlessness. It was found that the human organism adapts itself to space conditions within a certain time. This time varies individually from a few hours to several days. However, difficulties in a readaptation to normal gravity after the flight are reported, and the preparation of special measures for solving this problem in case of flights of a duration of several months are recommended including a provision of artificial gravity for interplanetary flights. A number of scientific tests conducted by the astronauts during the flight are discussed. G.R.


A study of transport aircrew sleep patterns in relation to fatigue and sleep disturbances. Sleep data were obtained from selected transport crewmembers flying 100 logistics missions and maintaining a log on work and rest on an around-the-clock basis starting 12 hours prior to each mission and ending after 3 days of post-mission rest. These sleep data indicate that a mission constitutes a significant physiologic load and that during the course of a mission a physiologic debt develops, despite the fact that regular periods are provided for sleep and rest. The various ‘stressors’ acting upon crewmembers are discussed, and their implications are reviewed. M.V.E.

A71-40342 Pulmonary capacity for dissipation of venous gas emboli. Merrill P. Spencer and Yohtaro Oyama (Virginia Mason Research Center, Seattle, Wash.). Aerospace Medicine, vol. 42, Aug. 1971, p. 822-827. 24 refs. Research supported by the Boeing Employees Good Neighbors Fund; NIH Grant No. HE-10258.

Description of an experiment in which nine unanesthetized sheep with chronically implanted ultrasonic Doppler flow probes on pulmonary and brachiocephalic arteries were subjected to experimental intravenous injections of oxygen, nitrogen, and carbon dioxide. Three different rates of injection (0.03, 0.09, and 0.15 cc/Kg/min) were used for 30 min each. Findings included transient and moderate elevation of right ventricular pressure, decrease in pulmonary blood flow, and diminished arterial O2 partial pressure. The degree of these vascular and respiratory changes was dependent on the kind and dosage of gas used. Bubble signals on the brachiocephalic artery were detected in 1 out of 5 O2 and 3 out of 5 N2 injections at the 0.15 rate. CO2 had the least effect and did not embolize the systemic circulation. Because of absence of clinical signs and plateauing of effects, it was concluded that the effects of continuous venous gas embolization at these doses can be tolerated and are reversible. (Author)


The method of evaluating bone density in the flight monkey of Biosatellite III is described, with changes in density in 17 anatomic sites given during the period of the mission, both for the flight animal and the back-up animal which served as a ground-based control during the same period, with the former markedly surpassing the latter. A discussion is given concerning possible causes of losses in skeletal density in some anatomic areas of both animals, with losses generally more extensive in the primate which experienced 8.8 days of weightlessness than in the control monkey. (Author)


The total decompression time of goats has been titrated using the standard Naval schedule both with and without interposing an excursion towards the surface between the exposure and the decompression. For a dive of 30 min. to 170 ft it was found that a surface interval of 1 min had no significant effect. For greater exposures it was found that there was a threshold depth for the excursion interval separating C.N.S. from limb bends as the symptoms arising during subsequent titration of the decompression. The results are discussed in relation to emphasizing the fundamental inadequacies of conventional supersaturation theories of decompression sickness. The surface excursion is suggested as a very useful model for studying the treatment of C.N.S. symptoms. (Author)


Description of the results of a study of the effect of drugs protecting against ionizing radiation on mice and the tolerance to back-to-chest accelerations. The investigations have demonstrated that radio-protectants may reduce the tolerance of the animal body to radiation exposure.
to accelerations, whereas stress effects may increase the toxicity of aminothiols. This emphasizes the importance of studying the response of the human body to space flight factors in order to develop indications of taking certain drugs in these circumstances.

M.M.


EEG, EMG, EOG, EKG and Electrodermal Measures were obtained from 16 normal volunteer female subjects during a 4-hour period of sensory isolation of the water-tank variety. The results showed significant decrease of EEG voltage and frequency, of ECG rate and an increase in some of the electrodermal measures. The findings are discussed in terms of progressive reduction of cortical activities as distinct from sleep and diverse autonomic reactivity resulting from an overall reduction of sensory input. (Author)


The paper examined the effects of hyperbaric, normoxic breathing gas mixtures of helium, nitrogen and neon on the electroencephalogram (EEG) and simple reaction time (RT) in man during a chamber saturation dive. Subjects breathed helium-oxygen at One, 4.02, 7.05, and 8.57 Ata; nitrogen-oxygen at One, 4.05, and 7.05 Ata; and neon-oxygen at 7.05 Ata. The only meaningful changes on any of the dependent variables occurred with increased pressures of the nitrogen breathing gas. There was a linear increase in RT, a suggestion of increased mean alpha frequency and an increase in failures to respond during the RT task with increased pressures of nitrogen-oxygen. Clearly defined EEG alpha block was observed at all pressures and with all breathing gases studied. The relationship of this finding to previous reports of a decrease in alpha block with increased pressures of gases containing a high partial pressure of nitrogen is discussed. (Author)


Eight young adult males had their daily sleep period split into two periods of 4 hours in length. Different lengths of intervening wakefulness were introduced between the two periods: 1 hour, 4 hours, and 12 hours. One of the two sleep periods began at 2300 each day. It was found that the total amount of the various sleep stages in the two periods did not differ from baseline sleep in the 1 hour and 4 hour split conditions; there was an increase in waking and light sleep and a decrease in REM sleep in the 12 hour condition. An internal examination of the sleep within the two periods for the three conditions indicates that the particular outcome of split periods of sleep will be dependent upon three factors: the time interval between periods, the length of the periods, and the sidereal time of onset. (Author)

A71-40349 Effect of acclimatization to altitude and cold on basal heart rate, blood pressure, respiration and breath-holding in man. C. S. Nair, M. S. Malhotra, P. M. Gopinath, and Lazar Mathew (Defence Institute of Physiology and Allied Sciences, Delhi, India).


Basal heart rate, blood pressure, respiration and maximum breath-holding time were studied in 20 healthy subjects of age group 22-28 years at an altitude of 11,000 ft. They were divided into two groups. One group was subjected to hypoxia, while the other group was exposed to hypoxia and cold simultaneously. The results indicate that simultaneous exposure to hypoxia and cold brought about a return of heart rate to near sea-level values and elevated basal minute ventilation. Basal blood pressure and respiratory rate did not show any significant change. Maximum breath-holding time showed a trend towards a rise after 10 days, while the other group (hypoxia alone) lagged behind in this response. (Author)


Muscle tremor was measured on three aquanauts using a muscle force transducer developed to measure response variation within a specified force band. Tests were made during the 12-hour compression to 520 feet at 40 feet per hour, and during the 5-day decompression. Analysis of the power spectra revealed significant and stable differences among individuals, but in all cases tremor magnitude was within normal surface limits. Although there was a tendency for high frequency tremor components to drop out with higher pressures, neither total tremor nor the amount of tremor within particular frequency bands showed a significant systematic change with pressure. The stability of the differences among the divers may allow for the establishment of individual tremor 'signatures' as a monitoring standard. (Author)


Aircrew effectiveness was evaluated with the ability to interpret display data (perceptual judgments) and to make correct decisions when the choices are few in number (intellectual judgments). Eight hours' exposure to 100 dB(A) aircraft cabin noise had no effect on perceptual judgment ability or on the time required for intellectual judgment. During the second 4 hr of the 8-hr exposure there was a significant increase in the number of errors committed in the intellectual judgment task. A significant shift in hearing acuity threshold occurred, but normal hearing was recovered within 48 hr.

M.M.


Thin mice subjected to 90 psi of sea-level pressure for 5 hr and then decompressed to sea-level within 1 min do not develop decompression sickness. A relatively small incidence of the syndrome is observed when the animals, after a short surface interval, are further decompressed to a simulated altitude of 26,000 ft, SMAF (a smooth muscle-acting factor) markedly increases the incidence if administered prior to exposure to altitude. When, however, 2-4 phenacylaminethyl)cyclohexanone is given before exposure to 90 psi none of the animals develops the disease. The findings support the postulated implication of humoral smooth muscle-stimulating factors in the pathogenesis of decompression sickness, thus providing a new pharmacological approach for the prevention or amelioration of the syndrome.

M.M.

A71-40353 Changes in human urine and blood chemistry during a simulated oxygen-helium dive to 1,500 feet. P. B. Bennett

Description of experiments in which two subjects simulated saturation oxygen-helium dives to 100, 300, 450 and 1,500 ft. Blood was collected before and after the dives and analyzed for blood gases, white cell count and differential, hematocrit, platelets, lactic dehydrogenase, LDH/HBD ratio, total protein, ura, bilirubin, serum aspartate amiorntransferase, alkaline phosphatase and electrolytes. Urine was also analyzed. In the experiments at 100 to 450 ft, due to lack of heating, there was a cold diuresis with urine electrolyte excretion following the increased glomerular filtration rate (GFR). At 1,500 ft, with no cold diuresis, there was retention of sodium, calcium, magnesium and chloride and a diuresis of potassium and phosphorus with a high corticosteroid excretion. No changes were noted in those subjects except in the 1,500-ft experiment where post-dive there was a rise in leukocytes and a fall in platelets. The results are discussed in relation to the possible mechanisms involved and correlated with the results of previous experiments. (Author)


Body fluid spaces were determined before and after one and six days of bedrest. All fluid spaces were calculated and compared on the basis of fluid volume per kilogram body weight. The nine male subjects who participated in the study were divided into two groups according to their deviation from an ideal body weight as determined from individual heights. The subjects below ideal weight had a statistically greater mean ml/kg red cell mass, extracellular fluid volume and total body water than the respective means from the group whose weights were above ideal. During bedrest a decrease of statistical significance was noted in the red cell mass, total body water and extracellular fluid volumes. The data do not support the often stated theory of fluid and electrolyte diuresis as the cause of the slowly decreasing plasma volume loss found after the first 24 hours of bedrest. (Author)


The effect of a heat-acclimatization program was assessed in 5 male subjects by a work-heat test (5 km/hr; 50 C; 20% relative humidity). The acclimatization program included 4 exposures to 40 C, over a period of 2 weeks, during which the men walked on a treadmill at a speed of 3.5 km/hr while wearing vapor-barrier suits. Acclimatization resulted in final mean heart rate, rectal temperature, skin temperature, and sweat rate of 125 beats/min, 37.8 C, 37.7 C, and .918 kg/hr respectively. Three of the subjects, whose preacclimatization values were compared, showed mean heart rate, rectal temperature, skin temperature and sweat rate decrease of 21 beats/min, 1.0 C, 0.1 C and .113 kg/hr respectively. Sweat rate, expressed as per degree rise in rectal temperature, about doubled. These results suggest that preventing evaporative cooling presents a major factor in heat acclimatization. (Author)


Comparison of physiologic responses to an hour of hyperthermic stress (66 C ambient air, 10 mm Hg ambient vapor pressure), where the head was maintained in comfort, with those obtained under unventilated and air-cooled undergarment (MA-3) conditions. Head and MA-3 ventilation temperature was 15.5 C. Airflow to the head and one MA-3 subcondition was 5 cu ft/min. For the remaining MA-3 subcondition it was 12 cu ft/min. Head ventilation, involving merely 8% of total body surface area, more effectively reduces physiologic strain (in terms of cardiovascular and sudomotor responses) than ventilation of 60% (MA-3) of total body surface area under equivalent (5 cu ft/min) or even operational (12 cu ft/min) conditions. The premise is advanced that inclusion of the cold sensitive facial area in the cooling system design inhibits the otherwise active discharge of neural impulses from thermoreceptors. Depression of this neurogenic activity significantly attenuates the response of heat-compensatory mechanisms. (Author)


Three cases of epileptic conditions of flight personnel with unconsciousness during flight are described. The nonexistence at the present time of techniques for detecting potential epilepsy is indicated. Careful examinations of the personal histories, with particular attention to head trauma and impairment of consciousness, and systematic EEG with hyperventilation and photic stimulation tests, are suggested to minimize epileptic fit hazards in the air. (V.Z.)


In this article the population of patients referred to the USAF School of Aerospace Medicine Consultation Service for vertigo, symptoms suggestive of vertigo, or vertigo-related diseases during a six-year period is described. Of the 96 cases studied 21 were found to have symptoms other than vertigo. Vertigo, cause undetermined, was the diagnosis in 42 of the remaining 75 vertigo cases. Such a large proportion of cases which could not be specifically diagnosed was probably due in part to an incomplete acute evaluation. A rigorous acute evaluation of all cases of vertigo is recommended in order to institute proper treatment, predict the likelihood of recurrence, and make the appropriate aeromedical disposition. (Author)


Demonstration that spatial disorientation is still a significant flight safety problem. It is indicated that 192 mostly highly qualified USAF pilots lost their lives because of disorientation during the decade from 1958 to 1968 and that age, experience and phase of flight contributed little to these accidents. Operational analysis of training, of flight environment, and of indoctrination programs is suggested to remedy this situation. (V.Z.)


An earth-like, 'back to nature' ecology for space colonies is advocated, in contrast to present highly complex, machinery-filled space base designs. Submitted here for general evaluation is the concept of a hollow, sunlit rotating space chamber in which human,
A71-40406


Ninety-eight normal subjects (mean age 51 years) who had a maximal treadmill stress test were found to have a satisfactory apexcardiogram at rest and after a double Master's test. The mean resting a-wave ratio was 11.6% in 13 normal subjects with an abnormal maximal treadmill test, and 7.8% in 85 normal subjects with a normal treadmill test (P smaller than 0.001). The mean postexercise a-wave ratio was 19.7% in 13 normal subjects with an abnormal treadmill test, and 12.8% in 85 normal subjects (2%) who had a normal treadmill test. Seven of 13 normal subjects (54%) with an abnormal treadmill test had a postexercise a-wave ratio of greater than or equal to 20% compared to eight of 85 normal subjects (9%) who had a normal treadmill test.

V.P.

A71-40407


Research supported by the University of Michigan.

Eleven patients with borderline hypertension and high cardiac output were compared to 16 paid healthy volunteers. Cardiac output, heart rate, and intravascular blood pressure were determined at rest, after administration of 0.2 mg/kg of propranolol i.v., and after administration of an additional 0.04 mg/kg of atropine. In four additional patients, response to infusion of isoproterenol before and after administration of 0.2 mg/kg of propranolol i.v. was evaluated. Resting heart rate and cardiac output in patients with borderline hypertension were elevated. After propranolol infusion, the values decreased more in the patients with borderline hypertension, but remained significantly elevated. After atropine administration, the difference in cardiac output and heart rate between the two groups disappeared. Consequently, patients with borderline hypertension and hyperkinetic circulation simultaneously exhibit an increase of sympathetic and a decrease of parasympathetic tone.

V.P.

A71-40553


Alterations in microbial flora and immunologic response of man which may occur during long-term confinement in a sealed cabin are examined. These changes depend on the environmental parameters, the duration of the exposure to various environmental factors, and on work-rest schedules. It is shown that under these conditions, some significant shifts in intestinal microflora, including a reduction of the number of species, can occur. It was found that in animals subject to such shifts, the immunocompetent lymphoid tissue was strongly underdeveloped. Means and ways of stimulating the immunocompetent systems of astronauts during prolonged space flights are discussed. Particular attention is given to the microbiological examination included in the physical qualification test for astronauts.

V.P.

A71-40555


Methods of affecting protein synthesis in immune responsive cells are studied as a step toward the development of procedures that can be used to normalize human resistance to infections resulting from changes in endogenous microflora and immunologic reactivity of the human organism during prolonged space flights. It is found that ribonucleic acids stimulate antibody formation. Ribonucleotides accelerate the proliferation of immunocompetent cells. A single parental injection of a stimulant of this type is sufficient to sustain capacity for accelerated antibody formation for a long time. Methods of maintaining antigen balance are examined.

V.P.

A71-40556


State-of-the-art knowledge on the development of specific active immunity, the factors responsible for 'natural' and nonspecific resistance, and how prolonged space flight may hamper these highly complex mechanisms is summarized. Viruses which classically may be induced to cause recurrent infections, such as herpes simplex and herpes zoster are described. The effects that altered host defenses might have on slow virus infections, such as kuru and virus-induced malignancies are examined.

V.P.


The capacity of lymphoid cells to participate in immunity reactions is evaluated by blast transformation of lymphocytes under the influence of phytohemagglutinin, blast transformation being measured by cytoligic analysis and autoradiographic investigation of the rate of RNA synthesis in cells (using tritiated urad as label). An experiment performed with three test subjects over a period of one year showed that the blast transformation level of lymphocytes was significantly affected by various situations (changes in physical loads), and particularly by changes in the atmosphere.

V.P.


Eighty-three microbiological tests of feces of 27 subjects were carried out with the object of obtaining detailed information on the composition of the normal human microflora, including the intestinal flora. It is found that sporeless anaerobic bacteria predominate (90%) in the fecal microflora. Aerobic microorganisms (lactobacilli, E. coli, streptococci) amounted to less than 6% of the total microorganisms. Clostridia, staphylococci, yeast, and protozoa are always present in the normal fecal microflora, but in insignificant amounts (0.01% of the total). Changes in the microflora due to prolonged isolation are also studied. The data are discussed from the point of view of immunological responses of the human body.

V.P.


The paper presents data obtained during the year-long medical-engineering experiment (in which three test subjects participated) with respect to changes in the Escherichia composition as judged by colicinogenic and hemolytic activity. At the beginning of the experiment, colicinogenic E. coli (col/D and col/B) was found in one of the three test subjects (U-85%); he also showed the highest stability of intestinal microflora throughout the experiment. The two other test subjects displayed colicinogenic microorganisms of the same type plus an unidentified type only during and immediately after emergency situations. Hemolytically active E. coli was isolated from the subjects with unstable microflora under emergency situations and at the end of the experiment. Periodicity in the predominance of Escherichia with antagonistic and hemolytic activity is related to the changes in the physiological state of the macro-organism and the rate of mechanical and possibly genetic exchange within the microbial associations in the human intestine.

(Approval)


Under conditions of long-term isolation in a sealed environment the microbial contamination of the skin and upper respiratory tract of man was much more pronounced than under normal conditions. This intensification of the contamination went on in a series of periodic increases in the amount of micro-organisms. Every such increase in micro-organisms was much more prominent than the preceding one. The harmful nature of the rise of the level of microbial contamination of human epidermal tissues was expressed by the development of bacterial population shifts and periodic increases in the number of pathogenic microbial forms.

(Approval)


One to three persons were confined for 5 to 40 days in rooms measuring from 5 to 21 cu m, and the dynamics of the spreading of common and hemolytic microflora on bodies, clothes, walls, and in the air were studied. After 30 to 40 days, the skin was found to be covered with several thousand microbes per sq cm, of which hemolytic staphylococci amounted to about 500 cells per sq cm. Linen contained tens of thousands of bacteria per sq cm, including up to 7000 hemolytic staphylococci per sq cm. Contamination of the air increased during the experiments. Bacteria were found to accumulate steadily on floors and horizontal working areas, whereas accumulation on ceilings and walls was appreciably lower. The results suggest the need for special precautions to prevent the outbreak of various diseases among crew members.

V.P.

A71-40561 Microbiological problems of manned space flight. J. Spitzizen (Scripps Clinic and Research Foundation, La Jolla, Calif.). In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR,

An attempt is made to explain the unexpected demise of a monkey 16 hr after it was aborted on the ninth day of a projected 30-day orbital flight in June, 1968. An analysis of collected data indicates that weightlessness and the hypothermia acted to shift blood volume centrally, thus providing a strong drive for the reduction of blood volume. Restraint, unusual vestibular sensations, and the continuing polydipsia all acted to disturb the central mechanisms affecting salt and water metabolism; it is probable that the function of the kidney was significantly affected and that an excessive amount of salt was lost. Indications are that a serious electrolyte disturbance was superimposed on growing dehydration. Unpleasant vestibular sensations may have contributed to the high evaporative loss by automatic disturbance, the whole problem being compounded and reinforced by the unnatural restraint to which the monkey was subjected.

V.P.


Lyogenic strains of Escherichia coli were exposed to space conditions aboard the flight of Zond 5 and Zond 7. Space flight factors appeared to affect the state of episome systems of bacteria, as judged by data obtained with F-Lac donor cells which also carried genetic markers for threonine and leucine. Observations on phage induction are discussed and compared with results obtained aboard Biosatellite 2. A number of monolayer cultures of human cells (HeLa cells, fibroblasts, and A-1 cells) were repeatedly exposed to the space environment. In one instance, HeLa 19 cells increased in size after exposure to space conditions, a change which appeared to be genetically stable. HeLa 19 cells which were carried on six separate space flights showed a higher viability than the corresponding cultures which were exposed only once aboard Zond 5.

(Author)


Space effects on the viability and heredity of the unicellular green alga Chlorella were studied during the Soyuz 5 flight in earth orbit and in Zond 5, 6 and 7 on their earth-moon-earth flight. A culture of strain LARG-1 was exposed aboard the ship on mineral agar medium in the dark. The flight in earth orbit aboard the Soyuz 5 brought about a significant falloff in cell survival and a gain in their mutability. There was a trend toward the percent growth of anomalies in autoradiography. The results obtained in experiments aboard the automatic stations of the Zond series were rather contradictory. The flight aboard Zond 6, like the earlier Zond 5, led to a statistically significant falloff in cell survival. The cell mutability remained unchanged. Space had no effect on cell viability in the experiment aboard Zond 7, but there was a trend toward antimutagenic action of the space factors.

M.M.

A71-40568 # Post-flight histological analysis of turtles aboard Zond 7. L. S. Sutulov, S. G. Kuklin, P. P. Saksonov, J. L. Sutulov, N. I. Konnova, L. V. Truchina, E. S. Severgina, L. L. Samsonova, S. N. Sonina, T. V. Selivanova, and V. I. Solov’ev. In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR, May 20-29, 1970, Proceedings. Meeting co-sponsored by the International Union of Biochemistry, the International Union of Biological Sciences, and the International Union of Physiological Sciences. Edited by Wolf Vishniac. Berlin, East Germany, Akademie-Verlag, 1971, p. 125-126. On the occasion of the flight of Zond 7 four turtles were included in the payload. A detailed histological analysis was carried out upon recovery of the subjects. No gross changes were observed, but the nuclei in the cells of many tissues decreased in volume by a statistically significant amount. This decrease is assumed to correspond to certain changes in function which adapted the animal to space flight conditions. No pathological changes were observed.

A71-40569 # Fatigue in the context of flight safety. Flight International, vol. 100, Sept. 2, 1971, p. 362-365. 10 refs. The role of pilot fatigue, due to lack of sleep, irregular duty patterns, and sleep disruption, in pilot performance is analyzed. It is shown that sleepiness has much the same effect as alcohol on human skills and that there is a measurable deterioration of performance with lack of sleep. Inability to discriminate (or even detect) small signals was established in test subjects with two to three hours of sleep. Evidence is presented that pilot performance varies diurnally, and that it is affected by desynchronization of diurnal rhythm by time-zone crossing. Rest and duty schedules that would contribute to flight safety are proposed.

A71-40570 # Methods of search for extraterrestrial life. A. A. Imshenetskii, B. G. Mursakov, G. G. Sotnikov, and M. D. Evdokimova (Akademiia Nauk SSSR, Institut Mikrobiologii, Moscow, USSR). In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR, May 20-29, 1970, Proceedings. Meeting co-sponsored by the International Union of Biochemistry, the International Union of Biological Sciences, and the International Union of Physiological Sciences. Edited by Wolf Vishniac. Berlin, East Germany, Akademie-Verlag, 1971, p. 147-151. A comparative evaluation of various methods for the detection of extraterrestrial life led to preference of the following ones: observation of the growth dynamics of bacterial cultures in nutrient media; increase in content of iron porphyrin proteins and ATP; change in pH of a medium; increase in content of iron porphyrin proteins and ATP; change in pH of a medium; and measurement of radioactivity after addition of labelled carbon compounds to nutrient media. An electronic apparatus has been designed that makes it possible to receive signals indicating microbial activity either by individual methods successively, or by three methods applied simultaneously (photometry, manometry, and measurement of radioactive C02). Studies on the optical activity of soils provided evidence that the measurement of optical activity of soils can give an indication of life. The comparison of these different methods formed the basis for the design of a biological station aimed at the detection of extraterrestrial life.

A71-40571 # Some potentialities of living organisms under simulated Martian conditions. L. K. Lozina-Lozinska, V. N., Bchenkova, E. I. Zaar, V. L. Levin, and V. M. Rumiantseva. In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR, May 20-29, 1970, Proceedings. Meeting co-sponsored by the International Union of Biochemistry, the International Union of Biological Sciences, and the International Union of Physiological Sciences. Edited by Wolf Vishniac. Berlin, East Germany, Akademie-Verlag, 1971, p. 159-165. 35 refs. Studies of the Martian environment as a possible life-sustaining medium are reviewed in an attempt to summarize information which could support the hypothesis of the existence of life on that planet. The temperature, humidity and atmospheric composition on Mars are discussed in the light of available data, particularly from Mariners 4, 6 and 7. Also covered are simulation experiments on bacteria, emphasizing the fact that radiation resistance of unicellular organisms depends on the state of their cells. It is also indicated that a low atmospheric pressure alone does not affect microorganisms, plants and even insects, and that Protozoa sustain an atmosphere of 98% CO2 with 1% oxygen, so that even traces of oxygen in the Martian atmosphere may be sufficient for supporting microorganisms. V.Z.

A71-40572 # A mathematical model of the electrocardiographic QT-RR relationship. M. E. Valentunuzzi (Baylor University, Houston, Tex.). (Society of Engineering Science, Annual Meeting, 7th, Washington University, St. Louis, Mo., Nov. 3-5, 1963.) Medical and Biological Engineering, vol. 9, July 1971, p. 255-261. 19 refs. A mathematical model of the electrocardiographic QT-RR relationship is presented, and a curve produced by thereon based numerical estimates is shown to fit reasonably well an empirical approximation made with Bazett’s (1918-1920) formula. The model is general and would agree in principle with previous membrane theories. This fact should encourage experiments in mammalian hearts and in single cells. M.V.E.

A71-40573 # The influence of ultra-high vacuum on crystalline enzymes. S. V. Lyosenko and G. G. Sotnikov. In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR, May 20-29, 1970, Proceedings. Meeting co-sponsored by the International Union of Biochemistry, the International Union of Biological Sciences, and the International Union of Physiological Sciences. Edited by Wolf Vishniac. Berlin, East Germany, Akademie-Verlag, 1971, p. 169-172. 6 refs. Solutions of cytochrome C, catalase, peroxidase and ATP were kept under extremely high vacuum for 72 hr in a simulation study of possible effects of an outer space environment on their activity. Chemiluminescence studies with luminol, and lufierin/luciferase from Photinus pizalis, were used to measure the activity of the enzymes after exposures. High vacuum exposures decreased the activity of the enzymes by up to 7% in concentrated solutions and by up to 30% in diluted solutions.

A71-40574 # Some potentialities of living organisms under simulated Martian conditions. L. K. Lozina-Lozinska, V. N., Bchenkova, E. I. Zaar, V. L. Levin, and V. M. Rumiantseva. In: Life sciences and space research IX; COSPAR, Plenary Meeting, 13th, Open Meeting of Working Group 5, Leningrad, USSR, May 20-29, 1970, Proceedings. Meeting co-sponsored by the International Union of Biochemistry, the International Union of Biological Sciences, and the International Union of Physiological Sciences. Edited by Wolf Vishniac. Berlin, East Germany, Akademie-Verlag, 1971, p. 159-165. 35 refs. Studies of the Martian environment as a possible life-sustaining medium are reviewed in an attempt to summarize information which could support the hypothesis of the existence of life on that planet. The temperature, humidity and atmospheric composition on Mars are discussed in the light of available data, particularly from Mariners 4, 6 and 7. Also covered are simulation experiments on bacteria, emphasizing the fact that radiation resistance of unicellular organisms depends on the state of their cells. It is also indicated that a low atmospheric pressure alone does not affect microorganisms, plants and even insects, and that Protozoa sustain an atmosphere of 98% CO2 with 1% oxygen, so that even traces of oxygen in the Martian atmosphere may be sufficient for supporting microorganisms. V.Z.

Electron microscopy and a light-scattering technique were applied to study the sedimentation properties of protein, phospholipids, flavoproteins and cytochromes in Halobacterium cutirubrum cell envelope vesicles subjected to disintegration in low-concentration salt solutions. NaCl concentrations causing solubilization of flavoproteins, the outer envelope, cytochrome b, phospholipids and cytochrome oxidase are determined. The stabilizing effects of NaCl, NaN03 and NaClO4 concentrations on individual cell membrane components are compared. The action of hydrophobic and ionic binding forces of stabilization is discussed. V.Z.


Investigation of the contributions of hypoxia and hypercapnia to the differentiated changes of regional sympathetic activity during asphyxia in anesthetized, paralyzed rabbits. Under artificial ventilation with gas mixtures of various O2 and CO2 contents, the discharges of a postganglionic nerve twig accompanying the retroauricular artery (cutaneous sympathetic) and of a splanchnic nerve branch (visceral sympathetic) were recorded. PaO2, PCO2, pH, arterial pressure, and heart rate were measured. Moderate hypoxia (PaO2 27.2 torr) induced a differentiated response of regional sympathetic activity similar to that observed during moderate asphyxia - i.e., increase of visceral and decrease of cutaneous sympathetic activity. During severe hypoxia (PaO2 16.4 torr) both visceral and cutaneous sympathetic activity increased, the latter after a temporary decrease. During hypercapnia (PaCO2 59.3 torr) only a slight increase of visceral sympathetic activity was observed, while cutaneous sympathetic activity did not change. It is concluded that the differentiated responses of the sympathetic nervous system during asphyxia are caused mainly by hypoxia. (Author)


In anesthetized cats, the thoracic and lumbar sections of the cervical vertebral canal were selectively heated or cooled. Single unit activity was recorded with steel microelectrodes from the spinal cord. The positions of the electrode tips were determined by micromarking. The existence of two groups of temperature-dependent ascending spinal units was confirmed. One group of units was activated by spinal cord cooling below normal body temperature. No temperature-dependent neurons were found, so far, exhibiting maximum discharge rates at normal body temperature. A roughly proportional relation between discharge rate and vertebral canal temperature seemed to exist in both heat-sensitive and cold-sensitive units within a limited range of spinal hyperthermia or hypothermia respectively. Part of the units exhibited dynamic responses to changes of vertebral canal temperature in addition to their static responses. M.M.


The intracellular pH of muscle tissue was determined in 10 dogs anesthetized with Nembutil, using the DMO method. The arterial CO2 tension was varied between 20 and 100 torr. The extracellular space was obtained as chloride space and was on the average 0.179 kg H2O per kg tissue. The intracellular space was 0.563 kg H2O per kg tissue. At a CO2 tension of 40 torr and a pH of 6.934, the calculated total CO2 was 5.62 mM per kg tissue in the intracellular and 3.86 mM per kg tissue in the extracellular compartment. No difference was found when the calculations were done replacing the pCO2 of the arterial blood by the corresponding values of the mixed venous blood.

M.V.E.


Blood flow in arteries supplying cutaneous and intestinal vascular regions were simultaneously measured with an electromagnetic flowmeter in anesthetized dogs, paralyzed with succinyl choline. The hypothalamic preoptic region was selectively heated and cooled by means of a stereotaxically inserted, water perfused thermode. Skin blood flow increased during hypothermic heating and was reduced during hypothermic cooling. Conversely, intestinal blood flow decreased during heating and increased during cooling. Arterial pressure was not influenced by hypothermic cooling and decreased slightly during heating. The changes of blood flow distribution observed in the experiments are in keeping with the results obtained during selective spinal cord heating and cooling. It is assumed that antagonistic changes of blood flow in the cutaneous and intestinal vascular beds represent typical thermoregulatory responses of systemic circulation induced by regionally antagonistic changes of vasomotor activity. (Author)


In 9 dogs the heart rate was kept constant by electrical stimulation of the right auricle after elimination of the sinus node. Hypercapnia was induced by increasing inspiratory carbonic acid concentration at constant oxygen concentration. The mean arterial carbonic acid partial pressure increased from 40.5 to 70.5 mm Hg. The mean pH decreased from 7.30 to 7.14. Under these conditions the coronary flow did not change. Systolic and diastolic aortic pressure, left ventricular pressure, and the maximal rate of pressure rise in the left ventricle remained unchanged. Alterations of coronary blood flow caused by increased carbonic acid concentrations as described by other authors can be explained by a change of hemodynamic conditions. (Author)


A wireless measuring device for long term measurements of the diurnal temperature rhythm on unrestrained rats is presented. Up to

The precision of the projection of the visual field to the dorsal lateral geniculate nucleus (LGNd) of the cat was studied by plotting the receptive fields of single neurons recorded extra-cellularly in the nucleus. The concepts of a "projection column" and of "random scatter in the location of receptive fields" have been defined in relation to cells in the LGNd. The projections of adjacent areas of visual field overlap extensively in the LGNd. In this study, the overlap of retinal afferents in the LGNd was measured in terms of the random scatter of receptive field positions for cells recorded in a given electrode penetration parallel to projection columns in the nucleus. The monocular receptive field scatter within a column in the LGNd is about of the same magnitude as both the monocular receptive field scatter within a cortical column and the binocular receptive field disparities of cortical units. The differential magnification of the visual field on the LGNd is a reflection of the ganglion cell density differences in the retina.


The majority of cells in the dorsal nucleus of the lateral geniculate body (LGNd) in the cat have two receptive fields: one for each eye. Of the cells tested for binocularity (113), only 21 (18%) were purely monocular. The remainder had receptive fields for the nondominant eye, the great majority of which (81 or 88%) were inhibitory and only 11 (12%) were excitatory. The proportion of inhibitory receptive fields for the nondominant eye was slightly greater when the dominant eye was ipsilateral (77%) than when it was contralateral (68%). The properties of the inhibitory receptive fields were studied with moving slits of light and stationary flashing spots. Most of the fields were purely inhibitory and varied in size from 1.5 to 6 deg across. There were no specific stimulus requirements other than a change in contrast within the receptive field. The inhibitory effect was usually fairly weak, the spontaneous discharge of the neuron being inhibited much more readily than the driven discharge.


Additional measurements of the retinal directional effect in several subjects confirm the validity of a previously advanced theory which describes the retinal directional effect in terms of a Gaussian distribution of the orientations of a population of retinal cones. Arguments are given which show that the proposed population distribution theory is capable of explaining not only the directional brightness effect (Stiles-Crawford effect), but also its spectral variation and the hue shift.


A high-contrast grating was used to induce the tilt aftereffect. The effect was found to occur only close to the vertical and horizontal orientations. The interocular transfer of the effect is complete. Judgement of the horizontal and vertical orientations (as measured by determining the standard deviation at a number of orientations) is much more precise than for oblique orientations even when the cue of gravity is removed. All of the characteristics of the tilt aftereffect cannot be accounted for by adaptation of neurons selectively sensitive to orientation, even though they may play a significant role.

A71-40706 * Stimulation experience and incentive variables as determinants of behavior elicited by hypothalamic stimulation. Verne C. Cox (Texas, University, Arlington, Tex.) and Jan W. Kakolewski (South Dakota, University, Vermillion, S.D.). Psychonomic Science, vol. 24, Sept. 10, 1971, p. 245, 246. 7 refs. NIH Grant No. M-4529; Grant No. NGL-36-005-001.

Extensive stimulation experience is shown to increase the proportion of hypothalamic electrode sites yielding elicited eating and drinking during electrical stimulation. The great number of stimuli required for some electrode sites, prior to the emergence of elicited eating and drinking, suggests the possibility that changes in neural tissues surrounding electrode sites underlie the appearance of elicited behavior.


Outline of a special test procedure to derive the relation between intelligibility scores and articulation index (AI) for time-varying aircraft noise. This relation is then compared with a relation between intelligibility scores and AI obtained for steady-state simulated aircraft noise. A secondary objective of the study was to compare various physical measures of aircraft noise with respect to their effectiveness in predicting speech intelligibility. It is shown that for a given AI, time-varying noise provides less masking than steady-state noise.


Individual pairs of human chromosomes can be reliably identified by a new method that does not require special optical equipment and that results in permanent preparations. This method, which is based on treatment of the chromosomes in situ with NaOH, followed by incubation in sodium chloride-trisodium citrate and Giemsa staining, results in highly specific banding patterns in characteristic regions of the chromosome arms. It should prove useful for the detection of small structural changes in chromosomes.


Citellus lateralis squirrels were kept at 23 and 4 deg C in experiments designed to determine the metabolic processes in
Mitochondrial membranes during hibernation. The activity of succinate oxidase from isolated mitochondria of hepatic cells of active squirrels showed a nonintersecting discontinuous Arrhenius plot, suggesting that lipids in mitochondrial membranes may undergo a phase change at about 23 deg C. This discontinuity was not evident in mitochondria from the livers of hibernating squirrels, indicating the nonoccurrence of this phase change in their mitochondrial lipids.

V.Z.


In an attempt to determine what blood flow conditions give rise to vascular murmurs, a general "sound boundary" curve was developed which establishes the combinations of minimum flow Reynolds numbers and percent stenosis required for the onset of vascular murmurs. The curve was derived by a combination of engineering analysis and animal experiments in which thin circular orifice plates were implanted in the descending aortas of anesthetized dogs. The results indicate that the sounds are produced by jet instability and associated "free turbulence" in the flow.

M.V.E.


Action potentials studied in 36 human atrial muscle strips at 27 C were found to be separated into two components. Simultaneous recordings with two microelectrodes demonstrated an independent conduction of the second component through selective and variable pathways. Increased separation of the two components was elicited by higher rate and lower intensity of stimulation. It is concluded that the separation is attributable to a nonhomogeneous excitation of the preparation and that the two components are triggered by two relatively independent depolarizations using different channels.

M.V.E.


Review of current concepts on the colloidal nature of protoplasm, and survey of research on the coacervate state of colloidal suspension and on coacervate systems containing biological catalysts. The theory for the regulation of enzyme functions in a living cell is examined within the framework of colloidal-chemical approaches to the study of life. Coacervates are examined from the following three viewpoints: (1) as models of the protoplasm and its elements, (2) as systems simulating the multiple-phase conditions of the cell for studies of the enzyme catalysis, and (3) as models of structures leading to the formation of the simplest organisms.

T.M.


This book describes in popular form the history and progress of aeronautics and astronautics with the emphasis on the personal experiences and emotions of individual aeronauts and astronauts during training and flights. The daily routine, equipment, food, habits and personal characteristics of some Soviet and American astronauts are depicted. Their reactions and emotional behavior before and during flights are discussed in some detail. The authors are the first Soviet astronaut and a physician working in space psychology.

V.Z.


A model-matching technique was used to derive estimates of two parameters, system gain and effective time delay, of a differential-equation model for the tracking behavior of fourth, seventh, and tenth graders. These parameters appear to provide more analytic insight into S's performance than did tracking error scores alone and suggested that the differences in time delay represent maturational effects while system gain is sensitive to more individualistic properties of S's behavior.

A71-40984


Body fluids are generally contained in muscular organs. Thus we cannot understand blood circulation, lymph flow, etc., without knowledge of the function of the muscles. In this article a basic formulation of the mechanics of the muscular organ is presented, and is illustrated by the problem of ureteral peristalsis.

A71-40865


Description of a mathematical model of the heart and of an electrocardiograph which can compute the ECG of the heart model. An attempt is made to construct a system of nonlinear oscillators and a coupling between them so that this system reproduces the control system of the heart. A model of the electrocardiograph is constructed which produces six of the twelve traces of the ECG.

A71-40986


Cardiac rate-variability control and an initial demonstration of systolic blood-pressure variability control using visual feedback of physiological information were examined. Continuous measures of respiration, heart rate, EKG waveform analysis, and systolic blood pressure were obtained for both experimental groups and for yoked controls who saw the same visual display as the experimental Ss. Ss successful at reducing heart-rate variability showed clear changes in the P-R wave relationships of the EKG, indicating possible direct attempts to manipulate heart rate so as to reduce variability. Ss controlling blood-pressure variability who had high heart rates were
more successful in reducing variability than those with low rates, possibly because of differential feedback to Ss with high and low heart rates. In addition, apparently as a reaction to E's adjustment of the visual target range, experimental Ss showed decreases in mean blood-pressure levels. (Author)


The tests were carried out with white mice of mixed breed weighing from 20 to 25 g and guinea pigs weighing from 300 to 350 g. The animals were subjected to back-to-chest transverse accelerations in a centrifuge. All the tested radioprotectants, which were administered 30 min and 4 hrs before acceleration, reduced the resistance of the organism to acceleration. The reactivity of the organism to radioprotective compounds during the aftereffect of transverse accelerations was also studied.

G.R.


Experimental data demonstrating different effects exerted by aminazine and chloral hydrate on brain gangliosides and on such ganglioside components as N-acetylgalactosamine acid and N-acetylgalactosaminitol. Aminazine does not substantially affect either the entire ganglioside molecule or the polysaccharide section components. Chloral hydrate changes the metabolism of the entire molecule and sharply increases the activity of N-acetylgalactosaminitol. The tests were performed on rats.

T.M.


The metabolism of individual fractions of glycerides in the brain of rats was studied under normal conditions and during hypoxia in order to obtain information on the role of glycerides in the biosynthesis of phospholipids. The results show that monoglycerides are intermediate compounds in the metabolism of the other glycerides and phospholipids. Dicyglycerides exhibit the highest specific activity of the fractions studied. The specific activity of both monoglycerides and diglycerides increases sharply during hypoxia. The largest increase (3.7 times) is exhibited by diglycerides which shows that they play a vital role in the synthesis of triglycerides and phospholipids. The triglycerides show only a small increase in specific activity during hypoxia, and it is considered likely that they constitute a reserve for the synthesis of biologically more important lipids under specific conditions.

T.M.


The content of cerebrosides in the brain of growing rats was reduced by 2.5 times and the ganglioside content was reduced by almost four times after short exposures to acute hypoxia. The cerebroside content of adult rats remained unchanged, and their ganglioside content was reduced by three times. The cerebroside and ganglioside contents of both adult and growing rats remained within normal limits after exposure to moderate hypoxia. The cerebroside and ganglioside contents remained unchanged for fifteen days after exposure to small doses (40 r) of X-ray radiation. The data show that small doses of ionizing radiation do not cause significant changes in the ganglioside and cerebroside contents of nerve cells.

T.M.


The synthesis of brain glucose and glycogen from organic-acid products of the endogenic metabolism was studied in rats under normal conditions and during functional disturbances of the central nervous system. The dynamics of butyric acid penetration into the cerebral hemispheres was investigated together with the rate of accumulation of carbon-14 (originating from labelled butyrate) in the glucose and glycogen under normal conditions and during stimulation by caffeine and inhibition by chloral hydrate. Under normal conditions, the radioactivity of glucose is much higher than that of glycogen. Narcotic inhibition further increases the radioactivity of glucose and reduces that of glycogen. A still sharper decrease in the overall level of glycogen activity is observed during stimulation by caffeine.

T.M.


The peroneal nerve in frogs was used to study the role of antidromic stimulation of efferent fibers and the role of orthodromic stimulation of afferent fibers in the evocation of changes in the functional state of the contralateral symmetrical cerebrospinal center. Prolonged (duration of several tens of minutes) stimulation of the mixed nerve by rectangular pulses of threshold strength at a frequency of 80 to 100 pulses per second causes long-term changes in the excitability of the contralateral symmetrical cerebrospinal center. Stimulation of the afferent fibers may both enhance and depress the reflex excitability of the symmetrical center, depending on the mode of tetanization. Antidromic stimulation of the motor fibers reduces the reflex excitability of the symmetrical center.

T.M.


The state of operational rest denotes a passive condition of heightened readiness in expectation of a stimulus requiring urgent active response. The situation is encountered in many practical situations when an operator awaits an urgent signal on a control panel. The waiting period is usually characterized by the complete absence of sensory stimuli and of muscular activity, which may have a detrimental effect on the response of the subject when the signal finally presents itself. This possibility was examined by an experi-
ment in which the waiting period was characterized by the presence of additional non-urgent signals requiring specific functions; in addition, some muscular nerves of the lower extremities were electrically stimulated. Care was taken not to remove the attention from the arrival of the urgent signal. The additional activation of the operator during the waiting period reduced the response time for the urgent signal and improved the functional state of the operator. T.M.

A71-41061 // Trace processes as a basis for the change in efficiency during exercise and active rest according to Sechenov (Sledovy protsessy kak osnova rabotospособности pri upratzenii i aktivnom otzykhe po Sechenovu), L. P. Pavlova (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). Nervnaia Sistema, no. 11, 1970, p. 105-112. 16 refs. In Russian.

The functional state changes to continue in a phased manner after the stimulus has been terminated, and the necessity of analyzing these trace reactions when organizing rest and work periods in labor schedules has been demonstrated in previous studies. The present work examines the dynamics of trace processes in the symmetrical nerve centers of hands. The active rest mechanism is related with the trace exaltation phase on the basis of tests in which arbitrary rhythmic bending of fingers was used to determine the stimuli and sensations from exercised muscles. T.M.

A71-41062 // Problem of the formation of a motor stereotype with different muscular loads (K voprosu o formirovanii dvigatel’no go stereotipa pri razlichnykh myshechnyh nagruzakh), V. S. Aver’ianov and T. G. Mikhailova (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). Nervnaia Sistema, no. 11, 1970, p. 113-118. 5 refs. In Russian.

Training exercises were performed in which the subject was required to pull a lever with his right hand in response to a lamp signal. Completion of the task extinguished the lamp. The entire training period lasted from 50 to 60 min and consisted of 80 tasks in eight stages; each stage involved only one of four different lever loads. Measurements show that the training period is divided into three stages successively characterized by a reduction of the motor period, a stabilization of the motor period, and a reduction of the latent period. The electrical activity of the main working muscle increases for lever motions with small loads and somewhat decreases for motions with large loads. The static tension decreases in the course of the training period. Distal muscles are the first to be activated at the beginning of training, while proximal muscles are the first to be activated at the end of the training period. T.M.


The phenomena of molecular, cellular, systemic, and psychic levels are examined from common biophysical viewpoints. Differential excitability, reactivity, adequacy, and guidance are observed at all of these levels, and a theory is proposed for the relationship between recovery and creativity. The observed dependence of the depolarization of a single nerve fiber on the duration of the stimulus confirms the proposed definitions of differential excitability and adequacy. The latent period observed for both single and paired stimuli is examined as a possible measure of human biophysical neurodynamics. Curves of stimulus magnitude vs response duration were constructed for the blinking reflex, and the influence of nerve and brain adjustment processes on the blinking reflex was examined. The critical discreetness interval of the human tactual analyzer was measured. T.M.


The functional liability (rate of nerve processes) of a sensory analyzer can be determined by measuring the minimum interval between two discrete stimuli which are controlled in force, duration, and area of application. An air jet was used as a tactual stimulus, and the critical discreetness interval was measured on the basis of speech responses and unconditioned blinking reflex reactions. The duration of the critical discreetness interval is described as a function of stimulus duration, pressure, and affected area by a first-order equation in a four-dimensional space where the coordinates consist of these four variables. T.M.


Consideration of the problem of the visual localization of Obreimov’s (1966) so-called aventure spots in space. It is shown that each aventure spot is perceived as a point light source, located further from the eye pupil than the screen used in the observations. It is concluded that an increase in the degree of spatial coherence of the light flux increases the reaction of the receptor without increasing the stimulus energy. A.B.K.


Description of two methods of extracting from the total electroaurogram pattern component relating only to the electrical activity of the heart. The first method consists in maintaining a fixed distance from the probe to the subject’s chest, in order to decrease the mechanical vibrations of the latter with respect to the probe. The second method consists in limiting the frequency characteristic of the recording device. The types of information carried by the electrotonic and triboelectric components of the aural electric field are discussed. A.B.K.


Description of a scheme for constructing an analog statistical analyzer for measuring one-dimensional EEG amplitude distribution functions. The proposed scheme is based on the use of an analog computer to achieve transformation of tau sub i intervals into a sequence of square pulses with a standard amplitude and with lengths equal to the lengths of the tau sub i intervals. The use of the method is illustrated in an experiment to determine the reaction of a subject to a weak (threshold) acoustic stimulus. A.B.K.

A71-41068 // Certain studies of electroencephalogram wave asymmetry (Nekotorye isledovaniia asimmetrii voln elektroencefalogrammy), V. A. Doroshenko, A. I. Pudovkin, and V. E. Rozentfeld (Leningradskii Gosudarstvennyi Universitet, Leningrad,

Investigation results on the role of thyroxine in brain biochemistry are discussed. It is shown that thyroxine enhances the deamidation of glutamine in brain mitochondrialfractions much more strongly than sodium phosphate, acetylaspartate, bicarbonate and aspartate. It is found that phosphate-dependent and phosphate-independent isoenzymes of brain glutaminase form an enzyme system whose interaction is affected by thyroxine. M.V.E.


Comparison of the free amino acid content and composition of the brain arteries with those of the aorta and carotid artery in young and old human subjects and dogs. The vessels of humans spanning the ages of 12 to 91 were studied 16 to 20 h after death due to various causes. It is shown that brain arteries have the larger free amino acid content and that, in contrast to other arteries, they contain considerable amounts of gamma-aminobutyric acid. The free amino acid content of all arteries decreases with age and reaches a minimum in old age. Findings pertaining to dog arteries parallel those concerning humans. M.V.E.


Review of the composition of the hypothalamus and pyrimidine bases of cattle hypothalamus and their derivatives as determined by gel filtration and subsequent spectral analysis and chromatography. Substances recovered from the Sephadex G-10 column in an aqueous medium are in the order named: inosine monophosphate, guanosine monophosphate, adenine monophosphate, hypoxanthine, uracil, and guanine. M.V.E.


Coronary-dilating substances of low molecular weight, separated from their protein carriers through dialysis, are studied. After dialysis, these proteins exhibit no coronary-dilating effect, but, following their hydrolysis with trypsin, some coronary-dilating substances of low molecular weight are formed. The latter have been separated by paper chromatography. These results suggest that some specific proteins separated from the hypothalamus represent probably not only carriers but also sources of these active substances. M.V.E.


A study of the loss of serotonin from rat midbrain slices incubated in media of various ionic composition showed that in a medium of low Na(+) the loss of serotonin was significantly blocked. Conversely, the most pronounced loss of serotonin was observed in the presence of ouabain. Whereas the loss of serotonin from slices increased in a K+-strengthened medium, it was markedly impeded after incubation in a high K(+)low Na(+) medium. The loss of gamma-aminobutyric acid from slices was not significantly affected by the omission of Ca(++)+, was slightly reduced in the absence of K(+), and was very markedly enhanced in a low Na(+) medium. Gamma-aminobutyric acid inhibited the release of serotonin from slices in a medium of balanced ionic composition. M.V.E.


The results of white matter composition studies indicate that the amount of lipids and phospholipids increases from the cerebral white matter to the thoracic section of the spinal cord along which it decreases. The lipids of the spinal cord and especially of the sciatic nerve are richer in phospholipids than the brain. The phosphatides of the white matter of the brain and of the various parts of the spinal cord and sciatic nerve are mainly ethanol-amine phosphatide, phingomyelins, lecithins, and in lesser amounts serinephosphate, monophosphoinosolide, and polyglycerophosphate. The content of total lipids and most phosphatides in the white matter of the cerebral and thoracic sections of the spinal cord is higher than in the lumbo sacral section. But the relative percentage of phosphatides is very stable in the white matter of the various parts of the spinal cord. M.V.E.


The results are discussed of a study of ganglioside effects on the activation of respiration in rat brain mitochondria, using succinate (added both before and after the introduction of gangliosides) as the
respiratory substrate. The results obtained indicate that Ca(++) activates mitochondrial respiration by 44 per cent while gangliosides inhibit this process. The inhibitory effect of gangliosides is markedly reduced when they are added after the succinate. The reduction of Ca(++) transport in mitochondria seems to be due to reduction in oxidative phosphorylation.

M.V.E.


Accommodation was measured by the laser scintillation technique while the S viewed a stationary fixation spot through a series of apertures in a screen located at various distances. The magnitude of accommodation was a compromise between the distance of the fixation spot and the screen. Accommodation was affected significantly by the interaction of the distance of the screen with aperture sizes of 1 and 4 deg and distance of the screen with its order of movement from near to far or far to near. The data are interpreted as implying the importance of the peripheral visual field and/or perceptual factors when conflicting cues to distance coexist in the visual field.

(Author)


The magnitude of induced movement was measured as a function of the perceived depth between the test object and the plane of the induction object, with this perceived depth produced by stereoscopic cues. Predictions of the magnitude of induction as a function of the depth separation of the test and induction object were made from the subject-relative and object-relative hypotheses of induced motion. It was expected, however, that neither of these hypotheses would predict the results independently of a factor described in the adjacency principle. This principle states that the effectiveness of whatever cues or processes determine the induced movement will decrease with increased depth between the test and induction object. The data indicate that the adjacency principle must be considered in explaining the results. The subject-relative rather than object-relative hypothesis as modified by the adjacency principle was most successful in predicting the results.

M.V.E.


The monograph summarizes the results of morphological and physiological studies of the reversible and irreversible effects of radio waves on a total of 646 rabbits, rats and mice, covering chronic and acute exposures at 500 kHz to 1.5 MHz, 14.88, 69.7, 155 and 191 waves on a total of 646 rabbits, rats and mice, covering chronic and acute exposures at 500 kHz to 1.5 MHz, 14.88, 69.7, 155 and 191 Hz. The functional and morphological changes produced by exposures of various frequencies in the cardiovascular and nervous systems, myocardium, reproductive organs, biochemistry, blood, eye, weight, cerebrum, cortex, spinal cord, skin and nerves are discussed. Exposures in the centimeter wavelength range tended to affect the nervous fibers of the skin, internal organs and cortical neurons while exposures in the decimeter range showed no effect on the nervous activity of the skin. The monograph is intended for scientists interested in the subject.

V.Z.


Systematic evaluation of long-term experimental research on the physiology and pathophysiology of human higher nervous processes. Attention is given to the forms of nervous activity in normal and pathological states, the interaction of the cerebral cortex with lower substructures of the central nervous system, the behavior and interaction of nervous processes, and the unconditional-reflex activities. The main features of the reflex-forming function are described, together with the interaction of signal systems and the properties of conditioned and unconditioned inhibitions. Special attention is given to the development of nervous processes in the course of biological growth.

T.M.


Use of the photosensitivity of two primates as a means of studying hyperoxic convulsions. Sensitivity to hyperoxic oxygen appears to be similar in both species. However, the preventive effect of Diazepam and two of its derivatives (Ro.05.4023 and Ro.05.4200) was more definite in Macacus nemestrinus than in Papio papio.

F.R.L.


This series of papers brings together the knowledge and experience of scientists and engineers, those engaged in studies of perception, designers of signaling equipment, and users of flashing light signals. The sessions cover visual perception of flashing lights, general application of flashing lights, road, rail, and marine applications, aviation applications, and research - recent and future. Discussions are included at the end of every session. Also covered are a study of the apparent flicker rate at subfusional frequencies, the treatment of binocular vision problems with light flashing at 9 Hertz, and a study of the behavioral effects of flashing road pedestrian beacon. Author and subject indexes are provided.

G.R.


Aspects of flash perception considered include the conspicuousness at suprathreshold levels, the unreliability at threshold levels, and the latency effects which may be used with profit to simulate movement. The most important feature of flash perception is the state of unpreparedness of the visual system. All sorts of electrophysiological experiments have revealed so-called, "center-surround" processes in which the surround partly annihilates the activity of the center. Data on the quantitative importance of these processes have been derived in recent years from the study of spatial contrast sensitivity functions.

G.R.

It is found in the investigations conducted that the subjective brightness of a flashing light increases in two phases with increasing stimulus area. This is probably due to the integrated action of summation and inhibition in the retina. The transition area (the area at which transition between the two phases of increase in subjective brightness with stimulus area occurs) increases with increasing intensity. Background fields accentuate the shift in transition area with intensity. Edge effects contribute significantly to subjective brightness at suprathreshold levels but are insignificant at threshold levels.

G.R.


The experiments conducted show a high degree of constancy of the ratio of flicker and flash sensitivities even in cases in which the mean level of intensity is varied over a large range. The product of cut-off frequency and critical duration is also nearly constant. This constancy is explained in a theoretical analysis based on three system properties. The ratio of the sensitivity S, which is defined as the maximum value of the amplitude sensitivity at a certain level, and the sensitivity of flashes F is considered. The numerical experimental value of this ratio is found to be larger (by a factor of 2.5) than theoretically expected.

G.R.


Absolute foveal thresholds were obtained for a complete range of pulse lengths and null periods. It was found that the data could be described by a relation proposed by Blondel and Rey (1912), if the value of the empirical constant in the relation were variable. The constant is to be equal to the null period for very short null periods, and to approach the Blondel-Rey constant asymptotically for long null periods. A simple equation is suggested to describe the change of the constant with the null period. However, further data are needed to test the adequacy of this equation.

G.R.


The depth perception scores obtained for the ten subjects tested under the various combinations of the experimental conditions were statistically treated by a specialized analysis of variance routine. Source of illumination was the only statistically significant parameter which affected the depth perception scores. The data were further analyzed by the Duncan Multiple Range Test. The results indicate that the average decrement of depth perception under conditions involving a central illumination source was positive (i.e., subjects placed the movable rod in front of the stationary rod). Under the conditions of a peripheral source the average decrement of depth perception was negative (i.e., subjects placed the movable rod behind the stationary rod).

G.R.


The design of a clinical instrument employing flashed light stimuli is discussed. The instrument, called Visual Field Analyzer, is equipped with a separate external illuminator, which provides an illumination of 10 lux on a black screen. This screen contains the apertures for the stimuli, and has a reflection factor of approximately 10%. A xenon electronic discharge lamp was chosen as the light source. The minimum discernible luminance difference observed as a function of the age of the subject is discussed to obtain a basis for the differentiation between normal and abnormal cases. It is pointed out that the use of the Visual Field Analyzer makes it possible to conduct routine visual field examinations.

G.R.


The tests in the investigation were performed by two observers with good binocular vision. The observations were carried out at super-threshold luminances. The effects of the angular size and of the adaptation luminance were studied for white, blue, green, yellow, and red light signals with a constant pulse shape of the light flashes. With Bloch's law and the form factor relations for arbitrary pulse shapes can be determined. The calculation of the transfer factor of a light signal is discussed. The transfer factor describes the effective intensity of a flashing light in comparison to a steadily burning light under the same conditions of observation.

G.R.


The stimuli in the investigation were presented haploscopically in Maxwellian view in order to avoid possible retinal interaction effects that might be obtained with monocular stimulation. A true standard flash of a fixed duration and intensity was employed. The method of co-terminating stimulus presentation was also used. The data obtained show the presence of a Broca-Sulzer effect for point stimuli only when the standard flash illumination is 1 or 2 log units above the 99% threshold. The backward masking hypothesis suggested by Raab and Osman (1962) and Naus (1967) offers a tenable explanation for the results.

G.R.

A71-41485 A probability approach to visual effectiveness of signal lights. Guy P. Clark (U.S. Coast Guard, Applied Technology
A71-41486


The possibility of classifying flashing lights of various characteristics in a comparison method of reliability or attention-attracting value, is investigated by observing the behavior of the lights in a series of pairs and asking him to judge which one appeared to have the most attention. It is shown how the data can be converted into a psychometric scale of conspicuity. Practical precautions which should be taken to achieve the best results are outlined.

A71-41487


The sensation of motion that appears under certain conditions between two discrete stationary sources of light flashed on and off with one source lagging the other is analyzed. It is shown how this apparent motion phenomenon and real motion phenomena may be described by the same functional processes. Specifically, it is demonstrated that the existence of an apparent motion effect associated with stationary flashing light sources is a natural consequence of a model designed to describe certain real motion effects, and that the frequency response characteristics of this apparent motion are the same as those of the equivalent real motion effect.

A71-41488


Two flashes of equal area were presented to the same foveal location in succession, using a four-channel binocular Maxwellian viewing system. Changes in the field threshold as a function of the interstimulus interval (ISI) were evaluated for various durations of the test flash (in all experiments, the interval separating two flashes was greater than that required to just perceive two flashes). A lack of difference in the relative threshold changes was found in monocular and binocular conditions. This indicates that temporal interactions yielding the threshold effects observed in the successive method are centrally limited, to the degree that binocular presentation reflects central involvement. Brightness matches for simultaneously presented spatially adjacent fields (simultaneous contrast) showed that the temporal data reflecting adaptation and backward masking are adequately fitted by the Jameson and Hurvich formulation under successive contrast conditions.

A71-41489


The history and progress of flashing light applications in aviation up to date are surveyed, noting that the flashing characteristics of aviation lights were in most cases developed empirically from flight experience. It is pointed out that the primary purpose of flashing light uses in aviation has been and is conspicuousness and identification and that except for high intensity beacons economy of power has been a secondary consideration. The photometric characteristics of most flashing lights in aviation are given in terms of steady burning intensity and minimum flash duration, or in terms of instantaneous intensity during a flash integrated within a certain time limit, often 0.5 sec.

A71-41490


Subjects with varying types and degree of color deficiency were given various color tests including the American Optical H-R-R plates, the Dvorine plates, the Color Threshold Tester, the Farnsworth Lantern, the Farnsworth Munsell 100-hue, the Farnsworth Panel D-15, the Tittmus Vision Tester Color Plate, and an anomaloscope examination. Correlations are obtained to characterize the ability of subjects to discriminate red, white and green aviation signals. The results generally indicated that the Farnsworth Lantern was a superior predictor of performance in practical tests.

A71-41491


Recent work on aircraft warning signals, navigation and anticollision displays, and the autokinetic phenomenon carried out by the Canadian Forces is reviewed. Covered are two laboratory experiments on warning signals, three operational studies on anti-collision and navigation lights, and one laboratory experiment on autokinetic latency and displacement. The results are summarized as follows: pilots wearing spectacles in flight are less sensitive to peripheral visual stimulation than others. The tactile warning display studied is not effective in easing the workload of the visual system. Strobe lights of white rotating beacons should not be used on aircraft. Any rotating beacons operating in clouds can cause disorientation. Conventional navigation and anti-collision lighting systems fail to indicate aircraft flight path and altitude. Aircrew should be briefed on, but not trained in, autokinetic motion.

A71-41492

Perception of effective flashes produced by a scintillating xenon arc flash tube. Robert Bates (Rochester, University, Rochester, N.Y.). In: The perception and application of flashing lights; Proceedings of the International Symposium, Imperial College

The potential of strobe lighting in aviation is discussed as an effective approach to the reduction of the ever increasing midair collision hazards. The Collision Avoidance System (CAS) developed by the Airline Transport Association and the more recent Pilot Warning Indicator (PWI) are assessed, noting the latter as the one which is more promising for the application of strobe lighting to assist pilots in sighting approaching aircraft. Arguments are given in favor of a speedy introduction of strobe lighting into aviation. V.Z.


A description of three studies conducted to determine the effects of hypoxia on the detection of flash signals occurring in a number of positions distributed throughout the peripheral visual field. It appears that response time increased markedly and systematically as stimulus position became more peripheral. The data show that in a situation where visual signals occur in unpredictable fashion, operators are progressively slower and more variable in response as signal locations become more peripheral. These changes are heightened by hypoxia, in direct relation to severity and duration of exposure.

F.R.L.


Discussion of a method of analyzing the sensitivity and errors of the measuring apparatus, the principle of which is to examine successive stages of measurement of the pulse as it passes through the measuring channel elements, and to compare the output and input signals. The flash photometric apparatus is composed of an optical system, a photoreceiving unit, and an amplifying system with an indicating or a registering unit. Three aspects of the problem of passing these pulses through the apparatus measuring channel can be distinguished: spatial, spectral, and temporal, each of which can be matched with the same characteristics of the corresponding elements of the photometric apparatus.

F.R.L.


Results of a pilot study to investigate stimulus variables (test field size, brightness, and retinal location) that may influence an observer's assessment of the rate of flicker of a stimulus. A modified stroboscope was used to produce a constant light output per flash over the frequency range used. Observations were made monocularly, and throughout the study a rigorously applied sequence of instruction and observation was used for every observer. The results obtained tend to support the view that the retinal location of the stimulus is significant in modifying assessments of flicker rates. The tendency for the assessment of frequency to be moved toward 9 Hz leads to the suggestion that this is due to the inherent clock mechanism of the brain.

F.R.L.


Determination of thresholds by means of a special instrument (the quadrant adaptometer) which makes possible continuous tracking of fluctuations of sensitivity. The threshold stimulus display consists of four quadrant-shaped panels of opal glass which can be flashed sequentially or simultaneously for 0.1 sec at a controllable repetition period. In use, the luminance of the panels is continuously increasing or decreasing. Systematic statistical analysis of data for several observers indicates that threshold variations are unaffected by varying wavelength or the position of a small stimulus in the retina, showing that rod and cone initiated responses behave similarly and that the origin of the effect is probably not in the receptors.

F.R.L.


Eight normal subjects and seven cyanotic patients, five with tetralogy of Fallot, and two with Eisenmenger's syndrome, were studied with coronary sinus catheterization. In the resting state, myocardial lactate balance was similar in the two groups, but coronary sinus lactate/pyruvate ratios were frequently higher than arterial ratios in the cyanotic group. Myocardial oxygen delivery appeared adequate during exercise stress in cyanotic patients, and lactate and pyruvate analysis failed to show evidence of myocardial hypoxia. The results indicate that, although the mechanisms of oxygen delivery to the myocardium may differ in normals and some patients with cyanotic congenital heart disease, left ventricular myocardial oxidative metabolism is intact even in the presence of hypoxemia.

M.M.


Pressure-flow dynamics in the right ventricular outflow-tract were analyzed during sequential increases in cardiac sympathetic nerve activity in dogs anesthetized with chloralose. The aim of the study was to provide a precise definition of the extrinsic nervous
control of pressure and flow in the right ventricle. The measurements allowed for the assessment of the magnitude of kinetic pressure and permitted an analysis of the influence of the kinetic component on the formation of outflow tract pressure differences. The first wave developed in early systole and was independent of flow velocity in the outflow tract; the second wave developed in mid systole and extended into late systole. When the kinetic component was taken into account by recording impact pressure in the conus, the magnitude of the late systolic pressure difference was markedly reduced from values recorded as a function of lateral pressure. Total pressure differences in late systole were attributed to the formation of a dynamic resistance in the infundibular zone.


Consideration of the various factors involved in air transport of sick or injured persons, with an attempt to determine what pathological or psychological conditions forbid such transport. In general, a patient can be carried provided there is no inconvenience to the crew or other passengers. Among medical contraindications are serious heart conditions, certain respiratory and digestive ailments, glaucoma, ostitis, and severe mental disturbance. As a rule, air transport is considered far superior to other means of carriage, and medical incidents in flight have been rare.


Discussion of clinical elements which especially concern paroxysmal accidents and cardiovascular troubles induced by transport. Various therapeutic methods are considered, and a preventive treatment is proposed. It is shown that air transport involves fewer clinical incidents than ambulance transport; the most commonly observed incidents being of the cardiovascular type. Barbiturates, hemineurine, and diazepam or valium are recommended for protection.


Description of a telemetry system which simultaneously transmits EEGs, EMGs, EOGs, and EKGs, which was satisfactorily tested on man, the cat, and the primate. An AM/FM transmission group was used, the carrier frequency of which could be regulated between 27 and 160 MHz. The tests made it possible to demonstrate with absolute fidelity the reconstitution of the transmitted signals; the stability of the transmitter-receiver eliminates all restrictions on use and operation. The size and weight of the apparatus are very low.


Study of the psychopathological causes of inaptitude in order to demonstrate their importance in relation to other causes of inaptitude and to attempt to determine the reasons for this frequency. Inaptitude is understood to involve either dismissal or declasification for a less demanding specialty. The importance of psycho-pathology among the causes of inaptitudes reduces most often to an irreducible problem of motivation. Age is an important factor.

A71-41576 The world gliding championships of Marfa, Texas - Survey of the mediciophysiological supervision of the French

Attempts, by study of the results of three experiments, to determine if modifications of the time sense are found at the level of groups isolated under identical conditions and deprived of means of time keeping. The three groups took part in significant and constructive tasks. It appears that when individual behavior is averaged, the groups tend to keep to a timetable close to that of the surface. F.R.L.


Proposal of a fitness standard applicable to helicopter pilots, in view of the frequency of spinal troubles among them. A better seat configuration and reduction of vibration amplification through the seat are recommended, as well as regular medical examination, special exercises, and elimination of candidates who exhibit certain symptoms of spinal weakness. F.R.L.


The alternating display concept was tested using simulated radar and sonar CRT displays in a laboratory environment. Each of the four experimental conditions began with a 3-minute pretest, during which eight signals were presented at random locations. Two experimental conditions began with a 3-minute pretest, during which eight signals were presented at random intervals and locations. This was followed by a posttest identical to the pretest. Radar monitoring neither benefited nor was impaired by display alternation. Statistical analysis of the sonar data did not disclose a significant interaction between display conditions and time on duty. However, graphic portrayal of the data did suggest the presence of such an effect. G.R.

The results and the conclusions reached so far on the vestibular space experiment OFO-A are presented here. The various parameters of the life support systems are indicated. The activity at rest and the response to centripetal acceleration obtained by an on-board centrifuge have been studied in four statocaptors in two bull frogs. Some units were quiescent during the flight, some were at times stimulated slightly by the vibration induced by the water pump belonging to the life support system. The change was observed mostly for the activity at rest that first was slowed down and then increased in frequency to reach normal level at the end of the fifth day in the mission. A feedback control system throughout the efferent network is considered to be responsible for the changes and the following normalization. The impact of the method has a more general use in the physiological field. The vestibular space experiment OFO-A is a part of a program to investigate the transfer function of the labyrinth. It studies the long term reaction of the positioning sensors of the vestibule to the disappearance of the effect of a major environmental constant on earth - gravity - at the single unit level. This factor, gravity, is particularly important as it corresponds to the proper stimulus of the receptors: the lack of it will provide the input 'O' point in the input-output relationship in a close loop situation. (Author)


This study attempts to define atrial function directly in an intact animal, using the Frank-Starling approach to evaluate extent of atrial shortening as atrial load is increased by infusion. From analysis of diameter changes which reflect atrial fiber length, it is possible to define the limits of booster pump and conduit function during volume infusion. As atrial diameter was increased, atrial stroke shortening increased initially; however, as volume was further increased, the amplitude of atrial shortening decreased. Over the normal range of filling pressures the atrium functions as a conduit to transfer blood when the A-V valves are open, a capacitor or reservoir to accept venous inflow during ventricular ejection, and a booster pump during atrial systole. G.R.
on all visual tasks showed similar decrements which occurred rapidly and reached their maximum extent within approximately 1 hr of exposure and thereafter gradually recovered over the remaining interval. The impairments noted are apparently due to the effects of hypoxia acting directly on the visual system rather than to the possible influence of subjective feeling states, since they preceded by several hours the onset of subsequent illness symptoms. The retinal vascular changes observed corroborated former findings of engorgement, increased diameter, and tortuosity, but did not immediately abate upon return to normoxia. Signs of retinal hemorrhage or edema previously reported by others during exposure to higher elevations than that of this study were not observed. (Author)

A71-41720 Effect of water immersion on renin-aldosterone and renal sodium handling in normal man. Murray Epstein and Takao Saruta (USAFA, School of Aerospace Medicine, Brooks AFB, Tex.; Miami, University; U.S. Veterans Administration Hospital, Miami; Fla.; Texas, University, Dallas, Tex.). Journal of Applied Physiology, vol. 31, Sept. 1971, p. 368-374. 40 refs.

Eight normal male subjects were used in the investigations. All subjects were studied on three occasions while in balance on a 10 mEq Na, 88-120 mEq K diet including waist immersion, neck immersion, and control studies. Waist immersion produced a decrease of one-third in plasma renin activity without changing urinary aldosterone excretion. Neck immersion produced a decrease in plasma renin activity exceeding that induced by waist immersion with a two-thirds decrease in urinary aldosterone excretion. Since water immersion to the neck initially results in a redistribution of blood volume with a relative increase in intrathoracic blood volume, the current study lends further support to the concept of intrathoracic and/or cardiac receptors as important factors in volume regulation in man. G.R.


The power derived from the aerobic, lactacid, and alactacid energy sources was measured while eight male subjects performed three intensities of work (30, 60, 80% of maximal sea-level aerobic capacity) on a bicycle ergometer at 223, 2286, and 3810 m. The data suggest that there is a reciprocal relationship between the aerobic and anaerobic energy sources, so that the total power input for a given amount of work remains unaffected by hypoxia. The reduction in aerobic power was further shown not to be due to a decrease in Vo sub 2 but rather to a decrease in the duration of the exercise. The lactacid power is greater with altitude because this energy system produces the same or in some cases more lactic acid in less time. The lactacid capacity is unaffected by altitude. Lactacid power likewise increases with altitude because of the same energy release over a shorter period of time. (Author)


The effects of a reduced availability of free fatty acids (FFA) on the physical working capacity in normal man were investigated. The subjects first depleted their glycogen stores by bicycle exercise to exhaustion. Thereafter only fat and protein were given until the next day, when the exercise was performed under conditions in which the release of FFA from the adipose tissue was blocked by nicotinic acid that had been given to the subjects. Only limited stores of glycogen were then available in the body, facilitating the evaluation of the importance of a diminished FFA supply to skeletal muscle during exercise. It was found that when the glycogen stores are reduced, prolonged work can still be performed on submaximal levels provided that the supply of FFA is adequate. Elimination of both muscle glycogen and exogenous FFA seriously impairs the ability for prolonged exercise.

G.R.


The calculation of the heat stored by the human body in a hot environment according to Burton (1935) requires information concerning the mean body temperature. An equation for determining the mean body temperature from rectal and skin temperatures contains a factor x. The possibility that x can have different values in neutral and hot environments is investigated. Ninety-one experiments were made in five hot environments. The best values for x in neutral and in hot environments were calculated by an optimization method using a computer. G.R.


The health records of 1,152 actively employed, middle-aged American men were analyzed to determine the incidence of coronary heart disease and sudden death, and to ascertain some of the characteristics of those men who die suddenly and unexpectedly. Middle-aged men whose deaths are reported as due to coronary heart disease (including those with sudden and unexplained deaths) are not drawn from the population of apparently healthy men. Coronary deaths occur among a mixed population of men with coronary heart disease, hypertensive cardiovascular disease, chronic lung disease, or a combination of these. Men reported as dying from coronary heart disease have detectable abnormalities of cardiac rate, rhythm, and conduction prior to the onset of the final episode. Significant metabolic abnormalities include hyperlipidemia, impaired glucose tolerance, elevated serum uric acid, obesity, and alcoholism. T.M.


Vestibularly driven head movement (the 'vestibulo-colic reflex') was examined in seated human subjects exposed to sinusoidal and stepwise changes in rotational velocity about a vertical axis. In the absence of vision nystagmoid head movements occurred, but not in all subjects. Slow-phase head velocity showed less phase advance during slow sinusoidal stimulation than corresponding vestibulo-ocular response, and made a substantial contribution to ocular stabilization in the period immediately following a step change in rotational velocity. The practical and theoretical significance of these findings is discussed. (Author)

A71-41823 Survey of the medical causes of rejection of applicants for the BEA/BOAC sponsored ab-initio pilot training scheme. R. M. Barnes (Air Corporations Joint Medical Service, London Airport, Hounslow, Middx., England). Aerospace Medicine, vol. 42, Sept. 1971, p. 941-946. 5 refs. Research supported by the Royal Air Force and the Ministry of Defence (Nav). Since 1960 BEA and BOAC have sponsored young men between 18 and 24 years of age for ab-initio pilot training. Applicants may be excluded on medical grounds at three stages of the selection process:
A71-41824  Study of simulated airline pilot incapacitation.  
Phase II - Subtle or partial loss of function.  C. R. Harper, G. J. Kidera, and J. F. Cullen (United Air Lines, Inc., Denver, Colo.).  
The risk factor in airline flight operations generated by partial loss of cerebral function of one crew member is discussed with regard to etiology, incidence and detection.  
Aircraft flight crews have received little instruction concerning subtle cerebral incapacitation, and no observations existed regarding the reactions of the crew members who remained unimpaired.  
An original study involving 36 line qualified B-172 flight crews was performed in an aircraft simulator.  
The pilot-in-command became nonfunctioning, but not unconscious, during approach for landing.  
Reaction times of the unimpaired crew members and their subsequent conduct are discussed.  
Educational recommendations are presented.  (Author)

Male rats, fed ad libitum, were exposed to 100% oxygen at 191, 258, or 350 mm Hg for periods of time varying from one-half to 4 days.  
Food consumption decreased as the barometric pressure decreased.  After exposure, the in vitro incorporation of acetate-2-C14 into CO2 and fatty acids by slices of liver and epididymal adipose tissue was measured.  
In all hyperoxic exposures, the oxygen-exposed rats converted more acetate into fatty acids in both liver and adipose tissue than did their respective pair-fed controls.  
At 258 and 350 mm Hg, the oxygen-exposed rats incorporated acetate into liver fatty acids at rates comparable to those of ambient ad libitum controls.  
At 258 mm Hg, fatty acid synthesis in the adipose tissue of the oxygen-exposed rats was comparable to that of ambient ad libitum controls and at 350 mm Hg, exceeded that of the ambient ad libitum controls by 30%.  
Placing the oxygen-exposed rats on a restricted diet abolished the increase in fatty acid synthesis.  It is concluded that 100% oxygen has a stimulatory effect upon fatty acid synthesis in the liver and adipose tissue of rats exposed to the hypobaric hyperoxic environment of 258 and 350 mm Hg provided that the rats have free access to food.  (Author)

A71-41826  // Relationship of pentathlon sports skills to vestibulo-ocular responses to Coriolis stimulation.  P. J. Dowd and R. L. Cramer (USAF, School of Aerospace Medicine, Brooks AFB, Tex.).  
A Coriolis test on the USAFAMS biaxial stimulator was administered to pentathlon athletes, advanced Air Force pilots, and airman trainees.  
The rates of decay and sensitivity coefficients of vertical nystagmic responses were compared for these three groups.  
A significantly different rate of decay was found between athletes and airman trainees and a significantly different sensitivity coefficient was shown between athletes and the pilots and airman trainees.  
The pentathlon athletes demonstrated a significantly greater degree of habituation and suppression of responses to Coriolis stimulation than the pilot or airman trainee groups.  The possible reasons for these findings are discussed in terms of the physical conditioning requirements of the pentathlon athlete.  (Author)

A71-41827  Influence of alcohol on vestibular responses to angular accelerations.  David J. Schroeder (FAA, Civil Aeromedical Institute, Oklahoma City, Okla.).  
Although alcohol is known to affect the vestibular system through the development of a positional nystagmus, information concerning the effects of alcohol on 'vertigo' and nystagmus from stimulation of the semicircular canals is contradictory.  
Several investigators have reported that alcohol enhances these responses, while others have reported suppressive effects.  This study was designed to investigate the effect of alcohol ingestion on both 'vertigo' and nystagmic responses to angular stimulation.  Response were obtained (1) with and without visual fixation, and (2) with the alertness of the subject controlled.  When recorded in total darkness, the nystagmic reaction to angular stimulation was suppressed in all of the alcohol.  When visual fixation was allowed, a high-frequency, low-amplitude nystagmus was obtained following alcohol ingestion; there was little or no response prior to drinking.  
This apparent enhancement of the response was due to an increase in vestibular sensitivity but, rather, to the suppressive effect of alcohol on the ability of the subject to maintain adequate visual fixation.  'Vertigo' sensations resulting from the rotatory stimuli evidenced only slight declines following alcohol ingestion.  (Author)

A71-41828  // Heart rate response to square wave breathing.  
One G compared to zero G.  Philip C. Richardson, Ashley J. Welch, and Robert Groshner (Texas, University, Austin, Tex.; USAF, School of Aerospace Medicine, Brooks AFB, Tex.).  
A transient change in beat-by-beat heart rate occurs in the human when sudden inspiratory or expiratory efforts are effected.  
Under conditions of zero G, as produced while flying in a parabolic flight path, the heart rate responses were of a similar shape for inspiration and for expiration; however, there was a significant baseline shift down of 4.3 beats per minute for inspiration and 3.8 beats per minute for expiration in the zero G environment.  We propose that this change in base line is due to hydrostatic pressure changes in the carotid sinus and aortic arch receptors.  (Author)

D. A. Harris, G. Verne Pegram, and Bryce O. Hartman (USAF, School of Aerospace Medicine, Brooks AFB, Tex.).  
Six experimental transport missions using a double crew were flown in a C-141 on routes generating various combinations of long and short legs.  
Crews followed a 4/4 of 16/16 work/rest schedule within operational constraints.  On-board crew-rest facilities were provided so that the plane could fly through the airlift system without crew changes or crew delays.  
The missions required approximately 55-60 hours to complete.  The flying time averaged around 43 hours.  
Crew performance was evaluated by ratings made by an on-board flight examiner.  There were no significant differences in flight examiner ratings.  Subjective fatigue was measured by a rating scale.  There were no significant differences related to work/rest cycles.  There were significant differences related to mission profile and crew position.  Sleep EEG's were recorded by the two navigators and were supplemented by self-reports from all crewmembers.  There was a marked reduction in total sleep as well as stage 1-REM and deep sleep.  Findings are discussed in relation to the demands of flying transport missions.  (Author)
A71-41830


Description of experimental data from 53 exposures of mice to single, double, and triple gas mixtures. Contaminants used were CO, CO2, and NH3. The TUF for CO exposure was used as a baseline against which other exposures were compared. It was found that double gas exposures extended the TUF, whereas triple gas exposures extended the TUF even more. A theory is suggested for the mechanism of this extension phenomenon. These results are considered to be preliminary and their validity must be further substantiated from additional experimental studies. This information is applicable to: (1) the selection and development of interior materials which neither burn nor produce dangerous toxic products; and (2) stimulate further investigation in this neglected area of research. M.M.

A71-41831


Cold pressor response was elicited on 18 subjects of the age group 21-28 years at sea level and at an altitude of 11,000 ft under hypoxic acclimatization and under simultaneous acclimatization to hypoxia and cold at 10 days' interval for 40 days after which they were retested at sea level. A group of 10 highlanders were also studied. Results indicate that there is a depression of cold pressor response irrespective of superimposition or withdrawal of cold stress. However, the group of subjects who were exposed to cold and hypoxia simultaneously from the day of arrival at altitude showed a return of the sea-level pattern of response at the end of 40 days of their stay at altitude and on retest at sea-level. The depression of cold pressor response was also noticed in highlanders. (Author)

A71-41832

Ingestive capacity of peritoneal macrophages from mice exposed to hypobaric hypoxia. George W. Irvine, III and Jerome P. Schmidt (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). Aerospace Medicine, vol. 42, Sept. 1971, p. 986-988. 15 refs. USAF-supported research.

At approximately 6-day intervals peritoneal macrophages were harvested from groups of mice exposed continuously to a simulated altitude of 18,000 ft. These cells were allowed to attach to suitable vessels and exposed to a suspension of Serratia marcescens. After a carefully controlled ingestion period, bacteria were liberated from the phagocytes by freezing and thawing and the ensuing quantitative assays were based on colony-forming units of the microorganisms in the resulting suspensions. The ingestive efficiency of peritoneal macrophages from mice exposed to altitude was generally less than that of peritoneal macrophages from nonexposed mice. This change in ingestive ability in relation to the time of exposure to hypobaric hypoxia is evidently a physiological reaction to the environmental conditions. The change in functional efficiency of the macrophage may be a factor in the susceptibility to infection of animals subjected to altitude. (Author)

A71-41833

Vertigo due to increased middle ear pressure - Six-year experience of the aeromedical consultation service. Frederic M. Biam (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). Aerospace Medicine, vol. 42, Sept. 1971, p. 999-1001. 6 refs.

Vertigo due to increased middle ear pressure appears to be more common than is generally realized. Although it has been known as a syndrome for 75 years, only recently has it received any significant study. In this article 6 years' experience with this entity from the USAF School of Aerospace Medicine Aeromedical Consultation Service is presented. Four new cases are presented and discussed with two previously published cases. The facts that two cases occurred during a rapid descent with a forceful Valsalva rather than during climb-out and that two cases experienced vague symptoms which were not classic vertigo but could be duplicated by caloric testing are felt to be significant. Other associated factors are discussed, and a simple preventive approach is suggested. (Author)

A71-41834


Incapacitating or distracting physiological phenomena occur with considerable frequency during aerial flight. Only rarely, however, have such 'physiological incidents' been firmly established as cause factors in fatal aircraft accidents. By tradition medical investigation of accidents has largely been restricted to cataloguing mechanical trauma and searching for preexisting organic disease. By definition 'physiological incidents' are transient functional disturbances and not expected, by the inexperienced investigator, to be amenable to demonstration after the fact. However, it is often possible to recover, with high probability, physiological factors which initiated a sequence of events terminating in a fatal accident. Two cases are presented as illustrations. Attention is drawn to the fact that 'physiological incidents' and psychological factors undoubtedly underlie many presently obscure aircraft crashes. (Author)

A71-41835


Eight trainee pilots retired to sleep under laboratory conditions from 2000 hours to 0300 when they were awakened to spend 8 hours performing 2 behavioral tests (calculation and vigilance). This regime was repeated on alternate nights in a 4 x 2 design. The 4 experimental conditions under which they slept were No Drug, Placebo, Mogadon (5 mgs) and Seconal (100 mgs). Each subject spent 2 nights under each condition and during every alternate 24-hour period they were off-duty and free to sleep as they pleased. Continuous EEG recordings were made on each 'experimental' night and subjective ratings of mood and quality of sleep were used to complement the behavioral measures. Under both the drug conditions there were changes in the EEG together with a slight decrement in vigilance performance (d') in the later (1100-1500) runs of the day and an improvement in the rated quality of sleep. (Author)

A71-41836


Coincident with the beginning of the Second World War, attempts were made at the USAF School of Aviation Medicine at Randolph AFB, Texas, and at the Naval Air Station, Pensacola, Florida, to develop electroencephalographic methods for determining the suitability of candidates for flight training. These efforts were largely unsuccessful, but hope remained that the electroencephalogram would be useful in detecting latent epilepsy or other brain disturbances. In further pursuit of this goal, 2947 senior cadets at the USAF Academy in Colorado, during the period from the beginning of 1965 through the end of 1969, had at least a single electroencephalogram which included hyperventilation and photic stimulation. Three per cent of the records were abnormal. This percentage is strikingly low when compared with that of 'normal populations,' and may result partially from our practice of considering 'normal' the majority of occipital slow waves encountered in the EEGs of young adult subjects. (Author)
shortening and external work from the increased velocity of shortening, the effects of NE on myocardial oxygen consumption were evaluated in isometric contractions at equal levels of developed tension. Under these conditions, augmentation of the contractile state, characterized by increased velocity of contraction, was linearly related to the increase in myocardial oxygen consumption. The stimulation of myocardial oxygen consumption is attributed to the induced alterations in the intrinsic speed of contraction and may explain the so-called 'O2 wasting' effect of NE.

M.M.


Markedly increased activity of creatine phosphokinase (CPK) in rat plasma resulted from restraint at 2°C (cold restraint, CR) for as little as 15 min. The mean increase in enzyme activity after 2 hr of CR was 28-fold, but the range was very great. The increase in plasma CPK activity was highly correlated with the extent of hypothermia following CR. Adrenalectomized, adrenal demedullated, thyroidec- tomed, and control rats had comparable decreases in rectal temperature and increases in plasma CPK activity following CR of 30 min duration. The increase in plasma CPK activity following CR was markedly diminished in some cold-acclimated rats, varying with the extent of cold acclimation.

M.M.


In dogs undergoing water diuresis, the effect of unilateral intrarenal infusions of chlorpropamide on urinary concentration, free water clearance (CH2O), GFR (glomerular filtration rate), and sodium excretion was compared with that obtained in another group of similarly water-loaded animals during intravenous infusion of vasopressin. The antidiuretic action of chlorpropamide was demonstrable only in the presence of vasopressin and was not dependent on a fall in GFR. Since blood levels of chlorpropamide equal to those which were antidiuretic in the presence of infused vasopressin were without effect on urinary concentration in the absence of infused vasopressin, it does not appear that the drug increases water reabsorption as a result of the release of endogenous vasopressin. Therefore, the renal effects of chlorpropamide may be attributed to an action in the kidney to potentiate circulating vasopressin.

M.M.


Review of recent research on the effect of hypothermia on the nutritive processes and regulatory activity of the brain. Changes in the blood supply of the brain, in respiration, and in carbohydrate metabolism are considered, as well as the resistance of the brain to oxygen deficiency at low body temperatures. Data concerning the temperature levels at which unconsciousness occurs in humans and data concerning conditioned reflex activity in animals are presented, as well as data concerning the special features of the electrical activity of the brain cortex. The effect of hypothermia on the excitability of the centers of the diencephalon, the mesencephalon, thepons varolii, the medulla oblongata, and the spinal cord is shown.

A.B.K.

A71-41941 • Ultrasound and the possibility of using it in physiological studies (Ul' trazvuk i vozmozhnosti ispol'zovaniia ego v

M.M.
fiziologicheskikh isledovaniiakh). V. A. Mastriukov (Vsesoiuznyi
Nauchno-Issledovatel'skiy Institut Meditsinskogo Priborostroenia,
Moscow, USSR). Uspeshki Fiziolohicheskikh Nauk, vol. 2, Apr.-June

Attempt to give the experimental physiologist an idea of the
methods of ultrasonic investigation of the human organism and to
show the possibility of using this method in physiological and
pathophysiological experiments. Information concerning certain
physical properties of ultrasonic vibrations and concerning the
acoustic properties of living tissue is presented, which not only
makes it possible for the reader to comprehend the methods and
examples of ultrasonic diagnostics presented, but also to determine
himself the range of applicability of this method in physiological
studies.

A.B.K.

A71-41985 * # Medical results of Apollo 14 - Implications for
longer duration space flights. Charles A. Berry (NASA, Washington,
D.C.). International Astronautical Federation, International Astro-
24 p. 6 refs.

Review of the information on biomedical effects of space flight
obtained from the Apollo 14 mission. Various facets of the process
of adaptation to weightlessness are discussed. The differences found
in Apollo 14 results for the command module pilot versus the other
two crewmembers suggest certain benefits for 34 hours at one-sixth
gravity and for lunar surface exercise. These findings indicate that
the extent of the adaptation of astronauts to weightlessness, and any
resulting change in subsequent ability to enter and work in new force
environments, can be controlled to some degree. On the whole, space
flights to date demonstrate that man can live and work productively
in the space environment for periods of at least several weeks. M.E.V.

A71-41960 * Advanced systems of extravehicular protection
(Systèmes avancés de protection extravehiculaire). James G. Sutton,
Philip F. Heimlich, and Edward H. Tepper. International Astro-
nautical Federation, International Astronautical Congress, 22nd,

Evaluation of various concepts for systems for use in the 1980s
to make possible extravehicular activity (EVA) with complete or
partial regeneration of resources, with identification of the new
regions of technology which will be set in motion. The methodology
used is described, as well as the results of studies of systems and
subsystems. Schematic configurations proposed for the cases of the
Space Station, the Lunar Base, and Martian missions are presented.
The new technological developments required to make possible the
working out of the concepts of the Advanced Extravehicular
Protection System (AEPS) are discussed. F.R.L.

A71-42032 * The astronaut-teleoperator team for space
operations. Edwin G. Johnsen (AEC-NASA, Space Nuclear Systems
Office, Washington, D.C.). International Astronautical Federation,
International Astronautical Congress, 22nd, Brussels, Belgium, Sept.

Discussion of the use of teleoperators as a means for further cost
reduction of space operations and for increasing the productivity of
future manned space experiments by augmenting the capabilities of
astronauts. Some of the advantages and possible configurations and
applications of teleoperators are examined and astronaut-
teleoperator capabilities identified.

M.V.E.

A71-42041 * Psychological aspects of adaptive behavior
under complex spatial conditions (Psikhologicheskie aspekty
adaptivnogo povedeniya v slozhnykh prostranstvennykh usloviiakh).
V. I. Miasnikov, O. P. Kotzenko, and N. M. Rudometkin.
International Astronautical Federation, International Astronautical
Russian.

Investigation of the possibility of organizing posture-spatial
human activities amid psychologically trying conditions of the
altered posture-motor regime characteristic of astronauts' tasks. The
conditions confronted on the limited support area of a parachute
jump tower or high diving board (i.e., a stabilographic platform at
the edge of the tower top) at heights of 18 and 10 m were selected as
the experimental model. The results of a series of tests performed
with young healthy male subjects on the stabilographic platform are
reported and discussed.

M.V.E.

A71-42043 * Summary of a 90-day manned test of a
regenerative life support system. Albin O. Pearson (NASA, Langley
Research Center, Hampton, Va.) and John K. Jackson (McDonnell
Douglas Astronautics Co., Huntington Beach, Calif.). International
Astronautical Federation, International Astronautical Congress,

A 90-day manned test of a regenerative life support system was
completed on September 11, 1970. The test was performed with a
crew of four men and featured closed chamber operation with no
resupply. All food, makeup water, spare parts, and tools were stored
onboard at the start of the test. This paper presents the test
objectives, describes the life support subsystems, outlines some of
the operating procedures, and reviews some of the more significant
accomplishments of the test. Conclusions and some recommenda-
tions for additional future efforts are presented.

(Author)

A71-42119 * An electrostatic computer model of a biologi-
cal membrane. Vincent F. Gallucci (North Carolina State University,
Raleigh, N.C.) and I. H. Shames (New York, State University,

Description of a model of a biological cell membrane (Danielli-
Dawson, Robertson). The membrane is simulated by planar arrays of
dipoles. Dipoles represent lipid polar end groups and protein C = O,
N-H and R-group components of the membrane. An electrostatic
self-consistent field approach is used to solve a set of four
simultaneous equations. The four equations describe the forces
acting upon each molecule. The solution of the set of equations is a
set of angles which specify the orientation of the molecules. Then
the electrostatic field from the entire molecular array can be
calculated for any point in the neighborhood of the 'membrane'. An
empirical 'resisting torque' function is introduced to allow simulation
of the gross effects of the many interacting forces which act at the
molecular level. The effect of a macromolecule near the membrane is
simulated by using an appropriate electron density in a multipole
field expansion.

M.M.

Four groups of ten subjects performed simulated target acquisition (detection and recognition) tasks under simulated Mark 24 flare light (2,000,000 cp). One group performed with six aerial flares dropped 0.25 mi apart (simulated), another group with six flares 0.50 mi apart, another with four flares 0.75 mi apart, and the last group with two flares 1 mi apart. All groups performed at two simulated observer altitudes (2000 and 2500 ft) and with three simulated flare-ignition altitudes (2000, 2500, and 3000 ft). Generally, more targets were acquired at the 2000-ft flare-ignition altitude. There were no statistically significant differences attributed to flare separation or observer altitude. (Author)


An attempt is made to develop a systematic approach to the prediction of human performance as a function of task variables and environmental factors. The approach uses the basic literature of experimental psychology and of physiology in a context in which postulates and assumptions about underlying processes and empirical relationships are made as specific as possible. This paper is a presentation of the postulates, assumptions, and models for handling them. Its aim is toward organization and feasibility rather than toward a final theory of human performance. What is presented is more in the nature of a model of what a general theory might be and the variables of importance rather than a theory as such. (Author)


Results of a study to determine the time for initiation and stabilization of a precision movement both before and after sustained muscle exertion of sufficient duration and level to produce electromyogram (EMG) frequency changes. It was found that fatiguing muscle exertions do not seem to alter the speed of initiation of responses, but do alter movement time, particularly for movement associated with final corrective action. F.R.L.


The effects of letter size, case, and generation method were studied in a task of searching for a common five-letter word in a CRT display. Symbol sizes of 0.12, 0.14, and 0.16 in. were evaluated. Words were composed of all uppercase or all lowercase letters. Two symbol generation methods - letters drawn by means of continuous strokes and by means of a seven-wide-by-nine-high pattern of dots in a fixed matrix - were investigated. The results indicated that for both methods of symbol generation, uppercase words were searched 13% faster than lowercase words. No significant differences were found due to symbol generation method or letter size. (Author)


Demonstration that hydrolysis of urea by urease takes place in 'dry' urea-urease exposed to discrete water vapor pressures from 100 to 20% relative humidity and at 2 to 70 C. A discontinuity in enzymatic activities is observed at the transition of urea from a solid to a deliquescent solution. Urease is inactivated more readily at higher relative humidities in saturated urea solution than at lower relative humidities where water for urea hydrolysis is adsorbed on enzyme-protein only. Hydrolysis of urea by urease proceeds at a measurable rate in concentrated solutions of urea and of urea hydrolysis products, ammonium carbonate and bicarbonate, in the absence of ionic strength or pH stabilizing agents. (Author)


Mariner 4 data were utilized to establish the environmental test parameters. The test conditions involved maximum temperatures of 25 C, minimum temperatures of -60 C, and an atmosphere consisting of 70% carbon dioxide, 25% nitrogen and 5% argon at an atmospheric pressure of 6 mm Hg. On the basis of the test results it is concluded that survival probabilities for exposed microorganisms on the Martian surface would be very small. However, if microorganisms were protected from the solar irradiation the probability for survival increases. Microorganisms protected in subsurface environments would be expected to survive for extended periods. G.R.


Blind goldfish were subjected to linear accelerations on a motor car and on a parallel swing. Movements of the fish in a tank during the accelerations were recorded with a movie camera. During the horizontal acceleration, the fish aligns his longitudinal axis in a plane perpendicular to the direction of an apparent gravity with the fish's back pointing away from the direction of this apparent gravity vector. This is similar to the manner in which the fish usually aligns himself horizontally in response to the vertically downward terrestrial gravity and can therefore be termed 'gravity reference response.' It is concluded that blind goldfish cannot distinguish between otolith displacements caused by passive tilts and equivalent otolith displacements caused by moderate inertial forces during rectilinear acceleration. With a horizontal jerk of higher magnitude, two additional responses can occur: horizontal 180 deg turns following tailward jerks and straight forward darting following noseward jerks. (Author)

The properties of water are examined, and the possibility of enzymatic activity in nonaqueous media is considered. It is concluded that the unique ability of the solvent liquid water to form polymorphic, 3-dimensional, H-bonded aggregates and solvation envelopes of widely different character (hydrophobic or coulombic hydration and hydrophobic hydration) is a necessary condition for the realization of the levels of order in form and complexity in function required by carbonaceous biotic systems. G.R.


Conditions on the primordial earth are reviewed and information on pertinent microfossils and primitive microorganisms presented. A series of simulated pre-Cambrian environments are set up and 8 strains of blue-green algae are tested under 7 different anaerobic, mildly reducing atmospheres. Of 61 cultures tested, 12 showed growth, 32 survived and 17 died. Growth was measured spectrophotometrically. Microscopic examination failed to show any gross morphological changes in the experimental cultures. It is concluded that certain strains of blue-green algae have retained their ability to survive or grow under a primordial atmosphere. (Author)


Several models are developed for the estimation of the rate of exponential die-off from decontamination data. Calculations with illustrative data are reported which indicate that the estimation of this rate and its variance are sensitive to changes in modeling assumptions. Since extrapolation using this estimated rate is used in the specification of planetary quarantine standards, special care should be taken in the selection of an appropriate model and corresponding estimation procedure for the analysis of each set of decontamination data to be used for this purpose. (Author)


A system has been developed to identify the samples obtained from Apollo spacecraft which uses a computer to process laboratory test results. This system is described in detail. The results of using the system with the available data are presented compared with conventional laboratory identifications. As a result of the performance with these comparisons, the system has been incorporated into NASA’s Planetary Quarantine Lunar Information System for routine use. (Author)


Aspects of handling research during the years from 1935 to 1945 are related together with problems which had to be solved during the war years, giving attention to combat operations, accident prevention, and improvements in the basic understanding of the handling characteristics of military aircraft. Current work discussed includes the development of handling criteria, work in the Avionics Department, and investigations concerned with the pilot in order to improve his personal equipment. G.R.


After exposure to bacterial aerosols, mice were placed in air and in pure oxygen at 1 atm total pressure. Animals breathing pure oxygen showed an inhibition of early intrapulmonary clearance of Staphylococcus aureus and enhanced early clearance of Klebsiella pneumoniae. Furthermore, oxygen breathing for 24 hr after infection produced a delay of subsequent mortality due to K. pneumoniae. In vitro bacterial growth studies showed inhibition of growth of S. aureus by high oxygen and no effect on the growth of K. pneumoniae. Exposure to pure oxygen for 24 hr does not appear to have any major effect on the ability of the lung to inactivate inhaled bacteria. M.M.


Scanning ultrasonic imaging is used to monitor, in vivo, the development and location of microscopic bubbles formed in decompression sickness. Stationary or moving bubbles as small as 5 microns are detected. Methods of comparison of earlier reference images with real time images on an oscilloscope are described. Different image displays are presented, emphasizing the usefulness of combined deflection and brightness scan modulation. Experiments show unmistakable decompression bubble echoes around fatty tissues in guinea pig legs, which disappear almost completely with recompression. Guinea pigs can be safely decompressed by keeping imaged bubble echoes below a threshold. Preliminary results of human studies are discussed. (Author)


The greatest difficulty in measuring magnetic field generated by the heart’s electrical activity is in eliminating noise from other sources. The common mode portion of the noise was rejected by using a magnetometer with a pair of differentially connected superconducting flux transformers. The high sensitivity associated with the two Josephson junction quantum interference device permitted highly resolved magnetocardiograms of quality comparable to the normal electrocardiogram, without the use of shielded enclosures or signal averaging. (Author)


The concentrations of Na, K, Mg, and Cl were determined in muscles and liver, various zones of the kidney, plasma, red blood cells, and bladder urine in active and hibernating hedgehogs. Freezing point depression and urea concentration were determined in the kidney, plasma, and urine. Unaltered tissue water concentration and
15 to 20 percent decreased Cl and Na space suggest a shift of water from the interstitium to the cells during hibernation. Hibernation tended to alter the partition of electrolytes between tissues and plasma similarly to in vitro cooling of mammalian tissues. The osmolality and the concentration of urea, Na, and CI did not increase from cortex to papilla in the kidneys of hibernating hedgehogs. M.V.E.


From 49,512 EKGs on USAF flying personnel in 1968, 1188 had ST segment elevation in two or more limb or precordial leads. The prevalence was 2.10% in those less than 35, and 2.65% in those 35 or older. The individual lead most commonly showing ST elevation was V sub 6 (50%). In the limb leads it was noted most frequently in lead II (51%). One hundred EKGs, representative of the entire series, were analyzed in greater detail. ST elevation in excess of 2.0 mm was noted in 22 percent. Precordial T waves in excess of 10 mm were seen in 23 instances. Sturuing of the QRS complex into the ST segment was common in both limb and precordial leads, but a terminally notched QRS was not noted in the limb leads. Prior records, available in 87 cases, showed a consistent pattern of ST elevation in 65 instances for an average duration of 8.2 yrs. M.M.


The topics treat the anatomical, physiological, pharmacological, psychological, and clinical correlations of eye movements. Models of various parts of the oculomotor system are discussed in a comprehensive survey of biophysical, mathematical, and engineering aspects of eye movement control. Other topics include the structure of the extracocular muscle fibers of mammals, EEG, evoked potentials, supranuclear disorders of ocular control systems in man, and eye movements and perception. A comprehensive subject index is provided. M.M.


Discussion of questions fundamental to an understanding of movement in general, as well as movement of the eyes, such as the significance of ocular proprioception, the role played by sensory receptors in ocular motors, and the type of peripheral innervation which supplies the extracocular muscles (EOMs) so that they can move with the swiftness of a saccade or the slow smoothness of a following movement. Emphasis is placed on the afferenct and efferent innervation of the EOMs. Results of studies of stretch receptors and their pathways, types of motor innervation, and muscle fiber types are presented. A few pertinent effects of central nervous system (CNS) control are discussed. M.M.


Outline of the present knowledge about cerebral EEG phenomena which precede, accompany, or follow eye and image movements, with the emphasis on observations in humans. The topics include preference for certain eye movements in wakefulness and different EEG sleep stages, eye position and generation of alpha EEG patterns, EEG potentials which precede eye movements, pontine-genulocalcine-occipital waves and the question of efference copy, EEG potentials evoked by image movements on the retina, EEG potentials evoked by eye movements across patterned visual fields (lambda waves), EEG potentials evoked during saccades, and the saccadic suppression of perception, and the effect of stabilization of retinal images. M.M.
A71-42438
Supranuclear disorders of ocular control systems in man. William F. Hoyt (California, University, San Francisco, Calif.) and Robert B. Daroff (U.S. Veterans Administration Hospital; Miami, University, Miami, Fla.). In: The control of eye movements; Proceedings of the Symposium, University of the Pacific, San Francisco, Calif., November 10, 11, 1969.
Reappraisal, for the benefit of clinicians, of the supranuclear ocular motor syndromes and signs in terms of current physiologic concepts. An offer is made to share with colleagues in physiology and bioengineering opportunities for useful collaborative investigations of various defective eye movement control systems exemplified in patients with clinical involvement in the cerebrum, cerebellum, or brain stem. Much of the discussion is speculative, although based on what seems supported by current physiological, anatomical and clinico-pathological correlation. The various types of ocular motor disorders are discussed in terms of horizontal, vertical and vergence movements, with a section on para- and internuclear disorders. Several varieties of nystagmus are discussed.
M.M.

A71-42439
The topics include the structure and function of twitch and tonic neuromuscular systems in the frog and in extraocular muscles, effect of cholinergic agents on extraocular muscle, the effect of neuromuscular agents on extraocular muscles, nondepolarizing neuromuscular blocking agents, and a simple method for determining the presence or absence of depolarizing neuromuscular blockade. Also treated are the effect of cholinesterase inhibitors on extraocular muscles, effect of adrenergic agents on extraocular muscle, and the autonomic nervous system and extracocular muscles.
M.M.

A71-42440
Brief discussion of the manner in which eye movements affect the input to the visual system and how these movements affect the use of visual information. Eye movements serve a variety of functions, such as: (1) acquisition of a source of visual input; (2) maintaining the flow of information input through the visual system; (3) providing information about direction and egocentric localization of objects; and (4) providing the basis for the organization that results in visual perception of contours, shape, and distance.
M.M.

A71-42441
New York, Academic Press, Inc., 1971, p. 283-325. 23 refs. PHS Grant No. 5 R O1 EY-00498; NIH Grant No. P O1 EY-00269; Contract No N 0014-70-C-0141.
Description of preliminary dynamic studies of isolated oculorotatory muscles and globe restraining tissues, primarily carried out on cats but with some observations on humans. The static and dynamic mechanical properties of the orbital elements of the cat under conditions of graded stimulation are treated. Preliminary investigations have resulted in a conceptual model of the mechanical part of the oculomotor system on which further investigations of the human oculomotor plant will be based.

Measurements of the mechanical characteristics of the human eye movement control system are discussed. It is pointed out that insights derived from the mechanical measurements and calculations of the oculomotor system of the cat may be possible to guide further research and interpretations of mechanical parameters of the human oculomotor system which may be of clinical significance.
M.M.

A71-42442
Description of tests used in studies of the mechanical properties in strabismus which are helpful in understanding, diagnosis, and treatment. Some pertinent data on the passive and active forces giving horizontal alignment are reviewed, and it is shown that a quantitative approach to the forced duction test yields useful information. Ways of assessing the active force which the muscle gives during fixation or while the eye tries to move (force generation tests) are shown. The static forces which balance one another during steady fixation are first dealt with. It is then shown how one can get useful information from the dynamic behavior of the eye as it moves or tries to move with inputs from the various motor systems of the general oculomotor apparatus.
M.M.

A71-42443
Only one model has been proposed which simulates the behavior of the saccadic control system and which, with slight modifications, has survived since its original presentation in 1962. Before this model is described and evaluated, some pertinent saccadic properties which must be satisfied by the model are reviewed. In conclusion, some of the oculomotor pathways and areas believed to be concerned with the saccade are discussed.
M.M.

A71-42444
The control system for versional eye movements. Lawrence Stark (California, University, Berkeley, Calif.). In: The control of eye movements; Proceedings of the Symposium, University of the Pacific, San Francisco, Calif., November 10, 11, 1969.
Review of the control system for versional eye movements in order to expose the current state of knowledge as the complex situation really is: two well-formulated models under attack by their very success in generating critical new experiments; a few less refined models encompassing behavior as yet not understood; some quantitative descriptions without adequate underlying formulation; and many qualitative descriptions of complex phenomena, pursuit of which may lead to further crystallizations as new models. Four sections are each devoted to a somewhat separable major physiological process of the versional system: (1) dual mode control, (2) intermittency, (3) plane mechanics, and (4) prediction and pattern recognition. Each section contains models and quantitative descriptions that are related to each one of these four control phenomena.
M.M.
Review of features of the pursuit eye movement system which are known at present, and discussion of some system characteristics which are still uncertain. A simplistic view of the human eye tracking system recognizes two major modes of tracking: rapid saccadic eye movements and smooth pursuit movements. The saccadic eye movement system supposedly acts to maintain the image of the object of interest on the fovea by a sequence of discrete high velocity jumps. The smooth pursuit system has been assigned the role of stabilization of retinal images, or more particularly matching the angular velocity of the eye to the velocity of the object. This view has led to the development of several models which treat the saccadic system as a velocity servomechanism. It is shown that the pursuit system is not a simple, linear-velocity servomechanism based on retinal error velocity.

M.V.E.


Discussion of the system of vergence - i.e., disjunctive - eye movements that provides the binocular organism of primates and higher animals with a crucial degree of freedom which permits the fixation of points in visual space at various distances from the organism. The vergence system has received less attention from researchers than the versional system. Complexities are met at the input to the vergence system where either fusional or accommodative inputs are used to drive the system. Both of these inputs are difficult to generate compared to the relatively simple versional inputs. At the output of the vergence system, the range of eye movements is about one fourth of the range of versional movements. The system interacts in a complex, and as yet incompletely understood, fashion with the accommodative and pupillary systems as an integral part of the so-called near triad.

M.V.E.


Experimental data are used to define the mechanisms by which the need for an eye vergence movement is recognized and its magnitude and direction become fixed. Target configurations which are effective in producing eye vergence movements are illustrated, together with horizontal and vertical receptive field disparities of binocular units. The influence of barbiturates on the motor component of vergence movements is examined, and it is concluded that there is a central (probably midbrain) site for convergence responses that is affected by barbiturates.

T.M.


The input-output characteristics of the vestibulo-ocular reflex arc and associated neck proprioceptive mechanisms are examined with reference to the generation of a stabilized visual image during head and body movements. Compensatory eye movements for vestibular stimulation with earth-fixed and environmental fixation points are discussed for lateral stabilization.

T.M.


Analysis of experimental data for the vestibulo-ocular reflex arc indicates that the hydrodynamic response of the semicircular canal (at least during natural head movements) leads to the generation of an afferent neural signal containing the essential meaning of head angular velocity. This signal is then fed forward through subsequent neural relays to the oculomotor nuclei in a form which is largely unchanged and which hence retains the angular velocity message. This then generates a 'primary' oculomotor response after passing through a first-order lag system, with the special added feature that a 'secondary' saccadically generated signal (also acting through the subsequent first-order lag system) tends to restore correct phase (and presumably amplitude) relations between the response and the original stimulus head movement.

T.M.


Hypothetical neural arrangements are described which are compatible with the known structure and function of individual organizational elements in the oculomotor system. The vestibulo-ocular reflex is represented by a system which stabilizes the visual axes in space over a certain frequency range for head excursions too small to trigger the fast phase of vestibular nystagmus. Speculations are offered on the manner in which this basic reflex system can be overlaid by the more complex visually controlled saccadic and smooth pursuit systems. Sets of brain stem neural networks are proposed as the generator of saccadic eye movements. Attempts at assigning neurological mechanisms to the smooth pursuit system indicate that the available system models are greatly oversimplified and must be modified to make them more compatible with the capabilities of neural networks.

T.M.


It is argued that the phase lags observed in the human oculomotor system during tracking tasks can be represented accurately by simple time delays whose value is a function of the class of target motion. Experimental evidence indicates that the delay time is the time required by the retinal passage to sweep across enough receptors so that the integrated neural messages can generate the minimum afferent signal necessary to elicit corrective eye movements.

T.M.


Determination of the pulse wave velocity (PWV) in a large number of healthy subjects and patients suffering from eight different pathological states. A noninvasive photoplethysmographic technique was used, and two time periods were measured - the time period between the 'feet' of the pulse waves of the femoral and the dorsalis pedis arteries and the period between the QRS complex and
the pulse wave of the dorsalis pedis artery. PWV was found to increase significantly with age. Hypertension was accompanied by increased PWV only in older subjects, while peripheral vascular disease was associated with decreased PWV. No significant change was observed in normotensive subjects suffering from ischemic heart disease, rheumatic heart disease, congestive heart failure, diabetes mellitus, or anemia. The time interval between the feet of the femoralis and dorsalis pedis arteries was not altered significantly by cardiac pacing at fixed and increasing heart rates in eight patients with A-V block. Beat-to-beat measurements in eight cases of chronic atrial fibrillation showed that this interval was constant and independent of the preceding cycle length and, therefore, of variations in blood pressure. Premature beats generated intervals which were equal to or shorter than those generated by sinus or postpremature beats. On the other hand, the interval between two Q waves of the ECG and the foot of the pulse wave of the dorsalis pedis artery was prolonged by cardiac pacing and was inversely related to the preceding cycle length in atrial fibrillation. Likewise, intervals generated by premature beats were longer than those of sinus and postpremature beats. This finding is interpreted as indicating a prolongation of the 'left ventricular tension period,' rather than a change in the propagation time of the pulse wave.

A.B.K.

A71-42519

Results of a vectorcardiographic analysis of 19 subjects with inferior atrial rhythm as diagnosed by ECG. A predominance of clockwise rotation of the P loop in the frontal plane and counterclockwise rotation in the horizontal and right sagittal planes is noted. The initial limb of the loop and the greatest vector are directed upward and usually leftward. The spatial voltage of the greatest vector and the dimensions of the loop are within normal limits. No correlation is observed between the VCG and ECG classifications of nodal and coronary sinus rhythms. An analysis of the horizontal plane makes it possible to identify several types of IAR, probably resulting from different locations of the pacemaker.

A.B.K.

A71-42577

Description of experiments in which electroencephalographic analysis was made on 48 curarized rabbits with electrodes implanted in various sections of the cerebrum. The intracranial relations between the paraventricular and supraoptical hypothalamic anterior nuclei on the one hand and the dorsal hippocampus and the medial septum on the other are studied. The effect of oxitocin on these cerebral structures is discussed.

V.Z.

A71-42578

The neuron activity of the postero-lateral thalamic nucleus in response to heteromodal visual, acoustic and somatic stimuli is studied in anesthetized cats with microelectrodes inserted in the postero-lateral thalamic nucleus. Pronounced but different reactions on these stimuli, single or combined, are established in most of these neurons.

V.Z.

A71-42579

The volume of perceived sound intensity information was studied in soundproof chamber experiments on 3 trained subjects with normal hearing. The subjects were instructed to discriminate test signals from masking signals on an electrodynamic TD-6 telephone system when signals of either type were delivered in alternation. The rectangular 1000-Hz 30-microsec 20-to-70-dB test signals and the rectangular 1000-Hz 300-microsec 85-dB masking signals were produced by two 2G-10 acoustic generators and an electronic device designed by Makarov et al. (1963). The perception capacity of the subjects declined when the microintervals between test and masking signals were reduced.

V.Z.

A71-42580

Frequency analysis is carried out for blood circulation rhythms and oxygen tension in the cerebra of rabbits, cats, Macacus rhesus monkeys and human subjects with electrodes implanted in the cortical structures under normal physiological conditions. Computer calculations showed that most of the slow blood stream and p02 fluctuations had frequencies from 0.005 to 0.2 Hz with some differences for individual genuses of animals and for man.

V.Z.

A71-42581

Study of the reaction of the posterior sections of canine lungs in response to alternate stimulation of ipsi- and contralateral peripheral ends of severed trunci vagosympathetici. EKG, plethysmogram, pneumogram, and the pressure in the pulmonary artery were recorded in 26 anesthetized dogs given artificial respiration when the contraction of the respiratory muscles was drug-arrrested. Stimulation of the ipsilateral nerve produced an increase of blood content in the central section and a decrease of blood content in the peripheral sections of the lung.

V.Z.

A71-42582

Observations indicate that Citellus suslicus and Citellus major animals rewarmed at ambient temperatures of +10, +1 and -2°C during recovery from hibernation. The process of awakening was slowed down to 300 to 360 min at -2°C from 60 to 90 min at +10°C. The temperature of the heart rose faster than that of the brain when the ambient temperature during awakening was low.

V.Z.

A71-42583

Experimental studies of the influence of radiation-protection drugs on the reactions of organisms to accelerations and hypoxia. The effects of extremal flight factors on the response of organisms to these drugs are also examined, and extensive test data are quoted on the effectiveness of drugs and partial body screening in minimizing the effects of ionizing radiation. Symptoms brought about by combinations of drugs and flight conditions are described in detail. Methodological articles describe procedures for measuring the composition of cosmic radiation, for preparing samples in radiation pathology, and for determining the relative biological effectiveness of various types of radiation.

T.M.


Experimental determination of the dose dependence of the influence of cystamine and aminoethylisothiouronium on the resistance of rats and mice to lateral accelerations thirty minutes after the administration of the drug. The dose dependence of the drug effects was determined on the basis of the cardiac contraction rate. The resistance of the animals to the accelerations becomes stabilized within four hours after administration of the drugs. The reduction of the depressant effect of the drugs with time is associated with the elimination of the pharmacological (toxic) effect. The reduction of glycogen supplies in the liver is a possible mechanism responsible for the drop in resistance to acceleration under the influence of cystamine.

T.M.


Mice were subjected to lateral accelerations on a centrifuge after periods of 30 min, 4 hr, and 1, 2, and 5 days following the intraperitoneal administration of the drug. Expressions are derived for the dose dependence of the acceleration resistance of male and female animals during the 30-min period following the administration of the drug. The response of the animals receiving a 300 mg/kg dose did not differ from control animals after periods longer than 4 hr.

T.M.


Cystamine, mercaptopropylamine, and aminoethylisothiouronium (AET) reduce the resistance of guinea pigs to lateral accelerations. The bradycardia induced by these drugs is further aggravated by the accelerations and enhances the rate at which the adaptation (to acceleration) reserves are used up. The AET did not affect the cardiac contraction rate, but acute bradycardia also followed when it was combined with acceleration. The influence of cystamine can be totally or partially eliminated with the aid of atropine or dimedrol.

T.M.


Rats were subjected to the influence of lateral accelerations, cystamine, and a combination of both these factors. Pathomorphological and histochemical changes were examined in the lungs, liver, heart, diaphragm, and the adrenal glands. Both the accelerations and cystamine caused oxygen deficiency in the tissues and led to rapid exhaustion of energy reserves in the organism. The hypoxia effects were added during the combined action of accelerations and cystamine.

T.M.


The behavior of an organism treated with radiation-protection drugs in response to acute hypoxia was examined in experiments conducted with albino rats. Intraperitoneally and perorally administered cystamine (250 mg/kg) and aminoethylisothiouronium (800 and 250 mg/kg) substantially reduced the resistance of the animals to acute hypoxic hypoxia and to hypoxia induced by carbon dioxide. Possible pathophysiological mechanisms responsible for this effect are considered.

T.M.


Recommendations for the use and avoidance of specific drugs by crewmembers of spacecraft and aircraft. The composition of on-board medical supplies is examined from the viewpoint of preventing indiscriminate use of particular medicines by crew.
members who have only superficial knowledge of possible after-effects. Allergies induced by certain drugs are characterized, together with resulting effects as they affect the health requirements of flight personnel.

T.M.


Study of the influence of lateral accelerations on the tolerance of mice to toxic doses of cystamine, aminoethylsulfoxonium (AET), monosodium salt of beta-aminoethylthiophosphoric acid (cystophosphate), and 5-methoxytryptamine (5-MOT). A small increase in the tolerance to aminothiols (cystamine and cystaphose) was observed immediately after the accelerations. After 30 min, there was a statistically significant rise in the sensitivity of the mice to cystamine and AET; after 1 hr, this reaction returned to normal. Increased tolerance to 5-MOT was observed for a day following the acceleration. Increased levels of acceleration substantially enhanced the tolerance to cystamine.

T.M.


Cystamine, aminoethylsulfoxonium, monosodium salt of beta-aminoethylthiophosphoric acid, and 5-methoxytryptamine (administered in radiation-optimal doses through the mouth, intraperitoneally, and into the small intestine) reduced the rate of tracer (barium sulfate) evacuation from the stomach by factors of 4 to 8, 2, 5 to 6, and 2 to 3, respectively. Intraperitoneal administration of cystamine prior to irradiation at first increases the spasm of the pylorus and aggravates the disturbance of the stomach's evacuatory function; subsequently, the drug exerts a clear normalizing effect on the functional state of the gastrointestinal tract.

T.M.


Adrenaline, symphatol, veritol, adrenaline, ephedrine, amphetamine, and methamphetamine depress the reflex activity of the spinal chord. The severity and nature of this effect have a specific dependence on the chemical structure of the amine and on the functional state of the central nervous system. The toxicity of all amines is from two to four times higher for irradiated animals than for normal animals. The degree of depression of the spinal chord in irradiated animals was approximately the same as that in desymphatized animals.

T.M.


Caffeine, euphyllin, and cordamin depress respiration, reduce arterial blood pressure, disturb the heart's bioelectrical activity, and affect the metabolic processes in the organism during hypothermia (rectal temperatures of 19 and 20 C). Glycogen and ATP content becomes reduced in tissues of the heart, liver, kidneys, and brain. A tendency toward increased excretion of calcium ions with the urine was observed. Morphine does not increase the depressing effect of low temperature on the cardiac function and on the state of metabolic processes in the tissues; calcium chloride substantially reduces the arterial pressure. Adrenaline and mesaton retain their usual effects during hypothermia.

T.M.


Current uses of chemical compounds in radiation sickness prophylaxis are discussed, covering mercaptopalkylamines, aminoalkylisothioure derivatives and indolylalkylamines. The topics include the mechanisms of protective action, inactivation of radicals, protection by changing the state of biosubstrate molecules and metabolism modification, and recovery of radiation-afflicted cells.

V.Z.


Pharmacological properties of chemical compounds used as radiation protectors are reviewed. Covered are beta-mercaptopethylamine, beta-mercaptopropylamine, beta-aminoethylthiophosphoric acid, cystamine, cysteine, S-beta-aminethylisothiouronium Br-HBr, dimethylsulfotioxide and indolylalkylamines. Toxicity, metabolism, protective doses and physiological action of these compounds are discussed in the light of current knowledge.

V.Z.


The death rates, median life span, and weight were studied in mice exposed to gamma radiation doses of 139 to 159 r/min after intra-abdominal injections of cystamine. The protective action of cystamine was not affected when injections of 15 mg/kg were made 30 min before exposures but it did decrease when this time was extended to 1 hr. The protective action of cystamine and other aminothiols declined sharply when the exposures lasted 1.5 to 4 hr.

V.Z.


596
The radiation protective properties of cystamine, S-beta-aminooethylisothiuronium bromide-hydrobromide, monosodium salt of beta-aminooethyliothiophosphoric acid and 5-methoxytryptamine was studied on albino mice exposed to gamma-neutron emission. Depending on the radiation doses and composition, the protective effect of these compounds varied from zero to some statistically measureable levels.


Experiments on rats showed that the elimination rates of cystamine in them were 25 to 35% per hr during 3 hr following injections. An attempt was made to extend the radiation-protective action of cystamine by reirjection of eliminated portions. Cystamine elimination rates were lower when small doses of cystamine were added repeatedly at intervals of one hour, and its toxic action increased after 3rd injection. In general, its radiation-protective action declined faster with time than its toxic action. Preliminary experiments indicated that elimination of other radiation protectors could also be studied by this method.


Half-elimination times of cystamine toxic effect in gamma-irradiated and control mice are compared in a study of the effect of gamma-emission on the elimination rate of cystamine in the organism. Residual cystamine in the organism is calculated from the shift in T50 of the protector 3 hr after injections. Gamma doses of 850 r increased T50 from 1.8 in control mice to 2.3 in irradiated mice when cystamine was used as a prophylactic. The portion of cystamine remaining in the organism was 44.2% in exposed mice and 24.5% in control mice 3 hr after injection. It is theorized that a slower elimination of the toxic effect of cystamine after irradiation is due to a depressive effect of radiation on cystamine metabolism.


Experiments on rats exposed to general gamma neutron radiation with a neutron component of about 90% showed that the shielding of the head provided a much less effective protection than the shielding of the front section of the belly when the masses of protected tissues in both cases were equal. The shielding of equal head or belly tissue masses was nearly as effective during exposure to fission neutrons of about 1 MeV as it was during exposure to 120-MeV protons but was much less effective during exposure to gamma emission. Protective effect of head and belly shielding was substantially higher when the neutron proportion in gamma emission was reduced from 90 to 30%.

**A71-42717** // Changes in the reactivity of animals to certain pharmacological preparations when parts of the body are shielded during total irradiation (Izmenenie reaktivnosti zhivotnykh k nekotorym farmakokhimicheskim preparatam pri ekranirovanii chastei tela vo vremia obshego oblucheniia). B. L. Razgovorov, P. P. Saksonov, V. V. Antipov, V. S. Shakhno, and V. S. Morozov. In: Radiobiological aspects of the reactivity of organisms in connection with space flights. Moscow, Izdatel'stvo Nauka, 1971, p. 175-185. 10 refs. In Russian.

Study of the effect of cystamine, AET, and 5-methoxytryptamine (5-MOT) on rats subjected to total irradiation with 120-MeV protons and Co 60 gamma rays while their abdomen and head regions were protected by shields. It is found that the effectiveness of these preparations is considerably increased, especially in those cases where the substances are administered in suboptimal doses in the presence of 'low-efficiency' shields, under conditions of exposure of the animals to absolutely lethal radiation doses. While in the case of cystamine and AET the increase in specific effectiveness was the same whether the head was shielded or the abdomen tissue, in the case of 5-MOT the increase in its effectiveness is much more pronounced when the abdomen is shielded than when the head is shielded. This difference in the reaction of the animals is attributed to certain differences in the mechanism of action of the preparations.


Study of the effect of shielding of the head and the anterior part of the abdomen on the clinical evolution and outcome of radiation sickness in dogs subjected to lethal doses of total gamma irradiation. The test results confirmed the basic data obtained in experiments on small laboratory animals and showed the great effectiveness of shielding parts of the body in the case of dogs. Given a shielding of equal masses of tissue by shields producing an identical degree of radiation attenuation, and given an equal irradiation dose, shielding of portions of the anterior part of the abdomen is found to be considerably more effective than shielding of the head. In order to produce a significant protective effect of shielding in the presence of lethal irradiation doses, it is necessary to protect an abdomen (head) tissue mass equal to 10 to 15% of the body mass and to reduce the irradiation dose on the shielded tissue by a factor of 3 to 4.


Comparative study of the effect of irradiation in doses of 50 to 200 r on the level of disruption of the chromosome complex of bone marrow cells in experimental animals (with shielded abdomens) and control animals. Although no differences in chromosome behavior are noted within the first 12 or 24 hr after irradiation, after three days the frequency of chromosome aberrations in the bone marrow of the experimental animals practically returned to the initial level and was statistically reliably lower than in animals irradiated without a physical shield. The level of disruption of the chromosome complex in the experimental animals was also somewhat lower than in animals irradiated with a half-dose of irradiation, thus attesting to a decrease in the radiation effect by a factor of 2 to 2.5.

**A71-42720** // Blood serum aminotransferases in dogs after total exposure to gamma rays under conditions of shielding of the

Investigation of the activity of glutamicoaspartic (GAST) and glutamicoalanine (GALT) aminotransferases in the blood serum of dogs subjected to single irradiation with Co 60 in a dose of 600 r (2.9 r/min) with shielding of the head or abdomen. Hyperfermentemia was observed within 40 to 90 days after exposure. When the animals were subjected to radial accelerations (before the appearance of symptoms of disruption of cardiac activity), an almost equal hyperfermentemia occurs both in intact animals and in those irradiated with the abdomen region shielded, as contrasted with an absence of changes in the activity of GAST and GALT in dogs with head shielded. These differences are attributed to the dynamics of changes in aminotransferase activity, and to the rate and volume of the repair processes under different shielding conditions. A.B.K.


Study of the pathomorphological changes occurring in the spleen, testes, stomach, intestines, myocardium, central and peripheral nervous system, and the retina of the eye in rats subjected to irradiation with 120-MeV protons in a dose of 640 rad under conditions of partial shielding of the abdomen region. In the irradiated animals destructive changes typical of radiation sickness are noted not only in radiosensitive organs, but also in so-called radioresistant organs (the myocardium, the nervous system). Local shielding of the abdomen is found to reduce the extent and intensity of changes in the organs, especially in organs directly covered by the shield. A.B.K.


Study of the special features of the pathomorphological changes occurring in the organs of rats subjected to total gamma neutron irradiation in a dose of 300 rad under conditions of shielding of the head and abdomen regions. The mortality rate of the rats and the frequency of diarrhea were taken into account, the nature of the pathomorphological changes in the organs was noted, and the degree of recovery of the reproductive function in irradiated males was estimated. A special feature of radiation sickness in rats subjected to total gamma neutron irradiation is pronounced early damage to the intestines. Placing a shield in the abdomen region is a more effective means of ensuring protection from radiation than the use of a shield in the head region. A.B.K.


Study of the effectiveness of employing the radioprotective preparation cystamine hydrochloride, or a vitamin B complex together with vitamin C, in the course of radiation therapy. It is found that when patients undergoing radiation therapy are given before each irradiation 0.6 gram of cystamine hydrochloride the frequency of the appearance of various symptoms of radiation sickness is reduced by a factor of 2 to 3. The administering of a vitamin B complex and vitamin C in the course of radiation therapy has a favorable effect on the overall state of the patient and decreases intoxication symptoms, without appreciably affecting the white blood pattern. A.B.K.


Study of the reaction of a large number of mice to acceleration (44 g) after various periods of radiation sickness brought on by exposure to gamma irradiation in doses ranging from 500 to 400 r. Regression equations for the tolerance to acceleration by the irradiated animals are calculated for the case of exposure to radiation without radioprotectors and for the cases of exposure to radiation with the use of radioprotectors cystamine, cystaphen, 5-methoxytryptamine (5-MOT), and serotonin. A.B.K.


Study of the rate of recovery of the radioresistance of mice subjected to the combined action of gamma radiation and dynamic factors such as vibration and acceleration. In this study the rate of recovery is estimated on the basis of a determination of the dose which causes a 50% decrease in the weight of the spleen within four days after the test irradiation. A lengthening of the period of semirecovery of radioresistance is noted in mice subjected to the combined action of radiation and dynamic factors in comparison with mice subjected only to radiation. A.B.K.


Study of the determination of the protective effect of a radioprotector administered to a large number of white mice subjected to acceleration before and after exposure to gamma radiation. The radioprotector in this case was cystamine in a mixture with adrenaline and amphetamine, the criterion for estimating the protective effect being the rate of repair of the reversible part of the radiation damage, as determined from the time required for semirecovery of the radioresistance of the animals. It is established
that the protective effect of cystamine during the combined action of irradiation and acceleration is of the same extent as during irradiation alone.

A.B.K.


Study of the effect produced in the blood system of dogs by the complex action of single prior transverse accelerations and gamma irradiation in a dosage of 100 or 200 r with intervals of 2 or 24 hr between exposures. With an interval of 2 hr between exposures and an irradiation dosage of 100 r the changes in the peripheral blood during the first few hours were caused mainly by the action of acceleration and consisted of neutrophilic leucocytosis, lymphoedema-, and thrombocytopenia, expressed to a considerably greater extent than in the group subjected to irradiation alone. With an increase in the dosage to 200 r this effect decreases. With an interval of 24 hr between the acting factors and dosages of 100 and 200 r a more rapid and complete recovery of the composition of the peripheral blood is noted than in the case of exposure to irradiation alone.

A.B.K.


Thirty-three dogs were vibrated at a frequency of 70 Hz and an amplitude of 0.4 cm 2 hr and one day prior to gamma-irradiation in doses of 100 and 200 rads. Vibration is found to produce changes in the reaction of peripheral blood to irradiation. The effect of vibration was most pronounced in a group of dogs subjected to vibration 2 hr before irradiation in a dose of 100 rads. The effect of vibration was less pronounced when the dose was increased to 200 rads. Vibration one day prior to irradiation has no effect for either of the doses.

A.V.P.


The influence of a radiation protector belonging to the class of aminothiols on the degree to which a number of internal organs of white rats were damaged by single and twofold gamma-irradiation and by the combined effect of gravitational overloads and radiation is investigated. The radiation protector is found to decrease radiation damage and to further healing of damaged tissue.

V.P.


The effectiveness of cystamine and S, beta-aminoethylisothiou-rium administered in doses of 75 mg/kg each 15 to 30 min prior to exposure to the combined effect of Co60 gamma-radiation (350 and 700 rads) and transverse loads (10 units during 30 min) is studied on mice. The action of overloads one day prior to irradiation is found to decrease the radiation damage of hemopoietic organs. Mice exposed to overloads one day after irradiation exhibited a slight increase in radiation damage of spleen and bone marrow and a buildup of destructive changes in the peripheral nervous system. The combined effect of cystamine and aminoethylisothiou-rium is found to reduce radiation damage both in the case of irradiation without overloads and in the case of irradiation combined with overloads.

V.P.


The influence of X-rays doses of 50, 100, 200, 500, 700, and 1000 r on the resistance of white rats to acute anoxia, anemic, and histotoxic hypoxia is studied. The histophysiological state of the adrenal cortex was studied in parallel experiments. The observed increase in the resistance of irradiated rats to hypoxia is attributed to a nonspecific reaction of the organism, through the adrenal cortex, to stress effects.

V.P.


Investigation of radiation (450 r)-dose effects in rats exposed up to 98 days to a pressure of 198 mm Hg with partial oxygen pressure close to its sea-level value. The reduced barometric pressure exhibited a negative influence on the survivability of the irradiated animals. Preliminary acclimatization of the animals to the low-pressure environment somewhat mitigated the progress of radiation sickness. No substantial differences were seen in the blood indices of acclimatized and nonacclimatized rats exposed to radiation.

T.M.


An original sample-preparation method for radiation pathology research is described whereby sample sections of animal organs from different test series are closely packed on filtering paper. The resulting composite tissue blocks are frozen in solid carbon dioxide, and sections are cut for histochemical tests. Without preliminary freezing, such blocks can be placed in corresponding fixative mixtures (formaldehyde solution, Carnoy's fixative, and others), subjected to dehydrating and inducing media, and studied by ordinary histological methods. The method provides composite sections of any organ from animals in different test series, prepared under identical conditions.

T.M.
It was found that the cardiovascular and respiratory systems of astronauts Beliaev and Leontov were essentially normal during all phases of their space flight, with the exception of launching during which their heart beat and respiration rates increased 1.5 to 2 times. Additionally, normal was their oculomotor activity, with the frequency of oculomotor reactions increasing to 105 to 110 per min during the initial two orbits. The contents of adrenaline, noradrenaline, and creatinine in the urine, ketosteroids, and of lymphocytes and leucocytes in the blood were somewhat higher after the flight.

V.Z.


The effects of 20-min exposures to 114 to 115 dB and 125 to 126 dB noise on 24 subjects were investigated in a series of 105 experiments. Unfavorable reactions of the auditory and motor analyzers to noise of 125 to 126 dB were observed. Exposures to noise of 114 to 116 dB for 20 min are believed to be safely acceptable during space flights.

V.Z.


Healthy male subjects were kept at 34 C for 5 days immersed in water containing NaCl in experiments designed to determine the effect of a modified gravitational field on their motor functions. The functional behavior of the segmental apparatus of the spine cord during the execution of voluntary motions was studied during immersion. The results suggest that the functional activity of the supraspinal centers is depressed by the 2nd day of immersion.

V.Z.


Subjects were kept immersed in water, or restricted to bed rest for 24 hr on the same diet in a study of basic metabolic processes and external respiration under such conditions. Oxygen requirement, carbon dioxide discharge, pulmonary ventilation, and the oxygen consumption coefficient were higher in immersed subjects than in subjects with bed rest.

V.Z.


The variations in the external respiratory function and gas metabolism under transverse accelerations of 9 to 16 g were studied in a series of 77 experiments on 53 subjects kept in a reclined position in a rotating centrifuge. Respiration rates and volume, pulmonary ventilation, oxygen intake, carbon dioxide discharge, and the respiratory coefficient were determined during the experiments. The shifts in respiration and gas metabolism observed under accelerations are linked to an upset oxygen balance which becomes more pronounced with accelerations. Also the pulmonary ventilation and pulmonary gas metabolism were upset markedly at accelerations of 13 g and above.

V.Z.

Subcutaneous injections of atropine sulfate, acetylcholine, and carbocholine were given to albino rats immediately after and on the 3rd, 7th, 10th, 12th, and 14th day following exposures to 5-mm accelerations of 20 g at a rate of 0.2 g/sec. Roentgenograms taken immediately after injections showed distinct changes of gastrointestinal reactions in exposed rats to acetylcholine and carbocholine.

V.Z.


Light of 0.1, 100, and 260 lux inhibited the function of the vestibular nystagmus in two groups of 12 subjects who participated in 220 experiments in a study of interactions between the visual and vestibular analyzers. The duration of counterrotation illusion and the amplitude and duration of the postrotation nystagmus were reduced when the subjects were exposed to acoustic stimuli of 100 to 110 dB at 1000 Hz. Muscular stresses on a manual and especially on a stand dynamometer also reduced the duration of counterrotation illusion.

V.Z.


Dogs were exposed to continuous radiation at daily rates of 0.07 to 0.21 r up to total doses of 25 to 225 r for a year. Some of the dogs received prophylactic medication. The vestibular analyzers in dogs with 225 r/year radiation doses showed a higher excitability than in control dogs. Medication reduced this effect and increased the reactivity of the analyzer.

V.Z.


Morphological, electron-microscopic, and cytochemical studies of the subcutaneous connective tissue of albino rats subjected to increased oxygen partial pressure. A 6-hr exposure to pure oxygen at 1 atm activates the metabolism of connective-tissue cells (accumulation of glycogen and increased activity of oxidizing enzymes) without disturbing the infrastructures. Significant pathological changes occur after 12 hr; progressing further, these changes are evidenced by the destruction of cellular organelles, the suppression of the cellular metabolism, and the depression of the activity of oxidizing enzymes. Destructive changes in collagen fibers are observed. Results are also given for 50, 70, and 100% oxygen atmospheres at an equivalent height of 2400 m.

T.M.


Survey of original and published data on the morphology, infrastructure, and histochemistry of different organs from experimental animals subjected to hyperoxia. Emphasis is placed on the effects of pure oxygen at atmospheric pressure. An initial period of 6 hr is characterized by an activated cellular metabolism without apparent morphological changes. Pathological changes observed after 12 hr include cellular adiposis, reduced RNA and protein contents in cells, disrupted infrastructure of the mitochondria, and suppression of oxidizing enzymes. A compensatory increase in the activity of glycolytic enzymes occurs in connection with the occurrence of secondary hypoxia. Reaction features specific to various tissues and organs are described.

T.M.


Morphological, electron-microscopic, and cytochemical studies of the subcutaneous connective tissue of albino rats subjected to increased oxygen partial pressure. A 6-hr exposure to pure oxygen at 1 atm activates the metabolism of connective-tissue cells (accumulation of glycogen and increased activity of oxidizing enzymes) without disturbing the infrastructures. Significant pathological changes occur after 12 hr; progressing further, these changes are evidenced by the destruction of cellular organelles, the suppression of the cellular metabolism, and the depression of the activity of oxidizing enzymes. Destructive changes in collagen fibers are observed. Results are also given for 50, 70, and 100% oxygen atmospheres at an equivalent height of 2400 m.

T.M.


The thermoregulating tonus and the rectal temperature were studied for rats kept for one hour in an atmosphere of air, one hour in a helium-oxygen atmosphere, and again in an atmosphere of air. A distinct increase in electrical activity and the gas exchange level, and a drop in the rectal temperature were observed for animals placed in a helium-oxygen mixture at room temperature. The functions normalized when the animals were made to breathe air; however, heat balance was not completely restored after one hour.

V.P.

A71-42804 # Study of the physiological effect of substituting inert gases for atmospheric nitrogen under conditions of anoxia and high carbon dioxide concentrations (Izuchenie fiziolog-

refs. In Russian.

It is shown that an individual's capacity for sensing changes in the composition of the inspired air can be evaluated in tests involving the selection of a preferred respiratory mixture. The resolution of changes in mixture composition is improved when a constant level of pulmonary ventilation is maintained. Individual peculiarities in the reactions of different people to hypoxic and hypercapnic media are discussed, and it is shown that the sensory differentiation among various mixtures improves with subsequent exposures. This demonstrates that training can improve such capabilities and should be considered in crewmember training programs.

T.M.
Tests were performed under three conditions. With a height of 4000 m, a myogenic load of 300 kgf/m², and optimal air temperature, (2) a height varying from 2000 to 5000 m, a myogenic load varying from 100 to 300 kgf/m², and optimal air temperature, and (3) a height varying from 2000 to 5000 m, a myogenic load varying from 315 to 440 kgf/m², and optimal air temperature. The training cycle was 20 days. It is found that the third condition is the most effective one for increasing resistance to high temperatures, transverse loads, and similar factors. V.P.

Experiments with rats are described, showing that substitution of argon for atmospheric nitrogen in hermetically sealed chambers at 22°C does not affect the physiological functions nor the life span of the animals. Since the heat conductivity of argon differs only slightly from that of nitrogen, the result obtained is seen to support the assumption that the higher conductivity of helium is responsible for the increased life span of animals in hermetically sealed chambers with a helium/oxygen atmosphere. V.P.

Sealed vessel experiments were carried out on albino mice to study the effects of animals under acute hypoxic hypoxia. Three conditions were studied: (1) a height of 4000 m, a myogenic load of 300 kgf/min, and optimal air temperature, (2) a height of 4000 m, a myogenic load of 300 kgf/min, and +5°C, and (3) a height varying from 2000 to 5000 m, a myogenic load varying from 315 to 440 kgf/min, and optimal air temperature. The training cycle was 20 days. It is found that the third condition is the most effective one for increasing resistance to high temperatures, transverse loads, and similar factors. V.P.

Pressure chamber experiments were carried out in a study of the low pressure tolerance of albino rats to an atmosphere containing esters, aldehydes, ketones, volatile organic acids, alcohols, carbon monoxides and other volatile products of the thermooxidative decomposition of a synthetic polymer. The tolerance of the rats markedly lower at lower pressures than at normal pressure. Disorders of motor, cardiac, respiratory and nervous activities were already apparent under pressures corresponding to altitudes of 3000 m. V.Z.

Sealed vessel experiments were carried out on albino mice to determine the physiological action of aldehydes, aliphatic amines, ketones, volatile organic acids, indole, mercaptans, hydrogen sulfide and other toxic compounds liberated from new urine and feces into air. Increased motor activity, excitement and higher respiration rates were observed in the mice for a period of 30 to 35 min after the start of exposure. Increased carboxyhemoglobin contents and a higher oxygen consumption, increase the weight of the thyroid gland, inhibit animal growth, damage pulmonary tissue, induce anemia, increase oxygen consumption, increase the weight of the thyroid gland, inhibit animal growth, and change the activity of the blood catalase. T.M.

Sealed vessel experiments were carried out on albino mice to determine the physiological action of aldehydes, aliphatic amines, ketones, volatile organic acids, indole, mercaptans, hydrogen sulfide and other toxic compounds liberated from new urine and feces into air. Increased motor activity, excitement and higher respiration rates were observed in the mice for a period of 30 to 35 min after the start of exposure. Increased carboxyhemoglobin contents and a higher choline esterase activity in the blood were also established after exposures. V.Z.

A phenol derivative was tested to check the evolution of toxic gases from urine stored for 10 days at room temperature in sealed vessels. Acetone, organic acids, nitrogen oxides, carbon monoxide, carbohydrates, phensols, ammonia and aliphatic amines were determined in air samples and microflora in the urine. Preservative additions reduced the ammonia, ketone, fatty acid and nitrogen oxide contents in air samples without changing carbon monoxide and organic compound contents. V.Z.

A phenol derivative was tested to check the evolution of toxic gases from urine stored for 10 days at room temperature in sealed vessels. Acetone, organic acids, nitrogen oxides, carbon monoxide, carbohydrates, phensols, ammonia and aliphatic amines were determined in air samples and microflora in the urine. Preservative additions reduced the ammonia, ketone, fatty acid and nitrogen oxide contents in air samples without changing carbon monoxide and organic compound contents. V.Z.

The biological effects of the gaseous products of life functions were studied in 26-day experiments on albino rats confined in sealed chambers. The living environment was monitored for the level of contaminants. Inhalation of indole vapors (concentrations of 9 to 10 mg/cu m) over a period of 2 to 3 hr does not produce substantial changes in the organism of mice, rats, and rabbits. Direct injection of a 10 mg alcohol solution of indole in rabbits showed that the indole is quickly rendered harmless and removed from the organism. A vapor concentration of 0.45 mg/cu m is the threshold for perception of the
unpleasant odor of indole. Inhalation of indole vapors in concentrations greater than 1 mg/cu m can produce negative subjective sensations such as headache and nausea. T.M.


Male albino mice were placed in an atmosphere consisting of air expired by humans. In order to distinguish effects attributable only to the elevated carbon dioxide content, some animals were subjected to a control run involving a higher concentration of this gas as the only deviation from normal air. It is shown that a number of gaseous toxic products present in air expired by humans induce neurohumoral changes which stimulate some inhibitory reactions in the central nervous system. T.M.


Measurements were made on the degree of oxidation of organic impurities in condensates of atmospheric vapors within an inhabited cabin. Possible errors arising in such measurements are analyzed, and recommendations are given for the use of available oxidation-analysis methods in the evaluation of water regenerated under spacecraft conditions. T.M.


Description of a series of experiments performed on test stands and in an air-tight chamber to determine methods of decontaminating water regenerated from urine under space flight conditions. It is shown that the initial products can contain a large amount of microflora. A complex of technological procedures for ensuring decontamination of regenerated water is recommended, involving urine conservation, filtration of the water condensate through sorbents, and making the components of the system out of materials possessing antimicrobial properties. A.B.K.


Study of the effect of the replacement time of the nutrient solution on its regenerative power in the cultivation of higher plants by the hydroponic method with a substrate of keramzit (a porous clay filler). It is shown that to ensure the functioning of a greenhouse with a given productivity it is necessary to change the nutrient solution once every 90 days. Longer use of the solution leads to an increase in the area of the greenhouse. Then the need for frequent regeneration of large quantities of nutrient solution and the high absorbative capacity of the substrate made its use in closed-cycle greenhouses questionable. A.B.K.
A71-42821

'wet combustion' method in the composition of the correcting solution. During the course of a year no reduction in the productivity of the plants was noted either with moist or dry material. It is established that underoxidized organic compounds of the mineralized products did not accumulate in the nutrient solution. During the course of a year no reduction in the productivity of the plants was noted either with moist or dry material. It is established that underoxidized organic compounds of the mineralized products did not accumulate in the nutrient solution during the experiment, but were absorbed by the substrate or were completely mineralized by biological means and had no toxic effect on the plants.

A.B.K.


Comparative study of the effect of mineralization of various kinds of vegetable wastes by thermal combustion on the working surfaces of the furnaces employed. When plants are raised on keramzit (alumino-silicate), owing to the action of root excretions, heavy metals are washed out and are stored in the root systems. Out of all the plants studied the maximum quantity of metals is stored in the economically useless part of cabbage, a consequence of which is damage to the oxide film of the working surfaces of the furnaces. Since these plants figure in the human diet, it is necessary to impose a number of special requirements on furnaces used for thermal mineralization of vegetable wastes.

A.B.K.


Study of seven phenol-containing preparations for use in the conservation of urine stored in the sanitation facilities of spacecraft cabins. The most effective of the preparations studied was found to be a preparation called PNF, which dissolves well in urine and makes it possible to conserve urine for a period of up to 100 days by adding it to the urine at a rate of 0.2 g per 100 ml of urine. When introduced into the filler of a sanitation facility, PNF caused practically no changes in the physicochemical properties of the facility and imparted an antimicrobe activity to the filler.

A.B.K.


Study of the state of health, the metabolism processes, and the immunoreactivity of the organisms of six subjects living for 120 days on a ration consisting of dehydrated food products. It is shown that the experimental data obtained on the level of excretion of a number of substances from the organism and on the balance of certain elements can be used in a calculation of a food link based on stocks of dehydrated products during long flights with daily energy expenditures on the part of the astronauts of about 3000 kcal. Adaptation of the organism to such a ration generally occurs within the first two months.

A.B.K.

A71-42824 // Evolution and the problem of detecting organic material of the solar system (Evoliutsiia i problema obnaru-
Temperature in the described Mars environmental simulation chamber can be varied from -35 to +30 °C at various heating and cooling rates. Temperature can be held constant within 0.5 deg of the desired value, and pressure can be set to an accuracy of plus or minus 2 mm Hg in the range from 5 to 95 mm Hg. A circulation of air or any other nonaggressive mixture can be achieved within this pressure range. A system of UV filters permits irradiation at 280 and 356 nm and over spectral intervals from 1 to 253.7 nm and from 220 to 320 nm. Power can be varied from 2 to 3500 microwatts/cm², and illumination can be controlled from 5000 to 60,000 lux, with plus or minus 10% nonuniformity. All settings can be automatically monitored and regulated by special programs.

A71-42828


A71-42829


A71-42830


A71-42831


Catalase becomes inactivated after multiple freezing and thawing of its solutions. The effect is dependent on the freezing temperature and on the composition of the gaseous medium. Inactivation does not take place during freezing and thawing in an argon atmosphere. At a freezing temperature of -180 °C, other gases stimulate inactivation of the catalase in the following order of decreasing severity of the effect: hydrogen, oxygen, helium, and nitrogen. A gas mixture of nitrogen and oxygen exhibits additive summation of the effects of both gases. A 1:1 mixture (by volume) of hydrogen and argon exhibited a much stronger inactivation of the enzyme than expected by simple summation of the individual effects of both gases.

A71-42860


When a well-learned circle vs ellipse discrimination was made impossibly difficult for the subjects (rhesus monkeys), the controlling stimulus-response topographies were replaced by competing topographies. The identification of two training conditions sufficient to reinstate the original discrimination permitted the following inferences: the original controlling topography had merely decreased in probability of occurrence, whereas the 'strength' of the stimulus-response relation remained unchanged; discriminations along the apparently continuous circle-ellipse dimension actually involved several distinct stimulus-control topographies.

A71-42861


Lever (observing) responses produced either a stimulus indicating the availability of food or another stimulus indicating food was not available. Key responses in the presence of the food-available stimulus produced food on a continuous reinforcement schedule. In the absence of food-available stimuli, responding on the key had no scheduled consequences. Observing responses produced food-available stimuli according to three different random-interval schedules with mean intraschedule availability times of 1, 2, and 4 min. In the fourth component of the multiple schedule (observing extinction) food-available stimuli never occurred. Each component of the schedule was correlated with a distinctive auditory stimulus. Observing rates decreased with decreasing frequency of the food-available stimulus.

A71-42862


The effects of discrimination and avoidance training on the skin resistance response were studied in eight humans. Responses occurring during one stimulus delayed the interruption of music for 30 sec; responses during a second stimulus either had no effect or interrupted the music for 15 sec. The results showed stimulus control in all subjects and an increased discrimination between the first one-half and last one-half of the sessions for seven of the eight subjects.
OF POST-TRANSPLANTATION CARDIAC REJECTION
ULTRASOUND IN THE EARLY DETECTION AND STUDY OF POST-TRANSPLANTATION CARDIAC REJECTION
(Grant NGL-05-020-305)
(NASA-CR-121642) Avail: NTIS CSCL 06P
The application of ultrasonic techniques to the early detection of heart transplant rejection is discussed. Physiological changes in the structure of the heart may be detected by ultrasonic measurements and action taken to reduce the risk of rejection.

CIRCULATORY RESPONSES TO HYPOXIA IN EXPERIMENTAL MYOCARDIAL INFARCTION
Marianne Schroll, Sherilyn C. Robison, and Donald C. Harrison [1971] 26 p refs
(Grant NGL-05-020-305; HE-09058; HE-5709; HE-5968)
(NASA-CR-121665) Avail: NTIS CSCL 06P
Three levels of decreased arterial oxygen saturation elicited a graded circulatory response in dogs, manifested by stepwise increases in cardiac output, left ventricular dp/dt, and stroke volume. Responses to similar hypoxia challenges following experimental myocardial infarction were qualitatively similar but quantitatively less. Although the circulatory compensation for hypoxia was less effective following myocardial infarction, no further deterioration of the hemodynamics was noted.

EVALUATION OF THE CARDIOVASCULAR SYSTEM DURING VARIOUS CIRCULATORY STRESSES
Harrison Donald C. 31 May 1971 21 p refs
(Grant NGL-05-020-305)
(NASA-CR-121666) Avail: NTIS CSCL 06P
The research in developing hardware and techniques for studying man's circulatory performance in the space environment is reported, and research proposals for the next year are presented. The areas of accomplishments reported include: (1) testing a noninvasive method for measuring venous pressure, (2) computer graphic techniques for studying the function of the left ventricle, (3) the validity of new intravascular pressure sensors, and (4) ultrasound techniques for determining ventricular volume and cardiac output. The proposals include work in developing improvements in noninvasive techniques for measuring cardiovascular performance, and studies to understand more precisely the way in which the circulatory system responds to stresses. Abstracts of papers published during the reporting period are presented.

THE FLUID MECHANICS OF THROMBUS FORMATION
Final Technical Report
Jul. 1971 69 p refs
(Contract NASw-1894)
(NASA-CR-121668) Avail: NTIS CSCL 06P
Experimental data are presented for the growth of thrombi (blood clots) in a stagnant point flow of fresh blood. Thrombus shape, size, and structure are shown to depend on local flow conditions. The evolution of a thrombus is described in terms of a physical model that includes platelet diffusion, a platelet aggregation mechanism, and diffusion and convection of the chemical species responsible for aggregation. Diffusion-controlled and convection-controlled regimes are defined by flow parameters and thrombus location, and the characteristic growth pattern in each regime is explained. Quantitative comparisons with an approximate theoretical model are presented, and a more general model is formulated.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS
A. L. Reyes and J. E. Campbell Mar. 1971 12 p refs
(NASA Order R-36-015-001)
(NASA-CR-121727; OPR-23) Avail: NTIS CSCL 06M
A continuing investigation in identifying the thermal inactivation curve of B. subtilis var. niger spores is reported. Several experiments were conducted to determine the nature of the curve under 0.25, 2.6, 10, 100, and 500 micrograms of water per ml of headspace. The conventional plate count method was used in assaying spore survivors ranging from 1 million to less than 10 spores per cup. The data obtained are given along with parameters as to their significance. In addition, the results of tests conducted on the hardware and equipment to be used for the evaluation of a terminal sterilization process for unmanned landers are presented.

THE FLUID MECHANICS OF THROMBUS FORMATION
Release of Microorganisms from Solid Matrices
Final Report
E. A. Gustafson and R. L. Olson Jul. 1971 85 p refs
(Contract NAS7-100)
(NASA-CR-121707) Avail: NTIS CSCL 06M
Information on the release of microorganisms by hard impact and the effect of aeolian erosion on the release of microorganisms are discussed. The efficiency of gridding, as compared to dissolution, for recovery of microorganisms from solids was determined. An adjustment constant of 20 was derived from the data that can be used to equate bacterial spore
counts obtained by grinding with those obtained by dissolution. The percentage of microorganisms released due to hard impact of Eccobond onto sand was determined. Eccobond was impacted onto sand at velocities of 168, 457, 945 and 1554 m/sec. The results showed that less than 1 percent of the available organisms was released by impact. The percentage of bacterial spores released from methyl methacrylate and Eccobond by aeolian erosion was determined. Sand, accelerated by air or carbon dioxide, was used to erode 0.25 grams of material from one gram discs. The results showed that less than 1 percent of the available organisms was released by the erosion process.

Author

N71-34057*# Becton, Dickinson and Co., Raleigh, N.C. Microbiological Science Dept.


(Contract NAS7-100: JPL-952168)

(NASA-CR-121764) Avail: NTIS CSCL 06A

A decontamination chamber with the capability of maintaining set parameters of temperature, relative humidity, pressure and gas concentration was designed and fabricated. After establishing proper operation of the chamber, a sufficient number of cycles were conducted to gain some insight into the operation of the chamber and the effects of varying parameters and cycle phases on the efficiency of sterilization of spacecraft-type materials. The test pieces included glass, plastic, and stainless steel strips, capillary tubing, and open and Morton-capped test tubes, which were inoculated in all but one test series with spores of Bacillus subtilis var. niger. Morton-capped and capillary tubes were the most difficult test pieces to decontaminate. Stainless steel strips were the easiest test pieces to decontaminate. With respect to the individual parameters investigated, relative humidity appeared to have the most pronounced effect on sterilizing efficiency. An improved spore kill was observed when relative humidity was increased from 30% to 50% in the 50 C cycles. Effects of gas concentration, time and temperature might have been manifest with further testing.

Author


(NASA-CR-121861; BNWL-1183-2) Avail: NTIS CSCL 06R

Research efforts were directed primarily toward activation analysis of the astronauts' excreta to initiate studies involving the effects of the space environment on the mass balance of various elements by the body and delineate the future research in this area. The concentrations of 17 elements in the astronaut fecal samples from Apollos 7 and 9 and the calcium concentrations from Apollos 8 and 10 are reported. The search for possible Pm-147 contamination in the space capsule environment continued with an investigation of some filter media from the Apollo 10 air purification cannister. No Pm-147 contamination was observed in the spacecraft. A search for the presence of gaseous decay products of lunar uranium and thorium in the lunar atmosphere which might have become imbedded in the spacecraft skin during the lunar orbiting of Apollo 10 was attempted. The concentrations of the thorium and uranium daughter products in the sampled spacecraft skin were below detectable limits.

Author


(NASA-CR-121860; BNWL-1183-1) Avail: NTIS CSCL 06R

The results are presented of a study to evaluate radiation activation during the course of Apollo 7, 8, 9, and 10 missions by counting the radionuclides excreted in the feces and urine of the astronauts. Observed radioisotopes were Be-7, Na-22, Na-24, K-40, Cr-51, Fe-59, Co-60, and Cs-137. The Cr-51, Fe-59, and Co-60 were from preflight injection; the K-40 and Cs-137 are naturally occurring or normally present; the Be-7 and Na-22 were both of normally occurring and cosmogenic origins; the Na-24 was cosmogenic. An evaluation of the data indicates that: (1) the Apollo 7 astronauts were exposed to protons with an average effective energy of 38 to 40 MeV, and that the radiation dose was 480 + or - 310 mrads at the 65% confidence level; (2) the Apollo 8 astronauts were exposed to protons of less than 38 MeV; (3) the radiation dose received by the Apollo 9 astronauts was less than 315 mrads; and (4) the radiation dose received by the Apollo 10 astronauts was 870 + or - 550 mrads. Other studies are reported which include: neutron activation analysis of feces and urine of astronauts, induced radioisotopes in spacecraft, promethium 147 in the space capsule environment, and calibration of the NASA whole-body counter.

Author
An analysis was made of the position of stomatologic illnesses within the complex of pathologic changes in the human body during long space flights. Reports on stomatologic illnesses of humans in unusual conditions are summarized and the principal tasks faced by stomatologists in providing care during space flights and the simulating ground experiments are outlined.

J.G.M.

SHIFTS IN THE BLOOD OF POLAR WORKERS IN THE ANTARCTIC

(JPRS-53884) Avail: NTIS

Human adaptive reactions and possible explanations for the distinctions in the clinical course of some diseases were investigated by studying the changes in the peripheral blood of individuals during acclimatization to the extreme conditions of the Antarctic. The influence of geographic and cosmic factors on Antarctic stations are reviewed and detailed statistical data are provided on blood shifts among members of the 11th Soviet Antarctic expedition to the Moleodzhnaya Station.

J.G.M.

N71-34086# Cincinnati Univ., Ohio.
NOISE DISTURBANCE AND SLEEP. THE RELATIONSHIP OF NOISE DISTURBED SLEEP TO POST-SLEEP BEHAVIOR: AN EXPLORATION STUDY Final Report
Milton Kramer, Thomas Roth, John Trinder, and Alexander Cohen Jan. 1971 176 p refs Prepared, in cooperation with PHS, Cincinnati, Ohio

(Contracts DOT-FA-WAI-184; CPE-69-132)
(FAA-NO-70-18) Avail: NTIS

The effects of noise on sleep and post-sleep behavior in two 25, 50, and 70 year-old males is discussed. The subjects were run for 15 consecutive nights, the first five and the fifteenth serving as controls. Following each night's sleep, subjects completed a series of performance and psychological tests. Threshold sound levels for sleep disturbance were obtained for an impulse and a continuous test noise and discussed in terms of type of sleep disturbance, stage of sleep, time of night, adaptation, and age of subjects. The sleep profile results indicated that the pattern of noise-induced sleep disruption was related to age. The 70-year olds showed an increase in stage 1 and movement time. The 70-year olds showed an increase in time awake and a decrease in time spent in stage 3-4. The 50-year old subjects were intermediate with respect to each measure. The daytime performance data revealed no effects of noise-induced sleep disruption on pursuit rotor and reaction time tasks but some decrements were found in time estimation, arithmetic, and memory task measures. In addition, verbal sample scores demonstrated an increase in cognitive impairment and a decrease in human relations.

Author

N71-34066# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
OBJECT RECOGNITION IN AIDED AND UNAIDED NIGHT VISION
A. van Meeteren and F. W. Zonneveld 23 Aug. 1971 26 p refs

(IFZ-1971-7; TDCK-57805) Avail: NTIS

The recognition of 20 military objects with and without a three-stage image intensifier was studied as a function of luminance. The objects, photographed in the center of a landscape mock-up, were presented to 20 subjects by slide projection. They were recognized with the image intensifier at a 600 times lower luminance than with the naked eye. An information score is defined such that along with object identifications of individual objects it also evaluates recognition of object classes and thus provides a good performance measure. A clear-cut relation was found between the information score and the percentage of correct object identifications. The supposedly realistic collection of 20 test objects did not lead to invariant confusion classes and consequently did not allow a precise definition of class-recognition.

Author

N71-34068# Oak Ridge National Lab., Tenn.
NEUTRON DEPTH DOSE DISTRIBUTIONS IN HETEROGENEOUS PHANTOMS
John W. Poston (Ph.D. Thesis - Georgia Inst. of Tech.) Apr. 1971 127 p refs

(Contract W-7405-eng-26)
(ORNL-TM-3329) Avail: NTIS

The design and operational characteristics of extrapolation ionization chambers intended to measure analogous distributions due to fast neutrons are described. Measured distributions due to fission spectrum and 14-MeV neutrons are presented and discussed. Results from measurements with fission spectrum neutrons indicate that the high voltage electrodes attached to the front of the detectors were too thick to allow the measurement of the changes in dose distributions very near the interface. However, distributions due to 14-MeV neutrons indicate a reduction in the predicted homogeneous depth dose distribution due to the presence of bone. The reduction is about 20% at a distance in bone of about 2 cm. In tissue at the rear of bone, a buildup or increase in the dose deposited was demonstrated which is about 50% more than the interface value at a depth in tissue of 0.8 to 1.0 cm. These results are discussed and compared with available theoretical descriptions. Also included is a discussion of the problems associated with the use of these detectors, the sources of error in the experiment, and a set of recommendations for improvement and further study in this area.

Author (NSA)

N71-34067# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical lnst.
AFFECT ADJECTIVE CHECK LIST ASSESSMENT OF MOOD VARIATIONS IN AIR TRAFFIC CONTROLLERS
Roger C. Smith, C. E. Melton, and Jess M. McKenzie Apr. 1971 9 p refs

(FAA-AM-71-21) Avail: NTIS

Three groups of subjects completed Composite Mood Adjective Check Lists (CMACL) before and after selected shifts at two air traffic control (ATC) facilities as part of a multi-discipline study of stress in ATC work. At one facility, a high traffic density tower (HDT); 22 air traffic control specialists (ATCS) were sampled before and after five evening (1500 to 2300) shifts and five night (0000 to 0800) shifts. At the second facility, a moderate traffic density tower (MDT), 16 ATCSs were assessed on three day (0800 to 1600) and three night (0000 to 0800) shifts. In addition, non-ATC individuals involved in monitoring the MDT ATCSs for other aspects of the general stress study served as controls. It was found that all subjects, both ATCSs and controls, showed a considerable increase in feelings associated with fatigue and tiredness as a function of working an eight-hour shift. These effects were generally more pronounced for night shifts. There were no differences between subject groups on the variables predicted to be most sensitive to variations in stress. Findings are discussed in terms of expected work effects and the lack of significant stress variations.

Author
Subjects were exposed to four simulated indoor sonic booms over an approximate thirty-minute period. The overpressure levels were 1.0, 2.0, and 4.0 psf (as measured outdoor) with durations of 295 milliseconds. Subjects performed a two-dimensional compensatory tracking task during the exposure period and continuous recordings were obtained of heart rate and skin conductance. No evidence of performance impairment was found for any of the overpressure levels. Rather, performance improved significantly following boom stimulation along with heart-rate deceleration and skin conductance increase. The obtained pattern suggests that the simulated booms may have elicited more of an orienting or alerting response than a startle reflex. The results are discussed in terms of the possible importance of rise time as a determinant of the physiological and performance effects which may be produced by sonic booms.

Author

George H. Crampton and Kenneth J. Gall Apri. 1971 33 p refs (AD-724828; EA-TR-4505) Avail: NTIS CSCL 06/19

Single cell discharges from within the vestibular nuclei were recorded during constant angular accelerations of up to 5-min duration and during sinusoidal angular acceleration. The forms of discharge patterns are described and emphasis is placed on analyses of adaptation to long term constant stimuli. The great majority of the units will show a discharge increase and then a decline during the first 45 sec of acceleration. Results from longer accelerations, however, lead to the conclusion that a simple model based on a slightly underdamped cupular mechanism does not conform to the responses and neither does an adaptation explanation. It is speculated that a substantial processing of the sensory input takes place at the level of the second-order neuron and what is often seen in these recordings are functions more closely correlated with various response requirements than with one-to-one events at the sense organ.

Author (GRA)


The development of mechanisms for facilitating a systematic transfer of NASA technology to nonaerospace sectors is discussed. Majors sectors are: aerospace applications of technology in the public sector. The biomedical and public sector team work is reported. E.H.W.

David F. Culclasure and Linda Eckhardt 28 Feb. 1971 160 p refs

SIGNIFICANT TRANSFERS OF TECHNOLOGY ARE DESCRIBED. THEY INCLUDE AN IMPROVED METHOD FOR TAKING ECG IN INFANTS AND CHILDREN WITH A NASA-DEVELOPED HELMET AND ELECTRODE SYSTEM, AN INFANT AGNIE ALARM, AN EBRO-OPTICAL CALL SIGNAL FOR QUADRIPLEGIC PATIENTS ACTIVATED BY HEAD MOVEMENT, A LOW COST SIGNAL CONDITIONING SYSTEM WHICH PERMITS RECORDING AND PLAYBACK OF ECG SIGNALS ON A HOME TAPE RECORDER, AND A SYSTEM WHICH PERMITS TOTALLY PARALYZED PATIENTS TO USE EYE MOVEMENTS TO CONTROL SUCH ASSIST DEVICES AS PAGE TURNERS. SIGNIFICANT PROGRESS TOWARD SEVERAL TRANSFERS OF AEROSPACE TECHNOLOGY WAS MADE THROUGH AN IN-HOUSE APPLICATIONS ENGINEERING PROGRAM. PRESENT EFFORTS ARE BEING CONCENTRATED UPON THE COMPLETION OF A CATHETER-MOUNTED RADIATION DETECTOR FOR MONITORING CEREBRAL BLOOD FLOW IN HEAD INJURY PATIENTS AND PROBE DESIGNED TO PERMIT PRECISE MEASUREMENT OF RADIOACTIVE ISOTOPE UPTAKE BY EYE TUMORS.

Author

A STOCHASTIC MODEL FOR EYE MOVEMENTS DURING FIXATION ON A STATIONARY TARGET
R. Vasudevan, A. V. Phatak, and J. D. Smith May 1971 27 p refs
presented is an estimated version of Wald sequential probability ratio test (SPRT). The other method is a sequential version of the separating hyperplane approach to pattern classification. The procedures were tested on Gaussian samples and on the EEG responses. Smaller error rates were easier to obtain with the estimated SPRT. In particular, error rates as low as 0.1% were obtained. With sequential tests, it is possible to specify the probability of error decisions before the test is conducted, and the experimental error rates of the procedures agree with the specified error probabilities.

A restraint system for securing a person to an ergometer while exercising under zero gravity conditions or while operating the ergometer in earth environment in a position other than the upright position is described. A padded, form-fitting body belt fits around the operator’s waist and suspenders are attached to the body belt. The body belt is secured to the ergometer forwardly and rearwardly of the ergometer seat by adjustable belts joined to the body belt and releasably hooked to the ergometer frame.

Author

APPLICATIONS OF ADVANCED TECHNOLOGY TO UNDERGRADUATE MEDICAL EDUCATION
(RM-6180-NLM) Avail: NTIS

Undergraduate medical education and the ways in which advanced technology might bring about substantial changes in body the quantity and quality of graduates are discussed. Five such applications are described including computer-assisted instruction; computer-assisted self-evaluation; an ultra-microtache retrieval and display system: electronic video recording; and two multimedia aids known as the clinical encounter simulator and the patient management decision aid. The goals of applying technology to medical education are summarized, and questions are raised that must be answered prior to any attempt at widespread implementation of the systems described. Author

BIOSCIENCES AT RAND
(RM-6047-RC) Avail: NTIS

Research in the biosciences-biochemistry, biophysics, biomathematics, and bioengineering are described. Data cover (1) physiological modeling projects, (2) mechanisms and neurophysiology of human vision, pattern recognition, and enhancement, and (3) clinical application and diagnostic techniques. An extensive bibliography is included. E.H.W.

A personal hygiene protocol was promulgated to encompass the needs, desires, and realities of keeping man clean in a confined space. Based on an in-depth review of previous personal hygiene involvements, an analysis of cleansing agents, clothing interactions, water requirements and desirable skin conditions, a day-by-day schedule has evolved. It is hoped that by employing bacteriological sampling, psychological questionnaires, and various subject or observer rating schemes, a pattern of acceptable limits and techniques can emerge. Approximately 80 respondents with confinement experience replied to a questionnaire concerned with their confinement. Their responses have formed the basic data pool for this protocol. Baseline conditions will be obtained from a combination of previous inputs and refined by virtue of data contributions to be obtained from upcoming flights and chamber studies. Author

EVALUATION OF AN IMPROVED FLOTATION DEVICE FOR INFANTS AND SMALL CHILDREN
Ernest B. McFadden and Joseph W. Young Jul. 1971 10 p refs
(FAA-AM-71-37) Avail: NTIS

A simple, lightweight, life-support infant flotation device incorporating reliable self-righting, thermal protection and automatic self-ventilation is described. This design concept utilizes prior data relative to the centers of gravity of infants and small children and exhibits excellent self righting. Thermal protection is incorporated through the use of insulative neoprene foam in construction of the submerged portion of the device. Anesthetized adolescent primates exhibiting body weights and metabolic requirements equivalent to that of an infant or small child were used to test and confirm ventilatory capability as induced by air or water motion. An evaluation of the capability of the device to deter shark attack indicated that the infant flotation device, when occupied by anthropomorphic dummies or anesthetized primates, was less attractive to sharks than anthropomorphic dummies wearing a standard yellow color inflatable life vest. Author

N71-35238*# Baylor Univ., Houston, Tex. Dept. of Psychiatry, PHYSIOLOGICAL CORRELATES OF OPTIMAL PERFORMANCE Final Report
Robert Roessler 22 Jul. 1971 50 p refs
(Grant NGR-44-003-031)

The potential utility of psychological and physiological variables in predicting human performance during extended periods of stress was investigated under laboratory conditions. One phase was directed toward defining baselines on the psychological, physiological, and performance variables and the determination of their stability over time. The second phase consisted of a situation in which the subject experienced rest-alert periods over a seventy-two hour period to determine the physiological effects. Detailed information concerning types of measurements made on subjects and results of the tests are presented. Author

A MECHANISM FOR THE EVOLUTION OF THE GENETIC CODE
Michael Conrad Apr. 1970 12 p refs
(Grant NGL-10-007-010)

Multiple coding is proposed as a mechanism facilitating the evolution of the genetic code. Multiple coding can occur when several information storing molecules share the same cytoplasm. These molecules may code for different construction machinery that is, for different coding systems. Initially this will reduce the efficiency of the systems but will not be lethal if good proteins are still produced. An alternative coding system is retained if it can lead to the production of one useful protein. Under certain conditions the information in the genetic molecules associated with the alternate coding system will be rectified and this coding system will become predominant. Author

A BASELINE PROTOCOL FOR PERSONAL HYGIENE Final Report
31 Aug. 1971 206 p refs
(Contract NAS9-11509)
(NASA-CR-115181; FRD-3989) Avail: NTIS CSCL 06I

A personal hygiene protocol was promulgated to encompass the needs, desires, and realities of keeping man clean in a confined space. Based on an in-depth review of previous personal hygiene involvements, an analysis of cleansing agents, clothing interactions, water requirements and desirable skin conditions, a day-by-day schedule has evolved. It is hoped that by employing bacteriological sampling, psychological questionnaires, and various subject or observer rating schemes, a pattern of acceptable limits and techniques can emerge. Approximately 80 respondents with confinement experience replied to a questionnaire concerned with their confinement. Their responses have formed the basic data pool for this protocol. Baseline conditions will be obtained from a combination of previous inputs and refined by virtue of data contributions to be obtained from upcoming flights and chamber studies. Author

ECOLOGY OF THE THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Apr. 30 Jun. 1971
J. E. Campbell Aug. 1971 8 p
(NASA Order R-36-015-001)
(NASA-CR-121920; QPR-25) Avail: NTIS CSCL 06M

612
An investigation of thermal inactivation of microbial spores under various moisture temperature conditions is described. It was found that when the moisture level was below 0.5 ml (260 micrograms H2O/ml headspace) at 90 C about 1-1/2 logs of inactivation was observed. Between 250 and 500 micrograms H2O/ml headspace at 80 C, the moisture value had a pronounced effect on the number of spore survivors, with the greatest effect at 495 micrograms H2O/ml headspace. It is speculated that these conditions encourage the initiation of germination, which in turn renders the organisms sufficiently sensitive to heat so that they are killed almost instantaneously at 90 C. J.M.

N71-35240 Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
COLOR DEFECTIVE VISION AND THE RECOGNITION OF AVIATION COLOR SIGNAL LIGHT FLASHES
Subjects of varying type and degree of color deficiency were tested on a battery of color tests, including the American Optical H-R-R plates, the Dvorin plates, the Color Optometer, the Farnsworth-Lantern, the Farnsworth-Munsell 100-hue, the Farnsworth Panel D-15, the Titmus Vision Tester Color Plate, and an anomaloscope examination. Correlations with a practical test of the ability of subjects to discriminate aviation signal red, white, and green were obtained. The results generally indicated that the Farnsworth Lantern was a superior predictor of performance on the practical test.

N71-35241 Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
AUTOMATED DIFFERENTIAL FLUOROMETRIC ANALYSIS OF NOREPINEPHRINE AND EPINEPHRINE IN BLOOD PLASMA AND URINE
An automated fluorometric trihydroxyindole procedure is described for the measurement of norepinephrine (NE) and epinephrine (E) in blood plasma or urine. The method employs conventional techniques for isolation of the catecholamines by alumina column chromatography. Column eluates are analyzed in an AutoAnalyzer system incorporating two fluorometers. Differentiation of the amines is based on differences in the fluorescence characteristics of the lutines of NE and E. The accuracy (as estimated by recoveries of added amines) and precision of the method are comparable to those reported for other trihydroxyindole techniques. Representative values for urinary excretion and for plasma levels of NE and E compare favorably with values stated in the literature.

N71-35242 Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
COMBINED EFFECTS OF ALTITUDE AND HIGH TEMPERATURE ON COMPLEX PERFORMANCE
Nine well-trained subjects were tested on a complex performance device designed to assess functions of relevance to airborne activities. The tasks, which involved tracking, monitoring and mental arithmetic, were performed during exposure to altitude (14,000 feet) and heat (80 deg C) both singly and in combination. Several physiological measurements were taken. Exposure durations were 30 minutes for each condition with both preand post-testing. The only clear-cut effects of the conditions were significant differences across the environmental conditions on a perceptual-motor tracking task related to manual aircraft control. Altitude was clearly a more powerful variable than temperature in this study. This was evidenced by the fact that performance under the temperature-plus-altitude and the altitude-only conditions were approximately the same; performance under the temperature-only condition was significantly better than performance for either of the other two conditions.

N71-35243 Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
CHANGES IN CARDIOVASCULAR HEALTH PARAMETERS OVER AN EIGHT-YEAR INTERVAL IN AN ATC POPULATION SEGMENT
During 1960 to 1963, the Civil Aeromedical Research Institute (CARI) conducted a broad spectrum of biomedical evaluations on a large number of air traffic control (ATC) students. Approximately 1270 of these students (20-50 years of age) underwent biodynamic evaluation of physical fitness. From these data, the relationships of maximum oxygen uptake (MV02/Kg bw), resting SBP and DBP to age and the FRWI (an obesity indicator) were examined. General data trends indicated an increase in SBP and DBP with age and the FRWI. The MV02/Kg bw showed a general trend of decrease as both age and the FRWI increased. Relevant data from the current aeromedical certification files were examined. The average weight gain was approximately nine percent. The 1970 resting SBP and DBP also increased with both age and the FRWI. The percent incidence of the 400 pathology code, as well as resting exercise and recovery heart rates, increased with age and the FRWI.

N71-35244 Federal Aviation Administration, Washington, D.C. Aeromedical Standards Div.
THE PHILOSOPHY AND LIMITATIONS OF FAA AEROMEDICAL STANDARDS, POLICIES AND PROCEDURES
Designated Aviation Medical Examiners need available basic information concerning the FAA medical certification system, the philosophy which underlies standards, policy and procedures and certain limitations of the system. It is through such information that errors adverse to safety can be forestalled and differences in opinions between equally dedicated and knowledgeable physicians can be best averted. Regulatory medicine must have orientation different from that in the private practice of medicine. Insofar as these general differences and limitations are recognized, the FAA mission of safety and promotion of aviation should be enhanced by a more effective and equitable system of medical certification.

THE STRUCTURE OF HUMAN THINKING ACTIVITY
CONTENTS:
1. THE DEVELOPMENT OF THE GENERAL THEORY OF ACTIVITY p 1-26 refs
2. PSYCHOLOGICAL INVESTIGATIONS AND THE THEORY OF THINKING p 27-49 refs
3. THINKING AND THE THEORY OF INFORMATION p 50-74 refs
4. GAMES AND THEIR PROGRAMMING p 75-109 refs
5. THE MOVEMENT OF THE EYES AND THINKING
   p 110-144 refs
6. MANUAL THINKING p 145-182 refs
7. EMOTIONS AND THOUGHT p 183-209 refs
8. FACTORS CREATING THE OBJECTIVE COMPLEXITY OF HUMAN PROBLEM SOLUTION p 210-219 refs

N71-35246# Joint Publications Research Service, Washington, D.C.
THE DEVELOPMENT OF THE GENERAL THEORY OF ACTIVITY
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 1-26 refs
Avail: NTIS
Three theories of human behavioral patterns are generalized, including habits, perception, and latent learning capacity. The stage and memory of afferent synthesis are discussed. Formalism of actions and prediction is also considered, along with reverse afferentation and mismatching between goals. J.A.M.

N71-35247# Joint Publications Research Service, Washington, D.C.
PSYCHOLOGICAL INVESTIGATIONS AND THE THEORY OF THINKING
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 27-49 refs
Avail: NTIS
Various concepts and definitions of the term, thinking, are presented. The psychological concept of thinking as a form of mental activity is analyzed, emphasizing structural unit changes. Four types of intellectual associations are differentiated: (1) similarity, (2) contrast, (3) closeness in time and space, and (4) relationship between concepts. Various psychological studies are briefly summarized. J.A.M.

N71-35248# Joint Publications Research Service, Washington, D.C.
THINKING AND THE THEORY OF INFORMATION
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 50-74 refs
Avail: NTIS
A wide spread tendency in cybernetics was noted during mental process studies. Visual differential difficulty, degree of training of subject, and compatibility of stimulus and reaction were determined. Objective and subjective information from search acts of individuals was found to be the basis of the thought process. The selectivity of mental activity which is manifested as noncorrespondance of subjective and objective data content was studied, using a difference model and a broad range of theoretical problems. J.A.M.

N71-35249# Joint Publications Research Service, Washington, D.C.
GAMES AND THEIR PROGRAMMING p 008
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 75-109 refs
Avail: NTIS
An analogy between a communications channel and human mental activity is discussed in relation to cybernetics. Chess and the activity of the chess player are characterized. Psychological studies of chess are described, along with computer programming of the game. Games between men and machines are also evaluated. J.A.M.

N71-35250# Joint Publications Research Service, Washington, D.C.
THE MOVEMENT OF THE EYES AND THINKING
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 110-144 refs
Avail: NTIS
Functions of eye motion, characteristics of orientation zone, and factors determining the zone's volume are discussed. Search tactics in problem solving situations are analyzed, along with mean-end relationships during the solution process of mental problems. Changes in structural activity during memorization are examined, as well as move-selection problems in isolated positions, solution searching with insufficient time, and mechanism development of visual search. J.A.M.

N71-35251# Joint Publications Research Service, Washington, D.C.
MANUAL THINKING
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 145-182 refs
Avail: NTIS
Human thinking was investigated through problem solving in chess. Tactile activity of blind chess players was studied, using cyclographic method. Game analysis, merging mechanisms, intention predictions, and general structure of the problem solving process are presented, along with verbalized sense in tactile activity and types of semantic formations. Search selectivity and game tree and man and machine searches for problem solutions are also considered. J.A.M.

N71-35252# Joint Publications Research Service, Washington, D.C.
EMOTIONS AND THOUGHT
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 183-209 refs
Avail: NTIS
Skin resistance during the solution of mental problems is analyzed. Emotional activation and functions are discussed. Time relationships between the beginning of change and appearance of emotional exclamations, beginning of GSR shift (central nervous system mechanism) and verbal statement, and beginning of GSR shift and evaluation of solution attempts by subjects are also presented. J.A.M.

FACTORS CREATING THE OBJECTIVE COMPLEXITY OF HUMAN PROBLEM SOLUTION
In its The Struct. of Human Thinking Activity 3 Sep. 1971
p 210-219 refs
Avail: NTIS
The objective complexity of human problem solutions was found difficult to reduce to information processes. The natural and artificial conditions of the problem are given. The cybernetic interpretation is limited to the formal characteristics of the problem structure, abstracting itself from the characteristics of the problem which represents the primary determining factors in human activity for problem solving. J.A.M.

N71-35254# Federal Aviation Administration, Washington, D.C.
CIVIL AEROMEDICAL INST.
THE SPIRAL AFTEREFFECT. 3: SOME EFFECTS OF PERCEIVED SIZE, RETINAL SIZE, AND RETINAL SPEED ON THE DURATION OF ILLUSORY MOTION
(FAA-AM-71-31) Avail: NTIS
Many safety problems encountered in aviation have been attributed to visual illusions. One of the various types of visual illusions, that of apparent motion, includes as an aftereffect the apparent reversed motion of an object after it ceases real movement. Some effects of perceived size, perceived distance, and perceived stimulus speed on the persistence of illusory motion in the spiral aftereffect are discussed. Durations of the illusion were significantly affected by low retinal speeds, by small visual angles, and by perceived size per unit of retinal size. The results suggest that complex interactions of physical and perceptual factors can significantly alter the presence and the magnitude of visual illusions of motion.

T. Guenther et al. 1971 '21 p refs Transl. into ENGLISH from MAGNESIUMARM GEWACHSENER ZELLEN VON ESCHERICHIA COLI TAECKTSSANNOLIKHET DETECTION [OBSERVATIONSAVSTAND OCH UPP-TAEKTSSANNOLIKHET]

THE METABOLISM OF MAGNESIUM-DEFICIENT CELLS OF ESCHERICHIA COLI [UEBER DEN STOFFWECHSEL MAGNESIUMARM GEWACHSENER ZELLEN VON ESCHERICHIA COLI]


Under aerobic and anaerobic conditions, the amount of glucose degraded by Mg(+2) deficient cells of E. coli is decreased to about half that degraded by Mg( + 2) rich control cells. This is the result of a decreased permease activity. In Mg(+2) deficient cells of E. coli, the activities of phosphofructo kinase and pyruvate kinase are increased and respiration is decreased. These metabolic changes are specific for Mg(+2) deficiency; they are reversible and disappear after growth on media containing Mg(+2).

The probability of target detection with respect to the observation distance is discussed. The target was photographed on a terrain model and pictures were displayed by a tachiscope. The time for detection of the photographed target was measured using 32 persons viewing the film from various distances. Results of the trials are presented in tables and graphs.
associated with above average performance during the five year study, even when supervisory status, education, and seniority were controlled. Performance, however, did not predict well to subsequent reports of time pressure, suggesting a possible causal relationship from pressure to performance. Innovation and productivity (but not usefulness) were low if the pressure experienced was markedly above that desired. The five-year panel data were derived from approximately 100 scientists in a NASA laboratory. Some theoretical and practical implications of the results are discussed. Author

N71-35262*# National Aeronautics and Space Administration. Lewis Research Center. Cleveland, Ohio.
CREW RADIATION DOSE FROM THE PLUME OF A HIGH IMPULSE GAS-CORE NUCLEAR ROCKET DURING A MARS MISSION
Analytical calculations were performed to determine the radiation dose rate and total dose to the crew of a gas-core nuclear rocket from the fissile fragments located throughout the plume volume. The rocket plume is generated by the products of the reactor and consists of hydrogen, uranium, and fissile fragments. The mission chosen is a manned courier trip to the planet Mars. Five centimeters of lead shielding would reduce the radiation dose by two orders of magnitude thereby protecting the crew. Also additional attenuation is available in the form of liquid hydrogen propellant, spacecraft structure, nuclear fuel, equipment, and stores. Author

N71-35262*# Baylor Univ., Houston, Tex. Coll. of Medicine.
EVALUATION OF THE NEUROPHYSIOLOGICAL ELECTRODE-AMPLIFIER-HARNESS SYSTEM FOR PHYSIOLOGICAL DATA ACQUISITION Final Report
The development of a special electrode and harness system for the acquisition of electroencephalogram and other neurophysiologic data during space missions is discussed. The head cap, electrodes, preamplifiers, and harness have the following characteristics: (1) easy application and removal, (2) repeated on-off use during extended periods, (3) comfort when worn for periods up to 24 hours, including 9 hours of continuous sleep, and (4) detection of artifacts produced by such factors as sweating, eye movement, and muscle potentials. Author

N71-35264*# Beckman Instruments, Inc., Fullerton, Calif.
Advanced Technology Operations.
IODINE COLORIMETER Final Report
The design and development of an instrument for making rapid, accurate measurements of low concentrations of iodine in spacecraft potable water supplies are described. A direct spectrophotometric technique is used which eliminates the need for additional reagents or complicating agents. This approach offers substantial advantages over the reagent-addition methods commonly used--especially where storage room and reagent degradation (with time) militate against the use of the usual techniques. An advantage of the instrument described is that of requiring very little effort on the part of the operator to make the aqueous iodine measurement as compared with other methods. Author

N71-35265*# Space Age Control, Inc., Palmdale, Calif.
HIGHLY ARTICULATE FULL PRESSURE GLOVE Final Report
A highly articulate full pressure glove providing maximum digital dexterity, tactility, and stability at an operating pressure of 5 psid was developed. The program encompassed thumb/finger development, glove development, and glove fabrication and assembly. A mini-convoluted nylon/neoprene laminated fabric was developed for the fingers. Axial restraints located in conduits are used to compensate for pneumatic return force in the fingers. Author

SPACE SHUTTLE TECHNOLOGY CONFERENCE. VOLUME 2: BIOTECHNOLOGY
CONTENTS:
1. SPACE SHUTTLE ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS O. T. Stoll (North Am. Rockwell Corp., Downey, Calif.) and A. O. Brouillette (Hamilton Std., Windsor Locks, Conn.) p 1-17
2. EVALUATION OF AN ENERGY ABSORBING CREW SEAT INTEGRATED WITH A ROCKET EXTRACTION SYSTEM R. Carpenter (NASA. Flight Res. Center) p 19-34 refs
3. THE FLASH EVAPORATOR FOR TRANSIENT HEAT LOADS J. L. Gaddis (Vought Missiles and Space Co., Dallas, Tex.) p 35-65
4. RECENT RESULTS FROM ZERO 'G' CARGO HANDLING STUDIES G. P. Beaslev (NASA. Langley Res. Center) p 87-92
5. SUBSYSTEM TRADE-OFF ENVIRONMENTAL CONTROL AND LIFE SUPPORT FOR ORBITER PHASE B CONTRACTOR J. Jasin (McDonnell-Douglas, St. Louis, Mo.) and R. Augusti (Hamilton Std., Windsor Locks, Conn.) p 83-95
6. PRELIMINARY RESULTS OF SPACE SHUTTLE EC/LSS STUDIES L. G. Clark and R. E. Osborne (NASA. Langley Res. Center) p 97-121
7. DEVELOPMENT OF A BLADDERLESS TANK FOR SPACE SHUTTLE C. Feindler (Grumman Aerospace Corp.) p 123-165

SPACE SHUTTLE ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS O. T. Stoll and A. O. Brouillete (Hamilton Standard, Windsor Locks, Conn.) In NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 . 3 May 1971 p 1-17 refs
Avail: NTIS CSCL 06K
The space shuttle orbiter environmental control and life support system is presented. The rationale leading to selection of concepts is stressed. Concept trades were based on an anticipated 1977 initial orbiter flight, ten years operation, and a baseline mission support requirement of four men for seven days. The system must provide the following functions: (1) shirtsleeve environment for the crew and passenger compartment; (2) food, water, oxygen, storage and disposal of trash and human waste; and (3) where required, provide environmental control of equipment in and outside the crew compartment. The system can be refurbished and maintained using airline maintenance concepts, and state-of-the-art concepts will be used and a system will be provided at costs below previous space vehicle systems. Author
for thermal control in the space shuttle was investigated. Results

Consideration has been given to equipping the scaled prototype shuttle vehicle with a lightweight energy absorbing seat integrated with a crew extraction rocket. Such a system would provide protection for low velocity vehicle impacts and also offer a means of escape during higher velocity conditions. This system has been developed and fabricated at the Flight Research Center. The energy absorbing seat has been tested in a dynamic impact laboratory with satisfactory results. The escape system has been evaluated by extracting dummies by tractor rockets from a typical cockpit configuration. These tests indicate unsatisfactory performance during high roll rates.

The feasibility of developing a liquid spray flash evaporator for thermal control in the space shuttle was investigated. Results indicated: (1) high efficiency capability; (2) operation without active back pressure control; (3) control by supply rate modulation for heat load transients; (4) capability to assume dormant operation with instant reactivation; and (5) operation with multiple evaporants in a single device.

Water immersion simulation techniques were used to determine the limits of manual cargo handling and transfer under weightlessness conditions. Package masses from 3 to 50 slugs, volume of 1.5 to 142 cubic feet, and various other aspects such as maneuvering aid, pressure suit effects and one-man versus two-man transfers were considered. Preliminary results obtained indicated that manual cargo transfer, in an IVA mode, can be easily accomplished for packages of 50 slugs or more. This appears to preclude the requirement for automated systems for cargo transfer. However, considerations of practical limitations related to the shuttle configuration and time constraints are necessary before final decision is made.

The environmental control and life support (ECLS) subsystem in the orbiter provides a habitable environment for crew and equipment in the hostility of space. The ECLS must provide for the functions of: (1) shirtsleeve environment; (2) water management; (3) atmosphere gas supply; (4) atmosphere revitalization; (5) waste management; and (6) equipment thermal control. The ECLS is active during the mission phases of launch, ascent, on-orbit, entry and landing, and supports two pilots and two cargo handlers. Ground support equipment is utilized during prelaunch, launch, and post landing activity. The four man capacity allows for a wide latitude of mission capability ranging from seven days to thirty days. ECLS extended mission capability is achieved by the addition of modular equipment that is the same as the equipment provided in the orbiter. Provisions for this equipment addition are provided in the initial subsystem design.
DISPLAY ILLUMINATION ON TRACKING PERFORMANCE DURING VESTIBULAR STIMULATION

The effects of alcohol on the ability of men to suppress vestibular nystagmus while visually fixating on a cockpit instrument, thus degrading visual tracking performance (eye-hand coordination) during angular acceleration are discussed. Reduced display illumination, independently, has also been shown to degrade tracking performance during vestibular stimulation. The way in which low and moderate dosages of alcohol and two levels of instrument-display illumination combined to affect tracking performance in a static (on motion) environment, and in a dynamic (whole-body motion) environment is presented. Mean blood alcohol levels as low as .027 per cent significantly decreased tracking performance during whole-body motion, yet caused little change in performance in a stationary environment. Impairment was much more pronounced with dim display lighting than with bright lighting. These results suggest that serious problems may be encountered by the pilot who drinks even lightly and who considers flying, especially at night. Author (GRA)

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INVESTIGATION OF PULSATION DAMPERS FOR PERSONAL RESPIRABLE DUST SAMPLERS

A pulsation damping device designed to smooth pulsating flow in personal respirable dust samplers was evaluated. The effect on the pulsation dampener efficiency of six parameters was investigated, including volume, diaphragm elasticity, diaphragm area, center orifice area, inlet-outlet orifice area, and geometry (L/D ratio). The results indicate that volume predominates in determining snubber efficiency, while the other parameters become important at small volumes. Geometry has no effect on snubber efficiency. Criteria for an efficient pulsation dampener construction were obtained. Author

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DEVELOPMENT OF THE NMFRL TELEMETRY SYSTEM, VOLUME 21, NO. 11 Interim Report

The program involves efforts to convert the Naval Medical Field Research Laboratory's prototype telemetry equipment to a low-duty cycle tone burst system. A proprietary modulated by a series of 700 Hz tone bursts originating from especially designed equipment provided the best telemetered data yet gathered in this series of studies. It is recommended that further studies be conducted using monolithic and hybrid fabricated electronic circuits. Author (GRA)

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The EG and G SY-116 A photochromic goggle system was evaluated to delineate any problem areas associated with it before Category III testing. The following features are presented and discussed: (1) physical characteristics of the goggle, such as coloration time and peak optical density; (2) effect of the goggle upon the basic visual functions, such as visual acuity and color vision; (3) aircrew ability to visually detect various targets through the goggle; (4) comparative flashblindness recovery times for both operative and inoperative goggle situations under day and night conditions, utilizing FOT simulator systems; and (5) protection afforded by the goggle from various nuclear environments in terms of safe separation distances. Author (GRA)

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OPERATOR TARGET DETECTION PERFORMANCE AS A FUNCTION OF THE NUMBER OF SONAR ECHOES, INTERVAL BETWEEN TRANSMISSIONS, AND SIGNAL-TO-NOISE RATIO

A major goal of designers of active sonar systems is to obtain longer target detection ranges. One consequence of longer ranges is longer time intervals between transmissions. Another is lower signal-to-noise ratios and thus fewer transmissions that produce perceptible echoes from a target. The purpose of the study was to investigate the effects of these variables on operator target detection performance. The results indicated the desirability of history or memory type displays with long-range sonar systems to enhance operator detection performance. Author (GRA)

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AIRBORNE AUDIO-VIDEO RECORDING DESIGN CONSIDERATIONS

A brief summary of recent airborne audio-video recording research is presented. Based on this research, and recent Air Training Command requirements for an operational airborne audio-video recording system, discussion is presented which considers the several design goals which are involved in the design of any airborne audio-video recording system. Further, an engineering development philosophy is provided which weighs current requirements against various aspects of the state of the art in audio-video technology. Author (GRA)

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PRIMARY PRODUCTION IN OCEAN BIOLOGY [LA PRODUCTION PRIMAIRE DANS LA BIOLOGIE DES OCEANS]
Bougis and Dallot In Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 19 p In FRENCH

Avail: NTIS

Some factors, like the wavelength, the euphotic zone depth, and mineral salts, controlling the plankton primary production, are reviewed. Author (GRA)

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METHODS OF MEASURING PHYTOPLANKTON PRODUCTION [LES METHODES DE MESURE DE LA PRODUCTION DU PHYTOPLANKTON]
P. Nival In Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1971 37 p In FRENCH

Avail: NTIS
An electrical analogy model is given for the ocean ecological system. Some direct and indirect methods are listed, the former permitting the estimation of gross production of phytoplankton, the latter giving an estimation of the net production of the ecological system.

A PROPOSED INCIPIENT FIRE AND TOXIC GAS CAUTION AND WARNING FOR SHUTTLE
Avail: NTIS CSCL 06K

Based on present evidence, the gas filter cell offers the ultimate in background rejection. Not only does the gas filter cell offer sensitivity as good as the other systems, but its inherent throughput advantage offers more ultimate sensitivity at the expense of some source power. The most difficult problem in implementing the gas filter cell is making stable reference samples for the two-year lifetime. It is believed that the individual gas cell sensor can be made into a small, compact, and reliable instrument. However, multiple gas monitoring will probably require parallel optical systems. Based upon present data, the amount of toxic gas required to implement the system will be insufficient to be a significant hazard in the spacecraft. Also, this approach is believed to offer the most convenient changes in gas of interest by simply adding a sensor for the new species without changing any of the existing system.

FIRE PROTECTION DESIGN FOR SHUTTLE
Avail: NTIS CSCL 06K

The priority of the fire protection systems at KSC are reviewed along with the specific restrictions to the systems. The proposed fire protection measures and systems for the space shuttle as it moves through the vehicle assembly building launch pad, landing area, and safing area are described.
Typical Subject Index Listing

<table>
<thead>
<tr>
<th>SUBJECT HEADING</th>
<th>REPORT NUMBER</th>
<th>ACCESSION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPHYXIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procaine effects on asphyxial rigidity of cat gastrocnemius-soleus muscles and neuromuscular responses to shock A71-11117</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The NASA or AIAA accession number is included in each entry to assist the user in locating the abstract in the abstract section of this supplement. If applicable, a report number is also included as an aid in identifying the document.

A

ABDOMEN

Head and abdomen shielding effects on radiation sickness evolution in dogs under lethal gamma irradiation A71-12718
Abdominal shielding effects on chromosome aberrations in bone marrow cells of guinea pigs and rats under gamma irradiation A71-12719

ABIOGENESIS

Solar system organic compounds detection and evolution, considering element, isotope and pigment composition, optical activity and polymerization A71-12824

ACCELERATION (PHYSICS)

Plants and animals reactions to environment gravitational component, showing organism perception of accelerating force A71-39970
Blind goldfish gravity reference response under linear accelerations on motor car and parallel swing from movie camera recording A71-12238
Lateral accelerations effect on mice tolerance to toxic doses of aminothiol- and indolylalkylamine-series radiation protection drugs A71-12706

ACCELERATION STRESSES (PHYSIOLOGY)

Radioprotectants effects on mice and guinea pigs physiological reactions to back-to-chest transverse accelerations A71-12718
 Bullfrog activity at rest and response to centrifugal acceleration by on-board centrifuge in vestibular space experiment OGO-A A71-12190
Pathomorphological and histochemical changes in rat lungs, liver, heart, diaphragm and adrenal glands from acceleration and cysteamine caused tissue oxygen deficiency A71-12703
Rice under combined gamma radiation and vibration and acceleration dynamic factors, studying radioresistance recovery rate A71-12725
Rice acceleration before and after gamma irradiation, determining protective effect of cysteamine in adrenoline and amphetamine mixture A71-12726
Dogs peripheral blood reaction to complex action of transverse accelerations and gamma irradiation A71-12727
Radioprotective effectiveness of cysteamine and beta-aminoethylthiourea in mice under combined gamma irradiation and transverse acceleration loads A71-12730
Gastrointestinal tract reactions to atropine sulfate, acetylcholine and carbacholine in rats after acceleration exposures, using roentgenograms A71-12796

ACCELERATION TOLERANCE

Wheat seedling responses to chronic acceleration, considering total height, coleoptile diameter, root length, sensitivity to growth retardation and histological changes A71-40001
Animals physiological responses to gravity chronic acceleration A71-40002
Chronic acceleration effects on animals, considering growth rate, food intake, oxygen metabolism and life expectancy A71-40003
Radioprotectants effect on mice against ionizing radiation and tolerance to back-to-chest accelerations in space flight A71-40345
Mercaptoalkylamine group radiation protection preparations on resistance of rats and mice to lateral acceleration rate A71-12700
Beta-aminoethylthiophosphoric acid monosodium salt effect on mice stability to lateral accelerations A71-12701
Aminothiol group radioprotective drugs effect on guinea pigs cardiac function during lateral acceleration A71-12702
Acceleration tolerance of gamma irradiated mice with and without radioprotectors A71-12724
Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and medication sensitivity A71-12790

ACCIDENT PREVENTION

Military pilot handling characteristics, discussing combat operations, accident prevention and blind landing A71-12239

ACCLIMATIZATION

Heat acclimatization by evaporative cooling prevention in men wearing vapor barrier suits, considering body temperature and heart and sweat rates A71-40355
Statistical analysis of effects of acclimatization on hematopoiesis of Antarctic expeditionary personnel [JPPR-53984] A71-34063

ACETIC ACID

Hormones movement in geotropism, discussing supraoptimal auxin content and indoleacetic acid in wheat roots A71-39981

ACTIVATION (BIOLOGY)

Arousal and activation in nonspecific reticulo-thalamic-cortical systems due to underlying emotion expressed through cortical, visceral and somatomotor channels A71-40247
ACTIVITY CYCLES (BIOLOGY)

ACTIVITY CYCLES (BIOLOGY)
Chronobiology purposes, techniques and applications, discussing rhythmic or cyclic variation calculation, biological rhythms spectra and classification and time structure alteration of organisms
A71-40784

AUTOMATIC Aircraft noise effects on hearing acuity and perceptual and intellectual judgment tasks
A71-40351

ADAPTATION Astronaut work capacity and adaptation during long term flight of space vehicle Soyuz 9
A71-40259

Adenosine Triphosphate (ATP)
Extraterrestrial life detection methods, discussing bacterial cultures growth dynamics in nutrient media and iron porphyrins proteins and ATP content increase
A71-40570

ADEQUACY Excitability, reactivity, adequacy, creativity and guidance at molecular, cellular, system and psychic levels in human biophysical neurodynamics, plotting stimulus magnitude vs response duration
A71-40563

ADIPOSE TISSUES Stimulatory effects of hypobaric hypoxia on lipid synthesis in rat liver and adipose tissues under free feeding
A71-41825

ADRENERGICS Sympathomimetic amines effects on central nervous system reflex activity of irradiated and desensitized animals
A71-42708

ADJUVANTS Mice acceleration before and after gamma irradiation, determining protective effect of cystamine in adrenaline and amphetamine mixture
A71-42726

AESOPHAGEAL Human microflora variation in long term confinement, examining anaerobic and aerobic microorganisms responses
A71-40557

AEROSPACE ENGINEERING Transfer of aerospace technology to nonaerospace problems - NASA project [NASA-CR-121638]
A71-34072

AEROSPACE ENVIRONMENTS Earth-like ecology for habitation in space, considering hollow sunlit rotating space chamber for life cycles in controlled weather environment
A71-40360

Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties
A71-40563

Physiological deterioration of monkey onboard Biosatellite 3 and unexpected demise, presenting collected data for response analysis
A71-40564

AEROSPACE MEDICINE USAF aero medical consultation service experience on vertigo cases covering symptoms and related diseases
A71-40358

Medical rejection statistics of applicants for BPA/BHC pilot training, considering ophthalmic, ear, nose, throat and general health condition
A71-41823

Vertigo due to increased middle ear pressure, discussing etiology from experience of aero medical consultation service
A71-41833

Medical preparations use and avoidance by spacecraft and aircraft crew members, discussing aftereffects, allergies and health requirements
A71-42705

Voskhod 2 cosmonauts physiological data, presenting heart rate, respiration rates, oculomotor activity and blood composition
A71-40560

ABC D C B I S T I R P H O S P B T A B (ATP)
A71-42791

Hardware and techniques for studying human circulatory performance in space environment [NASA-CR-121666]
N71-34052

AEROSPACE SCIENCES Life science and space research - Conference, Leningrad, May 1970
A71-40551

AFFERENT OCCULAR SYSTEMS Afferent oculomotor pathways to extracranial muscle nuclei, considering disruption of collateral lemnisci role in head posture disturbance production
A71-42435

Neural control organization in vestibulo-ocular reflex arc, considering afferent and oculomotor neural signals
A71-42449

AFFIRMANCES Neurophysiological investigation of visual tilt aftereffect, comparing judgment precision at vertical and horizontal to oblique orientation with/without gravity cue
A71-40671

AGE FACTOR A71-40707
Age dependent changes in free amino acid content and composition of cerebral and carotid arteries in man and dog

Physiopathological processes causes for French Air Force flying personnel inaptitude, considering motivational problems and age factor
A71-41575

Physiological relationship of young to old men, considering body composition, aerobic capacity and capillary-muscle fiber ratio
A71-41717

AIR POLLUTION Physiological effects on mice of air pollution with gaseous toxic substances from smoke and fumes, noting increased respiration rate and choline esterase activity
A71-42007

Toxicological evaluation of carbon monoxide, atmospheric contaminants, and propellants in environmental pollution [AD-727022]
N71-35258

AIR SAMPLING Volume, diaphragm elasticity and area, orifice area, and L/D ratio effects on pulsation dampener efficiency for smoothing personal respirable dust sampler flows [AB-BX-7545]
N71-35276

AIR TRAFFIC CONTROL Physiological and psychological reactions to sonic boom and effects on efficiency of air traffic control personnel [PA-AM-71-28]
N71-34068

Biomedical evaluations of cardiovascular and overall physical fitness of air traffic control personnel [PA-AM-71-19]
N71-35293

AIR TRANSPORTATION Oxygen supply to air transported patients by chemical compounds, suspecting use of perchlorates and chlorates
A71-41571

Sick and injured transportation aboard regular airliners, considering pathological and psychological contraindications
A71-41572

Vibration induced paroxysmal and cardiovascular hazards during patients transport to hospital by air or ambulance, discussing therapeutic and prophylactic treatments
A71-41573

In-flight study of work/rest cycle effects on double crew performance and fatigue in flying transport missions
A71-41829

AIRBORNE EQUIPMENT Airborne audio-video recording system designs and requirements [AD-727025]
N71-35280

AIRBORNE INFECTION Bacterial contamination in confined sealed space during long term human occupation, observing hemolytic microflora spreading dynamics on bodies, clothes, wall and air
A71-40560
AIRCRAFT ACCIDENT INVESTIGATION
Epidemiology statistics of OSAF spatial disorientation aircraft accidents, noting pilot training, flight environment and incoordinated remedy programs
A71-40359

AIRCRAFT HAZARDS
Simulated airline pilot cerebral incapacitation etiology, incidence and detection, noting unpaired crew members conduct and reaction times during approach for landing
A71-41034

AIRCRAFT INSTRUMENTS
Canadian Forces experiments on aircraft flashing lights covering warning signals, navigation and anticollision displays and aerokinetic phenomena
A71-41691

AIRCRAFT NOISE
Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness
A71-41193

AIRCRAFT PILOTS
Spine radiological examination for helicopter pilot fitness determination, discussing spinal weakness symptoms, special exercises, medical examinations and vibration reducing seat construction
A71-41758

Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease after further flight training, presenting case histories
A71-40351

AIRCRAFT SAFETY
Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness
A71-41093

AIRCRAFT SAFETY
Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness
A71-41093

AIRCRAFT OPERATIONS
Sick and injured transportation aboard regular airliners, considering pathological and psychological contraindications
A71-41572

ALCOHOLS
Alcohol ingestion effects on vertigo and syntagmatic vestibular responses to angular acceleration, considering visual fixation and alertness control
A71-41827

Physiological effects of alcohol and cockpit illumination levels on pilot performance and flying safety
A71-35275

ALDOSTEROHE
Water immersion effect on plasma renin activity, urinary aldosterone excretion and renal sodium and potassium handling in normal man
A71-41720

ALGAE
Blue-green algae survival or growth ability tests under simulated Precambrian atmospheric conditions
A71-42230

Algae and plankton phototrophic responses for optimization of oceanographic resources
A71-35476

ALKALI COMPOUNDS
Bercaptoalkylamine group radioprotective preparations on resistance of rats and mice to lateral acceleration rate
A71-42700

ALLOGENIC DISORDERS
Medical preparations use and avoidance by spacecraft and aircraft crew members, discussing aftereffects, allergies and health requirements
A71-42705

ALPHABETIC CHARACTERS
Character size, case and symbol generation effects
A71-42195

AMBIENT TEMPERATURE
Ambient temperature effects on spontaneous rewarming of ground squirrels during awakening after hibernation
A71-42582

AMBUANCES
Vibration induced paroxysmal and cardiovascular hazards during patients transport to hospital by air or ambulance, discussing therapeutic and preventive treatments
A71-41573

AMINOHEN
Bercaptoalkylamine group radiation protection preparations on resistance of rats and mice to lateral acceleration rate
A71-42700

Aminoacid group radioprotective drugs effect on guinea pig cardiac function during lateral acceleration
A71-42702

Amino acid group radioprotective drugs effect on guinea pig cardiac function during lateral acceleration
A71-42702

Amino acid group radioprotective drugs effect on guinea pig cardiac function during lateral acceleration
A71-42702

AMINO ACIDS
Age-dependent changes in free amino acid content and composition of cerebral and carotid arteries in man and dog
A71-41070

Serothion and gamma-aminobutyric acid loss and interaction in rat midbrain slices incubated in media containing Na, K and Ca ions
A71-41073

Radiation damage diagnosis in humans, investigating free amino acid excretion with urine by paper chromatography method
A71-42736

UV radiation effect on amino acids and peptides in different gas atmospheres in presence of salts and metal oxides
A71-42829

AMMONIA
Time of useful function after mice exposure to life threatening toxic mixtures of carbon monoxide, carbon dioxide and ammonia produced by combustion
A71-41830

Urine preservatives for urine water recovery system, noting ammonia and organic compound contents in condensate
A71-42809

AMPLITUDE DISTRIBUTION ANALYSIS
Analog statistical analyzer for measuring one dimensional BIC amplitude distribution functions, illustrating reaction response to threshold acoustic stimuli
A71-41067
ANABOSES
Human microflora variation in long term confinement, examining anaerobic and aerobic microorganism responses A71-40557

ANAERTS
Visual and vestibular analyzers interaction, noting reduction in deration of counterrotation illusion and postrotation synkinesias in humans A71-42797

ANNIHILATIONS
White rats resistance to acute anoxic, anaemic and histotoxic hypoxia during various phases of X radiation sickness, studying adrenal cortex histophysiological state A71-42731

ANGULAR ACCELERATION
Bull frog activity at rest and response to centripetal acceleration by on-board centrifuge in vestibular space experiment OGO-4 A71-31690

UNITED STATES
Single cell responses within cat medulla during constant angular accelerations [AD-724628] A71-34069

ANTIALZIERS
Plants and animals reactions to environment gravitational component, showing organisms perception of accelerating force A71-39970

Soviet book on animals morphophysiological changes in cardiovascular and nervous systems and various internal organs under RF wave exposure A71-11369

Hyoperoxic medium effects on experimental animal cells, tissues and organs morphology, infrastructure and histochemistry A71-42001

Animal tolerance to carbon monoxide, nitrogen oxide, triethylamine and freon-12 toxic effects after adaptation to hypoxia from tests on albino mice A71-62810

Use of nutritional markers for studies of food intake, passage, and absorption in gastrointestinal track of humans and animals [NASA-CR-115125] A71-34076

Radiolocation equipment used in Interrogation recording location system, and results in remote ground, aircraft, and satellite tracking of elk and black bear [NASA-CR-121903] A71-35260

ANOXIA
Anoxia effect on laboratory animals cardiac action, discussing ECG injury current relation to myocardium phosphorylcreatine content A71-41568

White rats resistance to acute anoxic, anaemic and histotoxic hypoxia during various phases of X radiation sickness, studying adrenal cortex histophysiological state A71-42731

Physiological effects on rats of argon substitution for nitrogen in hermetically sealed chambers under conditions of anoxia and high carbon dioxide concentration A71-42804

ANTARCTIC REGIONS
Statistical analysis of effects of acclimatization on hematopoiesis of Antarctic expeditionary personnel [JFRS-53884] A71-34063

ANTIBODIES
Human body immune status normalization in prolonged space flight, investigating ribonucleic acid stimulated antibody formation A71-60554

Pulmonary antibacterial defenses with pure oxygen breathing mice, noting inhibition of early interpulmonary clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae A71-62241

ANTIHYPERETIC
Antidiuretic action of chlorpropamide in mammalian kidney, considering intrarenal infusions effect on urinary concentration, free water clearance, glomerular filtration and sodium excretion A71-41939

ANTIRRADIATION DRUGS
Radioprotectants effect on mice against ionizing radiation and tolerance to back-to-chest accelerations in space flight A71-40305

Radioprotectants effect on mice and guinea pigs physiological reactions of to back-to-chest transverse accelerations A71-41053

Mercaptopropanilone group radiation protection preparations on resistance of rats and mice to lateral acceleration rate A71-42700

Aniethiol group radioprotective drugs effect on guinea pigs cardiac function during lateral acceleration A71-42702

Radiation protection drugs effects on albino rats hypoxia resistance, discussing hypoxic hypoxia response to intraperitoneally and perorally administered cytoxan and aminoethylisothiourea A71-42704

Lateral accelerations effect on mice tolerance to toxic doses of anethioli- and indolykylamine-series radiation protection drugs A71-42706

Antiadhesion drugs effects on healthy and irradiated rats gastrointestinal tract transverctary motor function A71-42707

Radiation sickness prophylaxis chemical compounds, discussing protection mechanisms, radical inactivation and afflicted cell recovery [NASA-CB-121860] A71-42710

Prophylactic medication for radiation damage treatment, covering toxicity, pharmacological properties, metabolism, dosage and physiological action A71-42711

Chemical agents protective properties on albino mice under gamma-neutron radiation, noting dose and composition effects A71-42713

Cystamine hydrochloride or vitamin B complex with vitamin C for radiation sickness prevention and therapy A71-42723

Acceleration tolerance of gamma irradiated mice with and without radioprotectors A71-42724

Mice acceleration before and after gamma irradiation, determining protective effect of cystamine in adrenaline and asparteine mixture A71-42726

Aniethiol class radiation protector influence on tissue damage of white rats under single and two-fold gamma irradiation at various test conditions A71-42729

Radioprotective effectiveness of cystamine and 5 beta-asinoethylisothiochrom in mice under combined gamma irradiation and transverse acceleration loads A71-42730

Prolonged small radiation dosage effects on vestibular analyzer in normal and antiadhesion drug protected dogs A71-42798

ARGYRIA
Jet and turbulence mechanism of vascular murmurs associated with stenosis for minimum flow Reynolds numbers, using aorta oscillocite plates in dogs A71-40864

APOLLO FLIGHTS
Activation analysis of fecal samples from Apollo 7, 8, 9, and 10 astronauts determine effects of space flight on mass balance of various elements by human body [NASA-CR-121861] A71-34058

Measurement of radiation exposure of Apollo 7, 8, 9, and 10 astronauts by determination of radionuclide content of feces and urine [NASA-CR-121860] A71-34059

Nutritional evaluation of Apollo diets and gnotobiotic study of mice having diets with limited microflora [NASA-CR-121529] A71-34075

APOLLO 14 FLIGHT
Biomedical effects of Apollo 14 space flight, considering weightlessness adaptation A71-41985

I-4
APTITUDE
Psychopathological causes for French Air Force flying personnel inaptitude, considering motivational problems and age factor $A71-401575$

ARC LAMPS
Effective flashes by scintillating Xe arc flash tube, considering perception by human eye $A71-41092$

AROUSAL
Arousal and activation in nonspecific reticulo-thalamic-cortical systems due to underlying emotion expressed through cortical, visceral and somatomotor channels $A71-40247$

ARTERIES
Human blood pressure in brachial artery during spontaneous night sleep, recording EEG, EKG and horizontal eye movements $A71-40185$

Age dependent changes in free amino acid content and composition of cerebral and carotid arteries in man and dog $A71-401070$

ARTHROPODS
Gravity receptors and locomotion orientation in Crustacea, discussing statocyst, stimulation, input and compensatory eye movements with respect to gravitational field $A71-39992$

ARTICULATION
Time varying aircraft noise effect on speech intelligibility, discussing test for relation to articulation index $A71-40709$

ARTIFICIAL GRAVITY
Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks $A71-40255$

ASCORBIC ACID
Cystamine hydrochloride or vitamin B complex with vitamin C for radiation sickness prevention and therapy $A71-42723$

ASPHYXIA
Hypoxia and hypercapnia induced asphyctic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralyzed rabbits $A71-40629$

Time of useful function after mice exposure to life threatening toxic mixtures of carbon monoxide, carbon dioxide and ammonia produced by combustion $A71-41830$

ASTRONAUT PERFORMANCE
Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks $A71-40255$

Astronaut work capacity and adaptation during long term flight of space vehicle Soyuz 9 $A71-40259$

Soviet book on psychology and outer space covering astronauts experiences and emotions during training and flights, daily routine, equipment, food, habits and personal characteristics $A71-40876$

Astronaut teleoperators use for space operations cost reduction and future experiments productivity increase $A71-42033$

Human adaptive behavior under psychological stress of astronauts tasks posture-motor characteristics, discussing stabilographic platform test results $A71-42041$

Vockhid 2 cosmonauts physiological data, presenting heart beat, respiration rate, ocular motor activity and blood composition $A71-42791$

Physical and physiological aspects of visual optics in space flight $[NASA-CH-115120]$ $A71-34060$

ASTRONAUT TRAINING
Soviet book on psychology and outer space covering astronauts experiences and emotions during training and flights, daily routine, equipment, food, habits and personal characteristics $A71-40876$

ASTRONAUTS
Personal hygiene protocol for man in spacecraft environment $[NASA-CH-115181]$ $A71-35238$

ATHLETES
Habituation and suppression of vestibulo-ocular vertical saccadic system due to continuous rotation in pentathlons athletes, comparing to pilots and airman trainees $A71-41526$

ATMOSPHERIC COMPOSITION
Spacecraft cabin artificial atmospheric composition and variation effects on human immunocompetence, examining lymphocytes blast immunity reactions after lymphocytes blast transformations $A71-40556$

ATROPINE
Gastrointestinal tract reactions to atropine sulfa, atropine and carbocaine in rats after acceleration exposures, using roentgenograms $A71-42796$

ATTENTION
Visual processes involved in flash perception, considering attention attraction at suprathreshold levels, unreliability at threshold levels and latency effects $A71-39177$

Flashing lights attention attraction classification based on experimental results conversion into psychometric scale $A71-41486$

AUDIO EQUIPMENT
Airborne audio-video recording system designs and requirements $[AP-727025]$ $A71-35280$

AUDITORY
Comparative residual and reversed microinterval masking signals and human auditory perception capacity measurements using sound level estimates $A71-42579$

AUDITORY PERCEPTION
Comparative residual and reversed microinterval masking signals and human auditory perception capacity measurements using sound level estimates $A71-42579$

AUDITORY SIGNALS
Comparative residual and reversed microinterval masking signals and human auditory perception capacity measurements using sound level estimates $A71-42579$

AUDITORY STIMULI
Analog statistical analyzer for measuring one dimensional EEG amplitude distribution functions, illustrating reaction response to threshold acoustic stimuli $A71-41067$

Analog computer analysis of EEG wave asymmetry for organism functional state detection illustrated on human reaction response to threshold acoustic stimuli $A71-41068$

Auditory stimuli conditioning of human skin resistance responses on escape-avoidance schedule $A71-42862$

AUTOKINESIS
Canadian Forces experiments on aircraft flashing lights covering warning signals, navigation and anticollision displays and autokinetic phenomenon $A71-41981$

AUTOMATIC CONTROL
Automatic temperature control for liquid cooling garsets used during astronaut extravehicular activity with external auditory meatus, and skin temperature as input signals $[NASA-CH-115122]$ $A71-34077$

AUTOMATIC TEST EQUIPMENT
Computerized bacterial identification system to process Apollo spacecraft sample laboratory test results in NASA Planetary Quarantine Lunar Information System $A71-62233$


AUTOMATION
Operator performance improvement in monitoring automated processes by alternating displays,
AUTONOMIC NERVOUS SYSTEM

discussing simulated radar and sonar CRT display laboratory tests
A71-41636

AUTONOMIC NERVOUS SYSTEM

auditory stimulus conditioning of human skin resistance responses on escape-avoidance schedule
A71-42862

BACTERIA

Human microbial flora and immunologic response in long term space missions, describing environmental parameters and factors and work-rest schedules effects
A71-40553

Microflora simplification effects on immunocompetent organism systems, observing shifts in guinea pigs lymphoid tissue with limited flora
A71-40555

Human microflora variation in long term confinement, examining anaerobic and aerobic microorganisms responses
A71-40557

Bacterial contamination in confined sealed space during long term human occupation, observing hemolytic microflora spreading dynamics on bodies, clothes, walls and air
A71-40560

Bacterial spores survival under simulated lunar surface conditions, comparing results with vegetable cells experiments
A71-40567

Extraterrestrial life detection methods, discussing bacterial cultures growth dynamics in nutrient media and iron porphyrin proteins and ATP content increase
A71-40570

Halophilic bacteria electron transport chain, studying protein, phospholipids, flavoproteins and cytochromes sedimentation properties by electron microscopy and light scattering technique
A71-40593

Computerized bacterial identification system to process Apollo spacecraft sample laboratory test results in NASA Planetary Quarantine Lunar Information System
A71-42233


BACTEROLOGY

Effect of hard impact and septic erosion on release of microorganisms from geological formations [NASA-CR-121707] A71-34056

RED BLOOD CELL

Human vascular and extravascular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights
A71-40354

BEHAVIOR

Observing behavior in squirrel monkeys under multiple schedule of reinforcement availability
A71-42861

BELLOWS

Development of bellows-type tasks for long term storage of potable water for space shuttle
A71-35273

BIOLUMINESCENCE VISION

Visual perceptual masking under binocular and dichotic conditions separating peripheral and central interference effects
A71-40225

Inhibitory binocular receptive fields in dorsal nucleus of lateral geniculate body for dominant and nondominant eye in cats, using moving slit and flash spot stimulation
A71-40669

Flash light angular size, adaptation luminance, pulse shape and color effects on Blondel-Bey constant tested on observers with good binocular vision
A71-41483

SUCCESSIVELY presented flashing lights detection, discrimination and brightness measurements with four channel binocular Maxwellian viewing system
A71-41488

Passive and active extracocular muscle forces in strabismus, giving horizontal binocular alignment during fixation or eye movement
A71-42442

Eye vergence movement control, describing effective target configurations and binocular units receptive field disparities
A71-42447

BIOASTRONAUTICS

Life science and space research - Conference, Leningrad, May 1970
A71-40551

Prolonged manned space flight infectious disease hazards, discussing confinement, zero gravity, high oxygen content, personal hygiene, waste disposal and preflight immune status
A71-40551

Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties
A71-40563

Soviet papers on cosmic biology, Volume 16, covering man and animal physiology under extraneous, spacecraft life support systems and extraterrestrial life detection, etc
A71-42799

Vonkhold 2 cosmonauts physiological data, presenting heart beat, respiration rates, oculomotor activity and blood composition
A71-42791

Activation analysis of fecal samples from Apollo 7, 8, 9, and 10 astronauts to determine effects of space flight on mass balance of various elements by human body
[BASA-CR-121865] A71-34058

Measurement of radiation exposure of Apollo 7, 8, 9, and 10 astronauts by determination of radionuclide content of feces and urine [NASA-CR-121865] A71-34059

BIOCHEMISTRY

Soviet monograph on coacervates and protoplasm covering colloidal-chemical properties, enzyme catalysts and multiphase cell and organism simulation
A71-40870

Hemagglutinating biosystem likelihood from consideration of enzymatic activity possibility and liquid water unique ability for complexity required by carbonaceous biosystems
A71-42229

Chlorella biomass chemical composition stability during prolonged cultivation with nitrates recycling medium
A71-42818

BIOCONTROL SYSTEMS

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in labyrinth
A71-40009

Cardiac automatic rhythms, discussing diastolic depolarization in Purkinje fibers and factor controlling automatically
A71-40250

Cardiac sympathetic nervous control of right ventricular pressure-flow dynamics in outflow tract in anesthetized dogs
A71-41522

Ventilato-colic reflex control of head movement in seated man and animal under atmospheric conditions of rotational velocity stimulation, comparing with ocular stabilisation
A71-41522

Eye movement control - Conference, University of the Pacific, San Francisco, November 1969
A71-42932

Eye movement neurophysiology, discussing ocular proprioception, oculorotatory muscle sensory receptor role, extracocular muscle afferent and efferent innervation and central nervous system control effect
A71-42933

Human ocular control system supranuclear disorder syndromes and signs in terms of physiological concepts
A71-42438
<table>
<thead>
<tr>
<th>SUBJECT INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat and human eye movement control system measurements, studying isolated oculorotatory muscles and globe restraining tissues dynamics</td>
</tr>
<tr>
<td>Passive and active extracocular muscle forces in strabismus, giving horizontal binocular alignment during fixation or eye movement</td>
</tr>
<tr>
<td>Saccadic eye movement control system behavior simulation model evaluation, considering oculomotor pathways</td>
</tr>
<tr>
<td>Vergence eye movements control, discussing transient and frequency responses</td>
</tr>
<tr>
<td>Eye vergence movements control, describing effective target configurations and binocular units receptive field disparities</td>
</tr>
<tr>
<td>Neural control organization in vestibulo-ocular reflex arc, considering afferent and oculomotor neural signals</td>
</tr>
<tr>
<td>BIODYNAMICS</td>
</tr>
<tr>
<td>Vibration effects on human body, discussing neurophysiological data, safe exposure limits, therapeutic applications, action thickness, muscular responses and biomechanical responses</td>
</tr>
<tr>
<td>Mechanical properties of muscular organs, presenting mathematical model for biological fluid flow analysis</td>
</tr>
<tr>
<td>BIOELECTRIC POTENTIAL</td>
</tr>
<tr>
<td>Corneal-retinal potential as generator of occipital alpha rhythms in human electroencephalogram modulated at 10 Hz by tremor in extracocular muscles</td>
</tr>
<tr>
<td>Heart excitation and membrane permeability effects on two component action potentials in human atrial muscle strips, using microelectrodes</td>
</tr>
<tr>
<td>Human cerebral EEG phenomena and evoked potential relationships to eye and retinal image movements</td>
</tr>
<tr>
<td>BIOELECTRICITY</td>
</tr>
<tr>
<td>Nervous system functional characteristics based on neuron structure and electrical transmission from electron microscopy, electrophysiology and biochemical analysis</td>
</tr>
<tr>
<td>Electrical heart activity and ECG mathematical model with nonlinear oscillator system construction for normal and abnormal rhythms</td>
</tr>
<tr>
<td>Motor stereotype formation with different muscular loads, noting muscle electrical activity and static tension changes</td>
</tr>
<tr>
<td>Gas metabolism and electrical activity of skeletal muscles of rats in Be/0 medium at room temperature, noting rectal temperature drop</td>
</tr>
<tr>
<td>BIOENGINEERING</td>
</tr>
<tr>
<td>Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties</td>
</tr>
<tr>
<td>Technology utilization in biomedical areas, particularly for infants and handicapped persons [NASA-CR-1216277]</td>
</tr>
<tr>
<td>Development and characteristics of biomedical system for obtaining electroencephalograms and neurophysiologic data during space missions [NASA-CR-115132]</td>
</tr>
<tr>
<td>BIOENGINEERING</td>
</tr>
<tr>
<td>Miniature biopotential transmitter suitable for telemetry, giving EEG and circuit and performance characteristics</td>
</tr>
<tr>
<td>Aquanauts tremor response measurement by muscle force transducer during compression and decompression in 520-foot saturation dive, noting differences among individuals</td>
</tr>
<tr>
<td>Radiolocation equipment used in Interrogation Recording Location System, and results in remote ground, aircraft, and satellite tracking of elk and black bear [NASA-CR-121893]</td>
</tr>
<tr>
<td>Development and characteristics of biomedical system for obtaining electroencephalograms and neurophysiologic data during space missions [NASA-CR-115132]</td>
</tr>
<tr>
<td>BIOLOGICAL EFFECTS</td>
</tr>
<tr>
<td>Geoecological effects on plants geotropic reaction chain, discussing hormone auxin asymmetric distribution due to gravity</td>
</tr>
<tr>
<td>Integrative action of central nervous system in converting gravity sensation into crustacean equilibrium reactions</td>
</tr>
<tr>
<td>Biosatellite 2 onboard experiments studying weightlessness effects on biological processes and interaction with radiation from Sr 85 gamma ray source</td>
</tr>
<tr>
<td>Medical preparations use and avoidance by spacecraft and aircraft crew members, discussing aftereffects, allergies and health requirements</td>
</tr>
<tr>
<td>Lateral accelerations effect on mice tolerance to toxic doses of aminothiol- and indolyalkylamine-series radiation protection drugs</td>
</tr>
<tr>
<td>Intact irradiation drugs effects on healthy and irradiated rats gastrointestinal tract evacuation motor function</td>
</tr>
<tr>
<td>Hypoxia pathological effects on albino rats subcutaneous connective tissue, noting oxidizing enzyme activity depression and cellular metabolism suppression</td>
</tr>
<tr>
<td>Toxic biological effects of life functions gases products in albino rats</td>
</tr>
<tr>
<td>Simulation chamber for experimental investigation of organisms reactions to Mars environment</td>
</tr>
<tr>
<td>BIOLOGICAL EVOLUTION</td>
</tr>
<tr>
<td>Gravity receptor evolution in invertebrates, considering cilia role in reception and transduction into responses</td>
</tr>
<tr>
<td>Multiple coding mechanism for evolution of genetic code [NASA-CR-121896]</td>
</tr>
<tr>
<td>BIOLOGY</td>
</tr>
<tr>
<td>Articles concerning undergraduate education in biological sciences [NASA-CR-121726]</td>
</tr>
<tr>
<td>Bioscience research and applications to biological and medical problems [BR-6007-RC]</td>
</tr>
<tr>
<td>BIOMETRICAL DATA</td>
</tr>
<tr>
<td>Physiological deterioration of monkey onboard Biosatellite 3 and unexpected demise, presenting collected data for response analysis</td>
</tr>
<tr>
<td>Biomedical effects of Apollo 14 space flight, considering weightlessness adaptation</td>
</tr>
<tr>
<td>Biomedical evaluations of cardiovascular and overall physical fitness of crew members, discussing control personel [FAA-AM-71-19]</td>
</tr>
<tr>
<td>BIOLOGICAL EFFECTS</td>
</tr>
<tr>
<td>Dynamic sampling calorimeter for continuous measurement of human radiative, convective and evaporative heat loss, enabling closed loop control system analysis</td>
</tr>
<tr>
<td>BIOLOGICAL EFFECTS</td>
</tr>
<tr>
<td>Soviet monograph on coacervates and protoplasm covering colloidal-chemical properties, enzyme catalysts and multiphasic cell organisms simulation</td>
</tr>
<tr>
<td>Human perceptual motor skill development in tracking performance, using feedback control system gain and effective time delay as measures</td>
</tr>
</tbody>
</table>
BIOPARCS

Mechanical properties of vascular organs, presenting mathematical model for biological fluid flow analysis  
A71-40994

Electrical heart activity and ECG mathematical model with nonlinear oscillator system construction for normal and abnormal rhythms  
A71-60986

Computerized electrostatic field model of biological cell membrane  
A71-62119

Saccadic eye movement control system behavior simulation model evaluation, considering oculomotor pathways  
A71-62443

Vestibolar eye movement control system models, considering dual mode control, interactivity, plant dynamics and pattern recognition  
A71-62444

Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements and smooth pursuit systems  
A71-62450

BIOPARCS

Preservative phenol derivative effects on toxic gas evolution from stored urine in sealed vessels  
A71-62808

BIOSATELLITE 2

Biosatellite 2 onboard experiments studying weightlessness effects on biological-processes and interaction with radiation from Sc 85 gamma ray source  
A71-40007

BIOSATELLITE 3

Macaca nemestrina monkey bone density change during Biosatellite 3 mission  
A71-40343

Physiological deterioration of monkey onboard Biosatellite 3 and unexpected demise, presenting collected data for response analysis  
A71-40564

BIOSATELLITES

Microorganisms under closed environmental ecological conditions with reference to antrostat infectious diseases, demonstrating bacterial growth in Biosatellite 2 and earth based closed chamber experiments  
A71-40562

BIOSYNTHESIS

Glycerides metabolism in rats' brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis  
A71-41056

Rat brain carbohydrates biosynthesis from organic acid products under normal conditions and during central nervous system disturbances, investigating butyric acid participation  
A71-41058

Stimulatory effects of hypobaric hyperoxia on lipid synthesis in rat liver and adipose tissues under free feeding  
A71-41825

BIOCHEMISTRY

Radiotelemetrical equipment for continuous subcutaneous measurements of circadian body temperature rhythms in rats  
A71-40634

Miniaturized multichannel PA/2W biological telemetry system for simultaneous transmission of EEG, EKG, EEGs and EKGs  
A71-41574

Radiolocation equipment used in Interrogation Recording Location System, and results in remote ground, aircraft, and satellite tracking of elk and black bear  
[NASA-CR-121893]  
A71-35260

Development of SREVL telemetry system to low-duty cycle tone burst system  
[AD-726406]  
A71-35277

BIOTIN

Cystamine hydrochloride or vitamin B complex with vitamin C for radiation sickness prevention and therapy  
A71-42723

BLOOD

Military pilot handling characteristics, discussing combat operations, accident prevention and blind landing  
A71-42732

Vascular effects of vagus nerve on canine lung blood content in response to electrical stimulation of vagosympathetics  
A71-42581

Hypoxia affecting circulatory responses in dogs, such as cardiac output, left ventricular dp/dt, and stroke volume  
[NASA-CR-121663]  
A71-34051

BLOOD CIRCULATION

Thrombi growth in stagnation point flow of fresh blood  
[NASA-CR-121668]  
A71-34053

BLOOD FLOW

Cystamine and intestinal blood flow differentiation during hypothalamic heating and cooling in anesthetized dogs  
A71-40632

Coronary blood flow at increased arterial carbonic acid partial pressure, noting induced hypercapnia  
A71-40633

Jet and turbulence mechanism of vascular murmurs  
A71-40864

Atrial shortening during volume loading by infusion in animal, using Frank-Starling approach  
A71-41718

Frequency analysis of blood circulation rhythms and oxygen tension fluctuations in cerebro of rabbits, cats, monkeys and men  
A71-42580

BLOOD PLASMA

Human vascular and extravascular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights  
A71-40354

Water immersion effect on plasma renin activity, urinary aldosterone excretion and renal sodium and potassium handling in normal man  
A71-41720

Rat plasma creatine phosphokinase activity, hypothermia and stress, considering cold restraint  
A71-41938

Glutamicoaspartic and glutamicoalanine asaminotransferases activity in blood serum of dogs under gamma irradiation with shielded abdomen or head, observing hyperfermentemia  
A71-42720

Development and characteristics of automated fluorometric procedure for analyzing noradrenaline and epinephrine content of blood plasma and urine  
[PA-21-An-71-15]  
A71-35241

BLOOD PRESSURE

Human blood pressure in brachial artery during spontaneous night sleep, recording EKG, EKG and horizontal eye movements  
A71-40185

Altitude and cold aclimatization effects on human basal heart rate, blood pressure, respiration and breath-holding  
A71-40349

BODY COMPOSITION (BIOLOGY)

Physiological relationship of young to old men, considering body composition, aerobic capacity and capillary-muscle fiber ratio  
A71-41717

BODY FLUIDS

Human vascular and extravascular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights  
A71-42239
<table>
<thead>
<tr>
<th>SUBJECT INDEX</th>
<th>CARBOHYDRATE METABOLISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>BODYS MEASUREMENT (BIOLOGY)</td>
<td>composition of cerebral and carotid arteries in man and dog</td>
</tr>
<tr>
<td>Stereophotogrammetric measurement of body and limb volume changes after prolonged space mission</td>
<td>A71-40354</td>
</tr>
<tr>
<td>BODY TEMPERATURE</td>
<td>Hypothermia effect on brain nutritive processes and regulator activity, considering changes in brain blood supply, respiration and carbohydrate metabolism</td>
</tr>
<tr>
<td>Radiotelemetrical equipment for continuous subcutaneous measurements of circadian body temperature rhythms in rats</td>
<td>A71-40634</td>
</tr>
<tr>
<td>Mean body temperature compensation in neutral and hot environments from rectal and skin temperatures</td>
<td>A71-41723</td>
</tr>
<tr>
<td>Dynamic sampling calorimeter for continuous measurement of human radiative, convective and evaporative heat loss, enabling closed loop control system analysis</td>
<td>A71-42155</td>
</tr>
<tr>
<td>Ambient temperature effects on spontaneous rewarming of ground squirrels during awakening after hibernation</td>
<td>A71-42582</td>
</tr>
<tr>
<td>BODY WEIGHT</td>
<td>Altitude and cold acclimatization effects on human basal heart rate, blood pressure, respiration and breath-holding</td>
</tr>
<tr>
<td>Human vascular and extracellular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights</td>
<td>A71-40354</td>
</tr>
<tr>
<td>Diurnal water and food intake and body weight changes pattern in rats with hypothalamic lesions</td>
<td>A71-41936</td>
</tr>
<tr>
<td>Death rates, median life span and weight in mice exposed to gamma radiation after intra-abdominal injections of cysteamine</td>
<td>A71-42172</td>
</tr>
<tr>
<td>BONE MARROW</td>
<td>Bubbles Scanning ultrasonic imaging technique for in vivo monitoring of microscopic bubble formation in decompression sickness, presenting image displays</td>
</tr>
<tr>
<td>Bone marrow shielding effects on chromosome aberrations in bone marrow cells of guinea pigs and rats under gamma irradiation</td>
<td>A71-42179</td>
</tr>
<tr>
<td>Neutron dose distributions at bone tissue interfaces in human body [ONEL-TH-3329]</td>
<td>A71-34066</td>
</tr>
<tr>
<td>BONES</td>
<td>BUTYRIC ACID</td>
</tr>
<tr>
<td>Racca nemestrina monkey bone density change during Biosatellite 3 mission</td>
<td>A71-40343</td>
</tr>
<tr>
<td>BRAIN</td>
<td>CABIN ATMOSPHERES</td>
</tr>
<tr>
<td>Aminazine and chloral hydrate effects on metabolism intensity of rats brain gangliosides components including N-acetylmuramidase acid and N-acetylglactosaminase</td>
<td>A71-41055</td>
</tr>
<tr>
<td>Glycerides metabolism in rats brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis</td>
<td>A71-41056</td>
</tr>
<tr>
<td>Gangliosides and cerebroside content in rat brain under normal conditions, during hypoxia and under small X ray doses action</td>
<td>A71-41057</td>
</tr>
<tr>
<td>Rat brain carbohydrates biosynthesis from organic acid products under normal conditions and during central nervous system disturbances, investigating butyric acid participation</td>
<td>A71-41058</td>
</tr>
<tr>
<td>Thyroxine effects on brain glutaminase isoenzymes interaction and deamination in mitochondrial fractions, comparing with sodium phosphate, bicarbonate and aspartate</td>
<td>A71-41069</td>
</tr>
<tr>
<td>Serotonin and gamma-aminobutyric acid loss and interaction in rat midbrain slices incubated in media containing Na, K and Ca ions</td>
<td>A71-41073</td>
</tr>
<tr>
<td>Differential lipid and phospholipid composition of white matter in brain, cervical, thoracic and lumbar spinal sections of spinal cord and sciatic nerve in dogs</td>
<td>A71-41074</td>
</tr>
<tr>
<td>Gangliosides inhibitory effects on active Ca ion transport in rat brain mitochondria, using succinate as respiratory substrate</td>
<td>A71-41075</td>
</tr>
<tr>
<td>Single cell responses within cat medulla during constant angular accelerations</td>
<td>A71-41075</td>
</tr>
<tr>
<td>BRAIN CIRCULATION</td>
<td>CAPE KENNEDY LAUNCH COMPLEX</td>
</tr>
<tr>
<td>Age dependent changes in free amino acid content and</td>
<td>A71-34069</td>
</tr>
<tr>
<td>CABIN ATMOSPHERES</td>
<td>CAPILLARIES (MORPHOLOGY)</td>
</tr>
<tr>
<td>Total body water, fluid compartments, plasma volume and water content in man and dog</td>
<td>A71-35259</td>
</tr>
</tbody>
</table>

C
CARBOHYDRATES

Biochemical evaluations of cardiovascular and overall physical fitness of air traffic control personnel [FAA-AR-71-19] 77-1-35243

CARGO

Cargo handling, transfer, and stowage under weightlessness conditions of space shuttle 77-1-35270

CASE HISTORIES

Potential epilepsy determination in flight personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness 77-1-40357

USAF aeromedical consultation service experience on vertigo cases covering symptoms and related diseases 77-1-40358

Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease for further flight training, presenting case histories 77-1-41077

CATABOLISM

Monomethylhydrazine effects on glucose carbon metabolism and effects of pure oxygen inhalation rate [AD-727008] 77-1-35259

CATALASE

Gaseous medium composition and multiple freezing temperature effects on catalase activity 77-1-42831

CATECHOLAMINES

Psychophysiological reactions to understimulation and overstimulation, noting catecholamine output, heart rate and performance efficiency in humans 77-1-40177

CATNINE RAY TUBES

Character size, case and symbol generation effects on CRT display search time 77-1-42195

Visual performance compared using highly illuminated CRT similar to those encountered in high altitude flight in direct sunlight [NASA-CR-114361] 77-1-36073

CATTLE

Parine and pyrimidine derivatives of cattle hypothalms determined by gel filtration and subsequent spectral analysis and chromatography [AD-71071]

CELLS (BIOLOGY)

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in labyrinth 77-1-40009

Space conditions exposure of lysogenic strains of Escherichia coli and monolayer cultures of human cells aboard Zond 5 and 7 flights 77-1-40556

Living organisms life-sustaining possibility under simulated Martian temperature, humidity and atmospheric composition conditions, emphasizing unicellular organisms radiation resistance 77-1-40572

Computerized electrostatic field model of biological cell membrane 77-1-42119

Hyperoxic medium effects on experimental animal cells, tissues and organs morphology, infrastructure and histochemistry 77-1-42801

Control of mitosis in biological cells through inorganic ion hierarchy of cells involved [NASA-CSP-LAB-10773-1] 77-1-34061

Single cell responses within cat medulla during constant angular accelerations [AD-726628] 77-1-34069

Proceedings of conference on interaction between atmospheric environment and human system at cell level [AD-726601] 77-1-35256

CENTRAL NERVOUS SYSTEM

Integrative action of central nervous system in converting gravity sensation into crustacean equilibrium reactions 77-1-39993

Central nervous tissue sensitivity, considering direct sensing of gravitational stimuli of vibratory character 77-1-41718
Rat brain carbohydrates biosynthesis from organic acid products under normal conditions and during central nervous system disturbances, investigating butyric acid participation

Orthodromic and antidromic impulsion role in functional state changes of contralateral cerebrospinal center during mixed nerve prolonged stimulation by rectangular pulses

Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system

Central pathway connection between vestibular and oculomotor nuclei through ponts responsible for horizontal eye movements induced by visual and vestibular stimuli

Sympathetic amines effects on central nervous system reflex activity of irradiated and desympathized animals

Human expired air toxicity effect on mice, neurohumoral changes stimulating inhibitory reactions in central nervous system

CENTRIFUGAL FORCE

Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks

CENTRIFUGING

Bull frog activity at rest and response to centripetal acceleration by on-board centrifuge in vestibular space experiment OPO-4

CENTRIFUGING STRESS

Vestibulo-colic reflex control of head movement in seated men under sinusoidal and stepwise rotational velocity stimulation, comparing with ocular stabilization

Respiratory function and gas metabolism shift under high transverse accelerations in reclined centrifuged subjects

CENTRIFUGE FORCE

Bull frog activity at rest and response to centripetal acceleration by on-board centrifuge in vestibular space experiment OPO-4

CHLORAL

Aminazine and chloral hydrate effects on metabolism intensity of rats brain gangliosides components including N-acetylneuramine acid and N-acetylgalactosamine

CHLOROMYCETIN

Chlorella biomass chemical composition stability during prolonged cultivation with nitrates recycling medium

Chlorella viability and mutability aboard Soyuz and Zond spacecraft, noting trend toward growth of anomalies in autopspplication

Chlorella biomass chemical composition stability during prolonged cultivation with nitrates recycling medium

CHOLESTEROL

Cholesterol metabolism effects on metabolism intensity of rats brain gangliosides components including N-acetylneuramine acid and N-acetylgalactosamine

CHROMATOHENGER

Chromatography and chromatographic analysis of blood samples from Apollo 7, 8, 9, and 10 astronauts to determine effects of space flight on mass balance of various elements by human body

CHRONOBIOLOGY

Chronic acceleration effects on animals, considering total height, coleoptile diameter, root length, sensitivity to growth retardation and histological changes

Chronic acceleration effects on animals, considering total height, coleoptile diameter, root length, sensitivity to growth retardation and histological changes

CHRONIC CONDITIONS

Chronic acceleration effects on animals, considering total height, coleoptile diameter, root length, sensitivity to growth retardation and histological changes

CIRCADIAN RHYTHMS

CIRCUIT DIAGRAMS

Development of WNFEL telemetry system to low-duty cycle tone burst system

Developed a new circuit diagram for continuous subcutaneous measurements of circadian body temperature rhythms in rats
CIVIL AVIATION

CIVIL AVIATION

Flashing civil aviation lights, history, progress and photometric characteristics, discussing navigation and landing aids
A71-35277

CLAYS

Hydroponic plant cultivation with keramzit substrate, investigating replacement time effect and regenerative power of nutrient solution
A71-41489

CLINICAL MEDICINE

Antecedent clinical statistics of myocardial infarction and sudden death in actively employed middle aged men, noting cardiac rate, rhythms and conduction abnormalities
A71-42816

Bioscience research and applications to biological and medical problems
A71-34082

CLOSED ECOLOGICAL SYSTEMS

Microflora simplification effects on immunocompetent organism systems, observing shifts in guinea pig lymphoid tissue with limited flora
A71-40555

Bacterial contamination in confined sealed space, discussing hemolytic microflora spreading dynamics on bodies, clothes, wall and air
A71-40560

Prolonged manned space flight infectious disease hazards, discussing confinement, zero gravity, high oxygen content, personal hygiene, waste disposal and preflight immune status
A71-40561

Microorganisms under closed environmental ecological conditions with reference to astronauts infectious diseases, discussing bacteria growth in Biosatellite 2 and earth based closed chamber experiments
A71-40562

Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties
A71-40563

Spacecraft closed loop oxygen recovery system using electrochemical carbon dioxide concentrator, Sabatier reactor and water electrolysis subsystem
A71-42017

Manned 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities
A71-42043

Humans under constant diet feeding in closed ecological system, demonstrating instability in elimination process of various elements
A71-42817

Electrical analogy model for ocean ecological system, demonstrating instability in subsystems, crew, nutrition, hygiene, maintenance
disposal and preflight immune status
A71-40870

Computer generated buffered displays for psychological experiments involving interception, tracking, steering, memory and calculation tasks
A71-40136

Computerized electrostatic field model of biological cell membrane
A71-40119

Computerized bacterial identification system to process Apollo spacecraft sample laboratory test results in NASA Planetary Quarantine Lunar Information System
A71-42233

Utilization of electronic and computerized techniques for undergraduate medical education
A71-36081

Incentive goal and extensive stimulation experience effects on proportion increase of hypothalamic electrode sites yielding elicited eating and drinking behavior
A71-40706

Auditory stimulus conditioning of human skin resistance responses on escape-avoidance schedule
A71-40862

Life science and space research - Conference, Leningrad, May 1970
A71-40551

Flashing lights perception and application - Conference, London, April 1971
A71-41876

Eye movement control - Conference, University of the Pacific, San Francisco, November 1969
A71-42832

Proceedings of conference on interaction between atmospheric environment and human system at cell level (AD-720601)
A71-35256

Conference on space shuttle environmental control and life support systems - Vol. 2 (NASA-TM-X-67265)
A71-35266

Sympathetic blood flow and oxidative metabolism in cystoorganic congenital heart disease patients, using lactate/pyruvate ratios and coronary sinus catheterization
A71-41521
<table>
<thead>
<tr>
<th>SUBJECT INDEX</th>
<th>CYTOCHROMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONNECTIVE TISSUE</td>
<td><em>myocardium phosphocreatine content</em> A71-41568</td>
</tr>
<tr>
<td>Hyperoxia pathological effects on albino rats</td>
<td></td>
</tr>
<tr>
<td>subcutaneous connective tissue, noting oxidizing enzyme activity depression and cellular metabolism suppression A71-42802</td>
<td></td>
</tr>
<tr>
<td>CONSTRAINTS</td>
<td><em>rat plasma creatine phosphokininase activity, hypothermia and stress, considering cold restraint</em> A71-41930</td>
</tr>
<tr>
<td>Restraint system for ergometer used under zero gravity conditions or earth atmosphere in unconventional positions (NASA-CASE-RFS-21046) N77-34080</td>
<td></td>
</tr>
<tr>
<td>COPTATION</td>
<td><em>creativity</em></td>
</tr>
<tr>
<td>Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment</td>
<td>Excitability, reactivity, adequacy, creativity and guidance at molecular, cellular, systemic and psychic levels in human biophysical neurodynamics, plotting stimulus magnitude vs response duration A71-41198</td>
</tr>
<tr>
<td>Bacterial contamination in confined sealed space during long term human occupations, observing bacterial microflora spreading dynamics on bodies, clothes, wall and air A71-40559</td>
<td></td>
</tr>
<tr>
<td>CORRECTED STEREOTYPES</td>
<td><em>perceived distance effect on induced movement from stereoscopic cues</em> A71-41199</td>
</tr>
<tr>
<td>Orthodromic and antidromic isulation role in functional state changes of contralateral cerebrosplinal center during mixed nerve prolonged stimulation by rectangular pulses A71-41059</td>
<td></td>
</tr>
<tr>
<td>CORRODED ATMOSPHERES</td>
<td><em>(culture techniques</em></td>
</tr>
<tr>
<td>Blue-green algae survival or growth ability tests under simulated Pre cambrian atmospheric conditions A71-42230</td>
<td></td>
</tr>
<tr>
<td>CONVULSIONS</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>EEG study of hyperoxic convulsions in Roccus menintus and Papio primates, considering preventive effect of Diazepam and derivatives A71-41418</td>
<td></td>
</tr>
<tr>
<td>Vibration induced paroxysmal and cardiovascular hazards during patients transport to hospital by air or ambulance, discussing therapeutic and preventive treatments A71-41573</td>
<td></td>
</tr>
<tr>
<td>COOLING</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Physiological responses to head and neck vs trunk and leg cooling under hypertensive stress A71-40356</td>
<td></td>
</tr>
<tr>
<td>CORIOLIS EFFECT</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Habituation and suppression of vestibulo-ocular vertical nystagmic responses to Coriolis stimulation in pentathlon athletes, comparing to pilots and airman trainees A71-41826</td>
<td></td>
</tr>
<tr>
<td>CORNER</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Corneal-retinal potential as generator of occipital alpha rhythm in human electroencephalogram modulated at 10 Hz by tremor in extracranial muscles A71-41826</td>
<td></td>
</tr>
<tr>
<td>CORONARY CIRCULATION</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Coronary blood flow at increased arterial carbonic acid partial pressure, noting induced hypercapnia A71-40176</td>
<td></td>
</tr>
<tr>
<td>Coronary dilating substances of low molecular weight separated through dialysis from hypoxalamin protein carriers A71-41072</td>
<td></td>
</tr>
<tr>
<td><em>myocardial blood flow and oxidative metabolism in cyanotic congenital heart disease patients, using lactate/pyruvate ratios and coronary sinus catheterization</em> A71-41521</td>
<td></td>
</tr>
<tr>
<td>COFFEE</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Prefrontal cortex lesions effect on trained anticipatory visual target fixation in cats, noting performance impairment in voluntary eye movement control A71-42714</td>
<td></td>
</tr>
<tr>
<td>COSMOBAY</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Voskod 2 cosmonauts physiological data, presenting heart beat, respiration rates, ocuolnotor activity and blood composition A71-42791</td>
<td></td>
</tr>
<tr>
<td>COST REDUCTION</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Astronaut teleoperators use for space operations cost reduction and future experiments productivity increase A71-42033</td>
<td></td>
</tr>
<tr>
<td>CREATIN</td>
<td><em>(cytochromes)</em></td>
</tr>
<tr>
<td>Anoxia effect on laboratory animals cardiac action, discussing ECG injury current relation to A71-42726</td>
<td></td>
</tr>
<tr>
<td>Halyophilic bacteria electron transport chain, studying protein, phospholipids, flavoproteins and cytochromes sedimentation properties by electron paramagnetic resonance A71-42730</td>
<td></td>
</tr>
</tbody>
</table>
microscopy and light scattering technique

CITOTOLOGY
Specific banding patterns for identification and structural detection of human chromosomes, using differential staining method

DATA PROCESSING
Computerized bacterial identification system to process Apollo spacecraft sample laboratory test results in NASA Planetary Quarantine Lunar Information System

DECOMPRESSON SICKNESS
Decompression sickness, investigating surface excursion diving and selection of limb bends vs CBS symptoms by tests on goats

Humoral smooth muscle acting factor and phenyl-piperazinylmethyl cyclohexanone effects on decompression sickness production and prevention in mice

Scanning ultrasonic imaging technique for in vivo monitoring of microscopic bubble formation in decompression sickness, presenting image displays

DECONTAMINATION
Mathematical models for microorganism exponential die-off rate and variance estimation from decontamination data

Decontamination of spacecraft components with ethylene oxide as function of parameters of gas concentration, time, temperature, and relative humidity [NASA-CR-121764]

DEHUMIDATION
Breaded spacecraft life support system dehydrated food ration effects on human organism health, metabolism and immune response during long space flight

DENSITY (MASS/ VOLUME)
Macaca nemestrina monkey bone density change during Biosatellite 3 mission

DIABETES MELLITUS
Photoplethysmographic analysis of pulse wave velocity in healthy subjects and in patients with hypertension, heart disease, diabetes and anemia

DIAGNOSIS
Radiation damage diagnosis in humans, investigating free amino acid excretion with urine by paper chromatography method

DIALYSIS
Coronary dilating substances of low molecular weight separated through dialysis from hypothalamic protein carriers

DIATOLE
Cardiac automatic rhythms, discussing diastolic depolarization in Purkinje fibers and factor controlling automaticity

DICHROMOSIS
Visual perceptual masking under binocular and dichoptic conditions separating peripheral and central interference effects

DIETS
Humans under constant diet feeding in closed ecological system, demonstrating instability in elimination process of various elements

DIGESTIVE SYSTEM
Microflora simplification effects on immunocompetent organism systems, observing shifts in guinea pigs lymphoid tissue with limited flora

DIRECTIVITY
Retinal directional effect measurements confirming mathematical model based on Gaussian distribution of retinal cones orientation, explaining brightness stimuli effectiveness and hue shift

DISEASES
USAF aeromedical consultation service experience on vertigo cases covering symptoms and related diseases

DISORDERS
Human ocular control system supranuclear disorder syndromes and signs in terms of physiological concepts

Aspects of mouth disorders in space flight and space flight training [JPLS-53894]

DISORIENTATION
Epidemiology statistics of USAF spatial disorientation aircraft accidents, noting pilot training, flight environment and disorientation remedy programs

DISPLAY DEVICES
Computer generated buffered displays for psychological experiments involving interception, tracking, steering, memory and calculation tasks

Canadian Forces experiments on aircraft flashing lights covering warning signals, navigation and anticolision displays and autotactic phenomena [JPLS-61491]

Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness

Operator performance improvement in monitoring automated processes by alternating displays, discussing simulated radar and sonar CRT display laboratory tests

Character size, case and symbol generation effects on CRT display search time

DIURNAL VARIATIONS
Diurnal water and food intake and body weight changes patterns in rats with hypothalamic lesions

DIVING (UNDERWATER)
Decompression sickness, investigating surface excursion diving and selection of limb bends vs CBS symptoms by tests on goats

Agassazis tremor response measurement by muscle force transducer during compression and decompression in 520-foot saturation dive, noting differences among individuals

Biochemical measurements of human urine and blood changes during simulated oxygen-helium dives to 1500 feet

DOGS
Hypoxia affecting circulatory responses in dogs, such as cardiac output, left ventricular dp/dt, and stroke volume [NASA-CR-121665]

DORSAL SECTIONS
Visual projection, magnification and retina overlap on dorsal lateral geniculate nucleus in cats measured by random scatter in receptive field

Ishihara binocular receptive fields in dorsal nucleus of lateral geniculate body for dominant and nondominant eye in cats, using moving slit and flash spot stimulation

DOSEAGE
Neutron dose distributions at bone tissue interfaces in human body [GEHL-TM-3129]

DRINKING
Incentive goal and extensive stimulation experience effects on proportion increase of hypothalamic electrode sites yielding elicited eating and drinking behavior

DRUGS
EEG study of hyperosmotic convulsions in Macacus nemestrinus and Papio primates, considering preventive effect of Diazepam and derivatives
ELECTROCARCIOGRAPHY

Human blood pressure in brachial artery during spontaneous night sleep, recording EEG, EKG and horizontal eye movements

Mathematical model of electrocardiographic QT-RR relationship, showing agreement with membrane theories

Electrical heart activity and ECG mathematical model with nonlinear oscillator system construction for normal and abnormal rhythms

Heart rate and systolic pressure variability control through visual feedback of physiological information, obtaining respiratory measurements and ECG

Anoxia effect on laboratory animals cardiac action, discussing ECG injury current relation to myocardium phosphorylcreatine content

Miniaturized multichannel FM/AM biological telemetry system for simultaneous transmission of EKGs, EMGs, EEGs and EOGs

ST segment elevation spectrum in ECG of healthy male USAF flying personnel

Vectorcardiographic analysis of patients with ECG diagnosed inferior atrial rhythm

ELECTROENCEPHALOGRAPHY

Correlated-retinal potential as generator of occipital alpha rhythms in human electroencephalogram modulated at 10 Hz by tremor in extracocular muscles

Miniature biopotential transmitter suitable for telemetry, giving EEG and circuit and performance characteristics

Human blood pressure in brachial artery during spontaneous night sleep, recording EEG, EKG and horizontal eye movements

Hyperbaric normoxic breathing helium, nitrogen and neon gas mixture effects on EEG and reaction time in man

Potential epilepsy determination in flight personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness

Analog statistical analyzer for measuring one dimensional EEG amplitude distribution functions, illustrating reaction response to threshold acoustic stimuli

Analog computer analysis of EEG wave asymmetry for organism functional state detection illustrated on human reaction response to threshold acoustic stimuli

EEG study of hyperosmotic convulsions in Macacus nemestrinus and Papio primates, considering preventative effect of Dizapam and derivatives

Miniaturized multichannel FM/AM biological telemetry system for simultaneous transmission of EKGs, EMGs, EEGs and EOGs

Pilot EEG, behavioral and subjective correlates of natural and drug induced sleep at atypical hours, using calculation and vigilance tests

EEG characteristics of cadets and flying personnel, noting spike wave paroxysmal screening and epilepsy detection

Human cerebral EEG phenomena and evolved potential relationships to eye and retinal image movements

Hypothalamus anterior and hippocampus limbic system relation and osiocin effect in rabbits, using EEG analysis

I-15
ELECTROLYTE METABOLISM

Sequential, distribution-free pattern classification procedures tested on Gaussian and EEG patterns [NASA-CR-127750] N71-34074
Development and characteristics of biomedical system for obtaining electromyographic and neurophysiologic data during space missions [NASA-CR-115132] N71-35263

ELECTROLYTE METABOLISM
Fiber optic effects on hedgehog electrolyte distributions and renal function, determining Na+, K+, Mg and Cl concentrations in muscles, liver, kidney, plasma red blood cells and bladder urine A71-42274

ELECTROPHYSIOGRAPHY
Miniaturized multichannel PK/AM biological telemetry system for simultaneous transmission of EEGs, EKGs, EEGs and EKGs A71-42194

ELECTROPHYSIOLOGY
Prior muscle exertion effect on reaction time and duration of simple discrete movements, considering electroencephalogram frequency changes A71-41574

ELECTRONIC EQUIPMENT
Utilization of electronic and computerized techniques for undergraduate medical education [EE-6180-MLR] N71-34081

ELECTROPHYSIOLOGY
Normal females electrophysiologic changes during sensory isolation of water tank variety from EEG, EKG, EEG, EKG and electrode measurements, considering cortical activities reduction A71-60346

EMBOLISMS
Pulmonary dissipation of gas emboli produced by oxygen, nitrogen and carbon dioxide intravenous injection in anesthetized sheep with chronically implanted ultrasonic Doppler flow probes A71-40342

EMERGENCY LIFE SUSTAINING SYSTEMS
Design, development, and evaluation of emergency support systems to protect infants and small children during water survival situation [FAA-AH-71-37] N71-34083

EMOTIONAL FACTORS
Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease for further flight training, presenting case histories A71-41837

EMOTIONS
Acral and activation in nonspecific reticulo-thalamic systems due to underlying emotion expressed through cortical, visceral and somatomotor channels A71-60237

ENERGY ABSORPTION
Design, fabrication, and tests of energy absorbing seat integrated with extraction tractor rocket for space shuttle A71-35268

ENERGY DISSIPATION
Dynamic sampling calorimeter for continuous measurement of human radiant, convective and evaporative heat loss, enabling closed loop control system analysis A71-42155

ENERGY SOURCES
Power derived from aerobic, lactacid and alactacid energy sources during human muscular work under normoxic and hypoxic conditions, noting oxygen consumption A71-41724

ENVIRONMENT POLLUTION
Toxicological evaluation of carbon monoxide, atmospheric contaminants, and propellants in environmental pollution [AD-727022] N71-35258

ENVIRONMENT SIMULATION
Biochemical measurements of human urine and blood changes during simulated oxygen-helium dives to 1500 feet A71-40353

Bacterial spores survival under simulated lunar surface conditions, comparing results with vegetable cell experiments A71-40567

Simulated martian environment effects on terrestrialex microorganisms survival A71-42277

Blue-green algae survival or growth ability tests under simulated Precambrian atmospheric conditions A71-42230

Infuscia adaptation ability to extreme environmental conditions with emphasis on Mars surface A71-42825

ENVIRONMENTAL SIMULATORS
Simulation chamber for experimental investigation of organisms reactions to Mars environment A71-42827

ENVIRONMENTAL CONTROL
Earth-like ecology for habitation in space, considering hallow sunlit rotating space chamber for life cycles in controlled weather environment A71-40360


Environmental control and life support system for space shuttle orbiter A71-35267

Environmental control and life support subsystems for space shuttle orbiter A71-35271

Status of SBC program on space shuttle environmental control and life support systems A71-35272

ENVIRONMENTAL ENGINEERING
Human performance as function of task and environmental factors, using psychological and physiological references A71-42193

ENVIRONMENTAL TESTS
Time sense modifications among human groups isolated in underground environment and deprived of timekeeping means, evaluating average individual behavior A71-45177

Ruffled 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities A71-42043

Simulated martian environment effects on terrestrialex microorganisms survival A71-42227

ENGINE ACTIVITY
Space environment simulation for ultrahigh vacuum effects on crystalline enzymes activity, measuring by chemiluminescence techniques A71-40573

Low temperature effects on succinate oxidase activity of mitochonridial membranes in hibernating squirrels A71-40564

Soviet monograph on coacervates and protoplasm covering colloidal-chemical properties, enzyme catalysts and multiphase cell and organism simulation A71-40870

Aminazine and chloral hydrate effects on metabolism intensity of rats brain gangliosides components including N-acetylaspartic acid and N-acetylaspartylglutamic acid A71-41055

Thyroxine effects on brain glutaminase isoenzymes interaction and deamination in mitochondrial fractions, comparing with sodium phosphate, bicarbonate and amparete A71-41056

Water immersion effect on plasma renin activity, urinary aldosterone excretion and renal sodium and potassium handling in normal man A71-41720

Nait plasma creatine phosphokinase activity, hypothermia and stress, considering cold restraint A71-41938

Urease hydrolysis reaction rates by urease at low water activity, noting use for Mars surface bioassay A71-42226

Nonaqueous biosystems unlikelihood from consideration of enzymatic activity possibility and liquid water unique ability for complexity A71-42226

SUBJECT INDEX

A71-40567
A71-42227
A71-42230
A71-42825
A71-42827
A71-40360
A71-35266
A71-35267
A71-35271
A71-35272
A71-42193
A71-40573
A71-45177
A71-42043
A71-42227
A71-40573
A71-40564
A71-40870
A71-41055
A71-41056
A71-41720
A71-41938
A71-42226

I-16
required by carbonaceous biosystems

Glutamic acid and glutamicoalane

ammonotransferases activity in blood serum of dogs

under gas phase irradiation with shielded abdomen or

head, observing hyperfermentation

Hyperxia pathological effects on albino rats

subcutaneous connective tissue, noting oxidizing

enzyme activity depression and cellular metabolism

suppression

Physiological effects on mice of air pollution with

gaseous toxic substances from urine and feces,

noting increased respiration rate and choline

esterase activity

Combined and individual effects of UV light, X ray

irradiation and freezing-thawing cycles on

ribonucleoside

Gaseous medium composition and multiple freezing

temperature effects on catalase activity

REVUES

Physical determinants of gravity receptor

mechanisms, discussing hydrostatic stress effects

on membranes and gravity influence on enzymatic

transport

RPELEPSY

Potential epilepsy determination in flight

personnel, suggesting systemic EEG with

hyperventilation and photic stimulation tests and

personal medical history data of head trauma and

unconsciousness

EEG characteristics of cadets and flying personnel,

noting spike wave paroxysmal screening and

epilepsy detection

EQUILIBRIUM

Gravitational and other forces involved in

equilibrium of growing plants, showing gravity

sensing ability lower limit existence

Integrative action of central nervous system in

converting gravity sensation into crustacean

equilibrium reactions

Ecroimeters

Restrain system for ergometer used under zero

gravity conditions or earth atmosphere in

unconventional positions

[NASA-CASE-MPS-21046]

Erosion

Effect of hard impact and aeolian erosion on release of

microorganisms from geological formations

[NASA-CR-121707]

Erro analysis

Flashing lights radiation characteristics

photometric measurement, discussing measuring

apparatus sensitivity and errors analysis

Visual stimulus control removal and restoration in

rhesus monkeys, analyzing test errors

Escape Rotcets

Design, fabrication, and tests of energy absorbing

seat integrated with extraction tractor rocket for

space shuttle

Escherichia

Composition and colicinogenic and hemolytic

activity changes of Escherichia isolated from

man during long term confinement

Space conditions exposure of lysogenic strains of

Escherichia coli and mosolayer cultures of human

cells aboard Zond 5 and 7 flights

Metabolism of magnesium deficient Escherichia coli

cells under aerobic and anaerobic conditions

[HRC-SP-1742]

Ethylene oxide

Decontamination of spacecraft components with

ethylene oxide as function of parameters of gas

concentration, time, temperature, and relative

humidity

[A71-42229]

EVPAPRITIVE COOLING

Heat aclimatization by evaporative cooling

prevention in non wearing vapor barrier suits,

considering body temperature and heart and sweat

erates

EVPAPRATORS

Liquid spray flash evaporator for space shuttle

thermal control

EXCERPTION

Antidiuretic action of chlorpropamide in mammalian

kidney, considering intrarenal infusions effect on

urinary concentration, free water clearance,

glomerular filtration and sodium excretion

EXPERIMENTAL DESIGN

Soviet book on experimental research on human higher

nervous activity from growth aspect covering

normal and pathological states, cerebral cortex

interaction with central nervous system

EXPIRED AIR

Human expiratory oxygen and carbon dioxide partial

pressure and dissociation curves for

intrapulmonary gas mixing, using mass spectrometry

Human expired air toxicity effect on mice

neurobehavioral changes stimulating inhibitory

reactions in central nervous system

EXPONENTIAL FUNCTIONS

Mathematical models for microorganism exponential

die-off rate and variance estimation from

decomposition data

EXTRATERRESTRIAL LIFER

Extraterrestrial life detection methods, discussing

bacterial cultures growth dynamics in nutrient

media and iron porphyrins and ATP content

increase

Living organisms life-sustaining possibility under

simulated Martian temperature, humidity and

atmospheric composition conditions, emphasizing

unicellular organism radiation resistance

Nonaqueous biosystems unlikelihood from

consideration of enzymatic activity possibility

and liquid water unique ability for complexity

required by carbonaceous biosystems

Soviet papers on cosmic biology, Volume 16, covering

man and animal physiology under extremal loads,

spacecraft life support systems and

extraterrestrial life detection, etc

EXTRAVEHICULAR ACTIVITY

Extravehicular activity protection systems,

discussing resource regeneration, technology,

methodology and space station, lunar base and

Martian missions schematic configurations

Automatic temperature control for liquid cooling

garments used during astronaut extravehicular

activity with external auditory heating, and skin

temperature as input signals

[NASA-CR-115122]

EYB (APARATOR)

Reosynthesized alpha-glycerophosphate and 2,3-
diphosphoglycerate role in human extracellular

muscle metabolism

Human extracellular muscle fiber structural and

functional properties, discussing histological

arrangement, fiber type classification and motor

nerve endings

EYE DISEASES

Passive and active extracellular muscle forces in

strabismus, giving horizontal binocular alignment

during fixation or eye movement

EYB DOMINANCE

Inhibitory binocular receptive fields in dorsal

nucleus of lateral geniculate body for dominant

and nondominant eye in cats, using moving slit and

flash spot stimulation

I-17
EYE MOBILITY

Prefrontal cortex lesions effect on trained anticipatory visual target fixation in cats, noting performance impairment in voluntary eye movement control

Human blood pressure in brachial artery during spontaneous night sleep, recording EEG, EKG and horizontal eye movements

Eye movement control - Conference, University of the Pacific, San Francisco, November 1969

Eye movement neurophysiology, discussing ocular proprioception, oculorotatory muscle mesencephalic receptor role, extraocular muscle afferent and efferent innervation and central nervous system control effect

Central pathway connection between vestibular and human cerebral EEC phenomena and evoked potential

Eye movement control system models, describing effective efferent innervation and central nervous system control effect

Extraocular muscle pharmacology, discussing eye twitch and tonic neurovascular systems structure and function in frogs

Saccadic eye movement control system behavior simulation model evaluation, considering oculorotatory pathways

Versional eye movement control system models, considering dual mode control, intersaccade, plant dynamics and pattern recognition

Rapid saccadic and smooth pursuit tracking eye movement systems characteristics

Vergence eye movements control, discussing transient and frequency responses

Eye vergence movement control, describing effective target configurations and binocular units receptive field disparities

Vestibular and proprioceptive stabilization of eye movements

Human eye-tracking phase lags representation by time delays depending on target motion class

Stochastic model for observing motion of retinal image of target during visual fixation

Eye movement, mental performance, and problem solving

EYE PROTECTION

Operational test and evaluation of photochromic goggles for eye protection during exposure to nuclear explosion flash

FAST NEUTRONS

Relative biological effectiveness of fast neutrons, allowing for gamma component contribution

SUBJECT INDEX

FATIGUE (BIOLOGY)
In-flight study of work/rest cycle effects on double crew performance and fatigue in flying transport missions

FATTY ACIDS
Free fatty acids reduced availability effects on physical working capacity in normal man

FEBS
Activation analysis of fecal samples from Apollo 7, 8, 9, and 10 astronauts to determine effects of space flight on mass balance of various elements by human body

Measurement of radiation exposure of Apollo 7, 8, 9, and 10 astronauts by determination of radionuclide content of feces and urine

FEEDBACK CONTROL
Heart rate and systolic pressure variability control through visual feedback of physiological information, obtaining respiratory measurements and ECG

FEMALES
Normal females electrophysiological changes during magnetic isolation of water tank variety from EEG, EKG, EOG and electrodermal measurements, considering cortical activities reduction

FIRE PREVENTION
Incipient fire and toxic gas caution and warning system for space shuttles

FIRE PREVENTION, PROTECTION, AND FIGHTING SYSTEMS AT KSC FOR SPACE SHUTTLE OPERATIONS

FISHES
Semicircular canal and otolithic organ function in free swimming fish angular orientation behavior

Blind goldfish gravity reference response under linear accelerations on motor car and parallel swinging from movie camera recording

FLARES
Visual performance in simulated target acquisition tasks as function of flare-ignition altitude

FLASH
Flashing lights perception and application - Conference, London, April 1971

Visual processes involved in flash perception, considering attention attraction at suprathreshold levels, unreliability at threshold levels and latency effects

Subjective brightness of flashing light stimulus within fovea as function of stimulus size, noting edge effects contribution at suprathreshold levels

Flash threshold perception in relation to flicker, showing flicker/flash sensitivity ratio constancy over large intensity level range

Absolute foveal thresholds as function of flashes pulse length and null period

Flash light angular size, adaptation luminance, pulse shape and color effects on Blondel-Bey constant tested on observers with good binocular vision

Flashing lights effective intensity at threshold and suprathreshold levels, discussing Broca-Sulzer effect observance conditions

Probability approach to visual effectiveness of signal flashing lights, showing graphically Broca-Sulzer effect

Flashing lights attention attraction classification based on experimental results conversion into psychometric scale

Successively presented flashing lights detection, discrimination and brightness measurements with
Physiological effects of alcohol and cockpit illumination levels on pilot performance and flying safety [FAA-AR-71-34] 771-35275

**FLIGHT STRESS**
Transport aircrew sleep patterns effects on fatigue and sleep disturbances, discussing physiologic debt and stresses 771-40341

**FLIGHT STRESS (BIOLOGY)**
Unfavorable high intensity noise effects on auditory and motor analyzers during space flight 771-42793

**FLIGHT TESTS**
Bacca nemestrina monkey bone density change during Biosatellite 3 mission 771-40343

**FLOATS**
Design, development, and evaluation of emergency life support system to protect infants and small children during water survival situation (NASA-AR-71-37) 771-34083

**FLOW DISTRIBUTION**
Cutaneous and intestinal blood flow differentiation during hypothalamic heating and cooling in anesthetized dogs 771-40632

**FLYING PERSONNEL**
Potential epilepsy determination in flight personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness 771-40357

**FLYING CREWS**
Apparent motion effects associated with stationary flashing lights configurations, noting frequency response characteristics analogous to real motion effects in human visual system model 771-41487

**FLICKER**
Test field size, brightness and retinal location effect on observer assessment of stimulus at subfusional frequencies flicker suggesting inherent clock mechanism within human brains 771-41497

**FLIGHT CHARACTERISTICS**
Reflexer mechanisms and programmed command in insect flight stabilization, discussing gravity proprioceptors, wind sensing and optomotor control 771-39587

**FLIGHT CONDITIONS**
Gravity effect and lift perception in flying insects and animals, discussing flapping flight and aerial locomotion in aerodynamic balance weightless state 771-39593

**FLIGHT CREATIVITY**
Transport aircrew sleep patterns effects on fatigue and sleep disturbances, discussing physiologic debt and stresses 771-40334

**FLIGHT FATIGUE**
In-flight study of work/rest cycle effects on double crew performance and fatigue in flying transport missions 771-41629

**FLIGHT HAZARDS**
Transport aircrew sleep patterns effects on fatigue and sleep disturbances, discussing physiologic debt and stresses 771-40334

**FOOD METABOLISM**
Chronic acceleration effects on animals, considering gravity and radiation exposure in space travel experiments 771-40005

**FOSSA**
Diurnal water and food intake and body weight changes patterns in rats with hypothalamic lesions 771-41936

**FOVEA**
Subjective brightness of flashing light stimulus within fovea as function of stimulus size, noting edge effects contribution at suprathreshold levels 771-41878

**FREEZING**
Absolute foveal thresholds as function of flash pulse length and null period 771-41480

**FREQUENCY RESPONSE**
Combined and individual effects of UV light, X ray irradiation and freezing-thawing cycles on ribonuclease 771-42830

**PHOTOGRAPHIC MEASUREMENT**
Epilepsy detection by EEG characteristic analysis in cadets and flying personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness 771-41575

**PHYSICAL FACTORS**
Subjective brightness of flashing light stimulus within fovea as function of stimulus size, noting edge effects contribution at suprathreshold levels 771-41878
GALACTOSE

GALACTOSE
Gangliosides inhibitory effects on active Ca ion transport in rat brain mitochondria, using succinate as respiratory substrate

GASES
Computer programming of chess games

GASES
Human thinking studies using problem solving in chess

GAS RAYS
Biosatellite 2 onboard experiments studying weightlessness effects on biological processes and interaction with radiation from 5x105 gamma ray source

GAS RAYS
Death rates, median life span and weight in mice exposed to gamma radiation after intra-abdominal injections of cysteamine

GAS RAYS
Chemical agents protective properties on albino mice under gamma-neutron radiation, noting dose and composition effects

GAS RAYS
Gamma emission effect on cystamine toxicity elimination in rats organism

GAS RAYS
Partial body shielding effects on rats radiation sickness survival rates under gamma-neutron radiation, comparing head and belly shielding effectiveness at different intensities

GAS RAYS
Reactivity changes to pharmacological preparations under total protons and gamma ray irradiation of abdomen and head shielded rats

GAS RAYS
Head and abdomen shielding effects on radiation sickness evolution in dogs under lethal gamma irradiation

GAS RAYS
Abdomen shielding effects on chromosome aberrations in bone marrow cells of guinea pigs and rats under gamma irradiation

GAS RAYS
Glutamicoaspartic and glutamicoalanine aminotransferases activity in blood serum of dogs under gamma irradiation with shielded abdomen or head, observing hyperfermentemia

GAS RAYS
Rat organs pathomorphological changes under gamma neutron irradiation with head and abdomen shielding, noting intention early damage

GAS RAYS
Acceleration tolerance of gamma irradiated mice with and without radioprotectors

GAS RAYS
Rice under combined gamma radiation and vibration acceleration dynamic factors, studying radiosensitivity recovery rate

GAS RAYS
Rice acceleration before and after gamma irradiation, determining protective effect of cystamine in adrenaline and aspartame mixture

GAS RAYS
Dogs peripheral blood reaction to complex action of transverse accelerations and gamma irradiation

GAS RAYS
Vibration influence on peripheral blood reaction to gamma radiation in dogs, using clinico-hematological indices

GAS RAYS
Aminothiol class radiation protector influence on tissue damage of white rats under single and two-fold gamma irradiation at various test conditions

GAS RAYS
Radioprotective effectiveness of cystamine and 5 beta-aminohydroxyisothiouronium in mice under combined gamma irradiation and transverse acceleration loads

GAS RAYS
Relative biological effectiveness of fast neutrons, allowing for gamma component contribution

GANGLIA
Gangliosides inhibitory effects on active Ca ion transport in rat brain mitochondria, using succinate as respiratory substrate

GAS COMPOSITION
Gas micro medium composition and multiple freezing temperature effects on catalase activity

GAS EVOLUTION
Preservative phenol derivative effects on toxic gas evolution from stored urine in sealed vessels

GAS INJECTION
Pulmonary dissipation of gas emboli produced by oxygen, nitrogen and carbon dioxide intravenous injection in unsanitized sheep with chronically implanted ultrasonic Doppler flow probes

GAS MIXTURES
Human expiratory oxygen and carbon dioxide partial pressure and dissociation curves for intrapulmonary gas mixing, using mass spectrometry

GAS MIXTURES
Hyperbaric normoxic breathing helium, nitrogen and neon gas mixture effects on ECG and reaction time in man

GASES
Incipient fire and toxic gas caution and warning system for space shuttles

GASTROINTESTINAL SYSTEM
Antiradiation drugs effects on healthy and irradiated rats gastrointestinal tract evacuatory motor function

GASTROINTESTINAL SYSTEM
Gastrointestinal tract reactions to atropine sulfate, acetylcholine and carbamylcholine in rats after acceleration exposures, using roentgenograms

GASTROINTESTINAL SYSTEM
Use of nutritional markers for studies of food intake, passage, and absorption in gastrointestinal tract of humans and animals [NASA-CH-115125]

GENETIC CODE
Multiple coding mechanism for evolution of genetic code [NASA-CH-121896]

GEOBOTANY
Geoepticismic bending of Fritillaria Meleagris axes as prototype of geoinduced plagiotropic growth

GEOELECTRICITY
Geoelectric effects on plants geotropic reaction chain, discussing hormone auxin asymmetric distribution due to gravity

GEOELECTRICITY
External indole-3-acetic acid effect on elongation and geotropic bending of Avena coleoptiles related to auxin induced electrical responses

GEOTRIPSM
Geotropic stimulus in plants, describing method to test correlations between microscopically visible cell particles and geotropic bending direction

GEOTRIPSM
Gravity receptors in Physcomyces sporangiophores, considering transient and long term geotropic responses

GEOTRIPSM
Gravity susceptibility by higher plants, analyzing geotonic data for georeception theories

GEOTRIPSM
Auxin transport and geotropic response of roots and shoots, discussing plant growth mechanisms under stimulation-inhibition conditions

GEOTRIPSM
Hormone movement in geotropism, discussing supraoptimal auxin content and indoleacetic acid in wheat roots

GEOTRIPSM
Geotropic mechanism of lateral auxin movement and polar transport of growth substances/ethylene/ without differential cell enlargement

GEOTRIPSM
Linkage mechanism between gravity perceptors and auxin redistribution causing differential growth and geotropic curvatures in plants
Gravity receptors in Phycomyces sporangiophores, considering transient and long-term geotropism

Gravity receptors by higher plants, proving starch statolith hypothesis

Gravity perception by higher plants, analyzing geotactic data for georeception theories

Arguments against statolith theory of gravitational perception in plants

Linkage mechanisms between gravity receptors and auxin redistribution causing differential growth and geotropic curvatures in plants

Reflex mechanisms and programmed command in insect flight stabilization, discussing gravity proprioceptors, wind sensing and optomotor control

Gravity effect and lift perception in flying insects, discussing statocyst, flight stabilization and aerial locomotion in aerodynamic balance weightless state

Gravity orientation in insects, discussing different mechanoreceptors role

Gravity receptor evolution in invertebrates, considering cells role in reception and transduction into responses

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in balance

Geoelectric effects on plants geotropic reaction

Gravity effect and lift perception in flying insects

Gravity effect and lift perception in flying insects

Gravity receptors in Phycomyces sporangiophores, considering transient and long-term geotropic responses

Gravity receptors by higher plants, proving starch statolith hypothesis

Gravity perception by higher plants, analyzing geotactic data for georeception theories

Arguments against statolith theory of gravitational perception in plants

Linkage mechanisms between gravity receptors and auxin redistribution causing differential growth and geotropic curvatures in plants

Reflex mechanisms and programmed command in insect flight stabilization, discussing gravity proprioceptors, wind sensing and optomotor control

Gravity effect and lift perception in flying insects, discussing statocyst, flight stabilization and aerial locomotion in aerodynamic balance weightless state

Gravity orientation in insects, discussing different mechanoreceptors role

Gravity receptor evolution in invertebrates, considering cells role in reception and transduction into responses

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in balance

Geoelectric effects on plants geotropic reaction

Gravity effect and lift perception in flying insects

Gravity effect and lift perception in flying insects

Gravity receptors in Phycomyces sporangiophores, considering transient and long-term geotropic responses

Gravity receptors by higher plants, proving starch statolith hypothesis

Gravity perception by higher plants, analyzing geotactic data for georeception theories

Arguments against statolith theory of gravitational perception in plants

Linkage mechanisms between gravity receptors and auxin redistribution causing differential growth and geotropic curvatures in plants

Reflex mechanisms and programmed command in insect flight stabilization, discussing gravity proprioceptors, wind sensing and optomotor control

Gravity effect and lift perception in flying insects, discussing statocyst, flight stabilization and aerial locomotion in aerodynamic balance weightless state

Gravity orientation in insects, discussing different mechanoreceptors role

Gravity receptor evolution in invertebrates, considering cells role in reception and transduction into responses

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in balance

Geoelectric effects on plants geotropic reaction

Gravity effect and lift perception in flying insects

Gravity effect and lift perception in flying insects

Gravity receptors in Phycomyces sporangiophores, considering transient and long-term geotropic responses

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Geoelectric effects on plants geotropic reaction

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Gravity effect and lift perception in flying insects, discussing statocyst, flight stabilization and aerial locomotion in aerodynamic balance weightless state

Gravity orientation in insects, discussing different mechanoreceptors role

Gravity receptor evolution in invertebrates, considering cells role in reception and transduction into responses

Gravity sensors and intracellular conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in balance

Geoelectric effects on plants geotropic reaction

Gravity effect and lift perception in flying insects

Gravity effect and lift perception in flying insects
Gravitational Fields

Integrative action of central nervous system in converting gravity sensation into crustacean equilibrium reactions  

Central nervous tissue sensitivity, considering direct sensing of gravitational stimuli of vibratory character  

Gravity influence on plant growth, lateral development, apical dominance, bud initiation, orientation and flower morphology  

Geosensitive bending of Pritillaria Holmgreni axes as prototype of geinduced plagiotropic growth  

Animals physiological responses to gravity chronic acceleration  

Plants behavioral reactions to continuous gravitational field directional reorientation by clinostat, discussing gravity compensation effects on tropism and forces required for geotropic response  

Pinto beans circadian leaf movements in simulated weightlessness environment, relating rotational treatment time to rhythm phase  

Gravity responses and geotropic behavior on ontogenetic stages of higher green plants, noting tendril movement under mechanical stimulation  

Blind goldfish gravity reference response under linear accelerations on motor car and parallel swing from movie camera recording  

Healthy males immersion in water containing NaCl, determining polar transport of growth substances /ethylene/  

Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks  

Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks  

Growth

Auxin transport and geotropic response of roots and shoots, discussing plant growth mechanisms under stimulation-inhibition conditions  

Geotropic mechanisms of lateral auxin movement and polar transport of growth substances /ethylene/ without differential cell enlargement  

Linkage mechanism between gravity perceptors and auxin redistribution causing differential growth and geotropic curvatures in plants  

External indole-3-acetic acid effect on elongation and geotropic bending of Avena coleoptiles related to auxin induced electrical responses  

Gravity influence on plant growth, lateral development, apical dominance, bud initiation, orientation and flower morphology  

Chronic acceleration effects on animals, considering growth rate, food intake, oxygen metabolism and life expectancy  

Gravity effects on auxin transport, growth and foliage spread of green plants for efficient radiation capture, using horizontal clinostat experiments  

Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system  

Habitability

Earth-like ecology for habitation in space, considering hollow sunlit rotating space chamber for life cycles in controlled weather environment  

Halophiles

Halophilic bacteria electron transport chain, studying protein, phospholipids, flavoproteins and cytochromes sedimentation properties by electron microscopy and light scattering techniques  

Head (Anatomy)

Physiological responses to head and neck vs trunk and leg cooling under hyperthermic stress  

Afferent oculomotor pathways to extraocular muscle nuclei, considering discrete unilateral lesion role in head posture disturbance production  

Head and abdomen shielding effects on radiation sickness evolution in dogs under lethal gamma irradiation  

Head Movement

Vestibulo-collic reflex control of head movement in seated man under sinusoidal and stepwise rotational velocity stimulation, comparing with ocular stabilization  

Hearing

Aircraft noise effects on hearing acuity and perceptual and intellectual judgment tasks  

Heart Disease

Myocardial blood flow and oxidative metabolism in cyanotic congenital heart disease patients, using lactate/pyruvate ratios and coronary sinus catheterization  

Antecedent clinical statistics of myocardial infarction and sudden death in actively employed middle aged men, noting cardiac rate, rhythm and conduction abnormalities  

Photoplethysmographic analysis of pulse wave velocity in healthy subjects and in patients with hypertension, heart disease, diabetes and anemia  

Heart Function

Jet and turbulence mechanism of vascular surraces associated with stenosis for minimum flow Reynolds numbers, using sorta orifice plates in dogs  

Heart excitation and membrane permeability effects on two component action potentials in human atrial muscle strips, using microelectrodes  

Amoxia effect on laboratory animals cardiac function, discussing ECG injury current relation to myocardium phosphorylcreatine content  

Magnetic recording of heart electrical activity by cryogenic magnetometer with two Josephson junction quantum interference reduction device  

Vectorcardiographic analysis of patients with ECG diagnosed inferior atrial rhythm  

Aminothiol group radioprotective drugs effect on myocardium phosphorylcreatine content  

Application of reflected ultrasound to detection of post-operative rejection of heart transplant  

Anticoagulant group radioprotective drugs effect on guinea pigs cardiac function during lateral acceleration  

Application of reflected ultrasound to detection of post-operative rejection of heart transplant  

Heart Minute Volume

Atrial shortening during volume loading by infusion in animal, using Frank-Starling approach  

Heart Rate

Psychophysiological reactions to understimulation and overstimulation, noting catecholamine output, heart rate and performance efficiency in humans  

Cardiac automatic rhythms, discussing diastolic depolarization in Purkije fibers and factor
controlling automaticity A71-40250
Altitude and cold acclimatization effects on human basal heart rate, blood pressure, respiration and breath-holding analysis A71-40349
Electrical heart activity and ECG mathematical model with nonlinear oscillator system construction for normal and abnormal rhythms A71-40966
Heart rate and systolic pressure variability control through visual feedback of physiological information, obtaining respiratory measurements and ECG A71-41037
Transient heart rate response to square wave breathing in man under zero G parabolic flight A71-41828
Nerectopallylamine group radiation protection preparations on resistance of rats and mice to lateral acceleration rate A71-42700

HEAT TOLERANCE
Heat acclimatization by evaporative cooling prevention in men wearing vapor barrier suits, considering body temperature and heart and sweat rates A71-40355
Training cycle in altitude chamber for human adaptation to hypoxia, high temperatures and transverse myogenic loads A71-42805

HELIPECTERS
Spine radiological examination for helicopter pilot fitness determination, discussing spinal weakness symptoms, special exercises, medical examinations and vibration reducing seat construction A71-41578

HELIXUM
Gas metabolism and electrical activity of skeletal muscles of rats in 86°/48° medium at room temperature, noting rectal temperature drop A71-42803

HIBRONXES
Statistical analysis of effects of acclimatization on hemopoesis of Antarctic expeditionary personnel [JPBS-53884] W71-34063

HENDROSCYTHIC RESPONSES
Vasomotor effects of vagus nerve on canine lung blood content in response to electrical stimulation of vagosympathetics A71-42581

HENDROXICANICS
Cardiac sympathetic nervous control of right ventricular pressure-flow dynamics in outflow tract in anesthetized dogs A71-41522

HETATOLOGY
Composition and colonicinogenic and hemolysis activities changes of Escherichia isolated from man during long term confinement A71-40558

HIBERATION
Low temperature effects on succinate oxidase activity of mitochondria in hibernating squirrels A71-40854
Hibernation effects on hedgehog electrolyte distributions and renal function, determining Na, K, Mg and Cl concentrations in muscles, liver, kidney, plasma red blood cells and bladder urine A71-42016
Ambient temperature effects on spontaneous rewarming of ground squirrels during awakening after hibernation A71-42582

HIGH ALTITUDE ENVIRONMENTS
Physiological effects of high altitude and high temperature environments on human performance of complex actions [FAA-AR-71-17] W71-35242

HIGH TEMPERATURE ENVIRONMENTS
Skin body temperature computation in neutral and hot environments from rectal and skin temperatures A71-41723
Physiological effects of high altitude and high temperature environments on human performance of complex actions A71-41723

[FAA-AR-71-17] H71-35242
HYPPOCAMPS
Hypothalamus anterior and hippocampus limbic system relation and oxitocin effect in rabbits, using EEG analysis A71-42577

HISTOLOGY
Postflight histological analysis of turtles aboard Zond 7, noting decrease in cell nuclei size due to space flight conditions adaptation A71-40568

HORMONES
Amin transport and geotropic response of roots and shoots, discussing plant growth mechanism under stimulation-inhibition conditions A71-39980
Hormone movement in geotropism, discussing supernotial auxin content and indoleacetic acid in wheat roots A71-39981
Geotropic mechanisms of lateral auxin movement and polar transport of growth substances/ehtylene/ without differential cell enlargement A71-39982
Linkage mechanism between gravity perceptors and auxin redistribution causing differential growth and geotropic curvatures in plants A71-39983
Geoelectric effects on plants geotropic reaction chain, discussing hormone auxin asymmetric distribution due to gravity A71-39984
External insole-3-acetic acid effect on elongation and geotropic bending of Avena coleoptiles related to auxin induced electrical responses A71-39986
Gravity effects on auxin transport, growth and foliage spread of green plants for efficient radiation capture, using horizontal climastat experiments A71-40005

HUMAN BEHAVIOR
Time sense modifications among human groups isolated in underground environment and deprived of timekeeping means, evaluating average individual behavior A71-41577
Human adaptive behavior under psychological stress of astronauts tasks posture-motor characteristics, discussing stabillographic platform test results analysis A71-42041
Human thinking activity applied to man machine systems [JPBS-53983] W71-35245
Human behavior patterns A71-35246
Factors creating objective complexity of human problem solving reduced to information processes A71-35253

HUMAN BODY
Experimental analysis of information content of aural electric field of human body, considering electrotonic and triboelectric components A71-41066
Dynamic sampling calorimeter for continuous measurement of human radiative, convective and evaporative heat loss, enabling closed loop control system analysis A71-42155
Neutron dose distributions at bone tissue interfaces in human body [OBEL-TM-3329] W71-34066
Use of nutritional markers for studies of food intake, passage, and absorption in gastrointestinal track of humans and animals [NASA-CR-115125] H71-34076

HUMAN FACTORS ENGINEERING
Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties A71-40563
Flashing lights vision threshold systematic variations, using quadrant adaptometer for continuous tracking of sensitivity fluctuations A71-41498
Ramped 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities
HUHAH PATHOLOGY

Physiological and psychological reactions to sonic boom and effects on efficiency of air traffic control personnel [FAA-AM-71-29] N71-34068

HUMAN PATHOLOGY

Sick and injured transportation aboard regular airliners, considering pathological and psychological contraindications N71-41572
Antecedent clinical statistics of myocardial infarction and sudden death in actively employed middle aged men, noting cardiac rate, rhythm and conduction abnormalities N71-41798

Ultrasound use in physiological and pathophysiological experiments on human organism, considering ultrasonic vibration physical properties N71-41941

HUMAN PERFORMANCE

Psychophysiological reactions to understimulation and overstimulation, noting catecholamine output, heart rate and performance efficiency in humans N71-40177
Human perceptual motor skill development in tracking performance, using system gain and effective time delay as measures N71-40509
Functional ability of human tactial analyzers by measuring minimum interval between two discrete controlled stimuli N71-41064
Human performance as function of task and environmental factors, using psychological and physiological references N71-42193
Visual performance in simulated target acquisition tasks as function of flare-ignition altitude N71-42196
Comparative residual and reversed microinterval masking signals and human auditory perception capacity measurements using sound level estimates N71-42579
Human olfactory perception of inspired air composition, noting sensory differentiation improvement with subsequent exposures in space flight training N71-42800
Physiological effects of sleep deprivation produced by simulated aircraft noise [FAA-WO-70-16] N71-34064
Object recognition with aided and unaided night vision as function of luminance [IZF-1971-7] N71-34065
Psychological investigations and theory of thinking with four types of intellectual associations N71-35247
Five year panel study to determine effects of time pressure on performance of scientists and engineers [NASA-CR-121886] N71-35261
Effect of time between transmission, number of transmissions, and signal to noise ratios on sonar operators performance in long range target acquisition [AD-726741] N71-35279

HUMAN REACTIONS

Vibration effects on human body, discussing neurophysiological data, safe exposure limits, therapeutic applications, motion sickness, vascular responses and biomechanical effects N71-40147
Normal females electrophysiological changes during sensory isolation of water tank variety from EEC, EEG, EOG, and electrodermal measurements, considering cortical activities reduction N71-40346
Young adult males split-period sleep regimes dependence on intervening wakefulness time interval, periods length and onset sidereal time ED 726741
Human microbial flora and immunologic response in long term space missions, describing environmental parameters and factors and work-rest schedules N71-40348

SUBJECT INDEX

effects N71-40553
Human body immune status normalization in prolonged space flight, investigating ribonucleic acid stimulated antibody formation N71-40554
Spacecraft cabin artificial atmospheric composition and variation effects on human immunocompetence, examining lymphoid cell immunity reactions after lymphocytes blast transformations N71-40556
Human microflora variation in long term confinement, examining anaerobic and aerobic microorganisms responses N71-40557
Excitability, reactivity, adequacy, creativity and guidance at molecular, cellular, systemic and psychic levels in human biophysical neurodynamics, plotting stimulus magnitude vs response duration N71-40163
Transient heart rate response to square wave breathing in man under zero G parabolic flight N71-40128
Human cerebral EEG phenomena and evoked potential relationships to eye and retinal image motions N71-42371
Radiation damage diagnosis in humans, investigating free amino acid excretion with urine by paper chromatography method N71-42736
Healthy males immersion in water containing hexane, determining modified gravitational field effect on motor functions N71-42792
Unfavorable high intensity noise effects on auditory and motor analyzers during space flight N71-42793
Water immersion or bed rest effects on basic metabolism and external respiration under simulated weightlessness N71-42794
Humans under constant diet feeding in closed ecological system, demonstrating instability in elimination process of various elements N71-42817
Ranned spacecraft life support system dehydrated food ration effects on human organisms health, metabolism and immunoactivity during long space flight N71-42823
Auditory stimulus conditioning of human skin resistance responses on escape-avoidance schedule N71-42862
Application of reflected ultrasound to detection of post-operative rejection of heart transplant [NASA-CR-121642] N71-34050
Physiological effects of sleep deprivation produced by simulated aircraft noise [FAA-WO-70-16] N71-34064
Measurement of effects of stress on air traffic control personnel through use of mood adjective check lists [FAA-AM-71-21] N71-34067

HUMAN TOLERANCES

Heat acclimatization by evaporative cooling prevention in men wearing vapor barrier suits, considering body temperature and heart and sweat rates N71-40355
Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment N71-40559
Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and medication sensitivity N71-42790
Training cycle in altitude chamber for human adaptation to hypoxia, high temperatures and transverse hypoxic loads N71-42805

HUMAN WASTES

Biologically mineralized human waste products utilization in nutrient solutions for higher and lower autotrophs cultivation N71-42819
HYPOBARIC ATMOSPHERES

Visual performance and retinal vascular changes under hypobaric elevation and hypoxia, noting stereopsis, binocular depth perception, critical flicker fusion, dark adaptation, etc

Stimulatory effects of hypobaric hyperoxia on lipid synthesis in rat liver and adipose tissues under free feeding

HYPOTHALANUS

Cutaneous and intestinal blood flow differentiation during hypothermic heating and cooling in anesthetized dogs

Incentive goal and extensive stimulation experience effects on proportion increase of hypothalamic electrode sites yielding elicited eating and drinking behavior

Purine and pyrimidine derivatives of cattle hypothalamus determined by gel filtration and subsequent spectral analysis and chromatography

Coronary dilating substances of low molecular weight separated through dialysis from hypothalamic protein carriers

Diurnal water and food intake and body weight changes pattern in rats with hypothermic lesions

Hypothalamus anterior and hippocampus limbic system relation and oxytocin effect in rabbits, using EEG analysis

HYPOTHERMIA

Hypoxia and hypercapnia induced asphyctic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralyzed rabbits

Coronary blood flow at increased arterial carbonic acid partial pressure, noting induced hypercapnia

HYPERTHERMIA

EEG study of hyperoxic convulsions in Macacus nemestrinus and Papio primates, considering preventive effect of Diazepam and derivatives

Stimulatory effects of hypobaric hyperoxia on lipid synthesis in rat liver and adipose tissues under free feeding

Hyperoxic medium effects on experimental animal cells, tissues and organs morphology, infrastructure and histochemistry

Hyperoxia pathological effects on albino rats subcutaneous connective tissue, noting oxidizing enzyme activity depression and cellular metabolism suppression

HYPERTENSION

Parasympathetic inhibition effects on hyperkinetic borderline hypertension, measuring cardiac output, resting heart rate and intravascular blood pressure

Photoplethysmographic analysis of pulse wave velocity in healthy subjects and in patients with hypertension, heart disease, diabetes and anemia

HYPOTHERMIA

Physiological responses to head and neck vs trunk and leg cooling under hypothermic stress

HYPERVENTILATION

Potential epilepsy determination in flight personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness

Hyperventilation syndrome in flying personnel, discussing symptoms of parenthesis and extremities contraction, psychoemotional causes and control mechanism

HYPOBARIC ATMOSPHERES

Visual performance and retinal vascular changes

HYPEROSMOTIC

Biosynthesis of cutaneous and intestinal blood flow differentiation

Glycerides metabolism in rats brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis

Gangliosides and cerebrosides content in rat brain

Hypothesis stress, considering cold restraint

Hypothetia effect on brain nutritive processes and regulator activity, considering changes in brain blood supply, respiration and carbohydrate metabolism

HYPOTHERMIA

Hypoxia and hypercapnia induced asphyctic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralyzed rabbits

Glycerides metabolism in rats brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis

Gangliosides and cerebrosides content in rat brain under normal conditions, during hypoxia and under small X ray dosage action

Hypoxia effects on response time to peripheral visual signals, noting direct relation to exposure duration and intensity

Hypercapnia

Human nitrogen and water-salt metabolisms and respiratory activity during prolonged confinement in small volume chamber with cyclic varying hypoxic air

Incentive goal and extensive stimulation experience effects on proportion increase of hypothalamic electrode sites yielding elicited eating and drinking behavior

Hypertension effect on brain nutritive processes and regulator activity, considering changes in brain blood supply, respiration and carbohydrate metabolism

Hypoxia and hypercapnia induced asphyctic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralyzed rabbits

Hypothesis stress, considering cold restraint

Hypothetia effect on brain nutritive processes and regulator activity, considering changes in brain blood supply, respiration and carbohydrate metabolism

HYPOTHERMIA

Hypoxia and hypercapnia induced asphyctic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralyzed rabbits

Glycerides metabolism in rats brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis

Gangliosides and cerebrosides content in rat brain under normal conditions, during hypoxia and under small X ray dosage action

Hypoxia effects on response time to peripheral visual signals, noting direct relation to exposure duration and intensity

World championship gliding team medicophysiological problems during competition at Marfa, Texas, discussing climatic adaptation, nutrition, hypoxia and pilots general physical and psychomotor conditions

Visual performance and retinal vascular changes under hypobaric elevation and hypoxia, noting stereopsis, binocular depth perception, critical flicker fusion, dark adaptation, etc

Power derived from aerobic, lactic acid and alactacid energy sources during human muscular work under normoxic and hypoxic conditions, noting oxygen consumption
acclimatization and cold in man A71-41031
Peritoneal macrophagocytic ingestive capacity
decrease in mice under hypobaric hypoxia,
indicating infection susceptibility in altitude
environments A71-41032
Pathomorphological and histochemical changes in rat
lungs, liver, heart, diaphragm and adrenal glands
from acceleration and cysteamine caused tissue
oxygen deficiency A71-42703
Radiation protection drugs effects on albino rats
hypoxia resistance, discussing hypoxic hypoxia
response to intraperitoneal and orally
administered cysteamine and
aminocarbamylthiourea
White rats resistance to acute anoxic, asemic and
histotoxic hypoxia during various phases of I
radiation sickness, studying adrenal cortex
histophysiological state A71-42731
Human nitrogen and water-salt metabolisms and
respiratory acclimatization prolonged confinement
in small volume chamber with cyclic varying
hypoxic air A71-42799
Toxic gas and toxic compounds effects on low pressure
tolerance of rats under hypoxic hypoxia in
atmosphere containing polymer decomposition
products A71-42806
Animal tolerance to carbon monoxide, nitrogen oxide,
triethylamine and freon-12 toxic effects after
adaptation to hypoxia from tents on albino mice
A71-42810
Hypoxia affecting circulatory responses in dogs,
such as cardiac output, left ventricular dp/dt, and stroke

| IDENTIFYING |
| Specific banding patterns for identification and
structural detection of human chromosomes, using
differential staining method A71-40853 |
| ILLUMINATING |
| Visual performance compared using highly illuminated
CRT similar to those encountered in high altitude
flight in direct sunlight [NASA-CR-114361] A71-34073 |
| ILLUMINATION |
| Depth perception variability under central and
peripheral illumination conditions, using buscan
multiple range test for data analysis A71-41481 |
| Physiological effects of alcohol and cockpit
illumination levels on pilot performance and
flying safety [FAA-AM-71-34] A71-35275 |
| IMAGING TECHNIQUES |
| Scanning ultrasonic imaging technique for in vivo
monitoring of microscopic bubble formation in
decompression sickness, presenting image displays
A71-42250 |
| IMMUNITY |
| Active biological immunity development in long term
space flights, discussing natural and nonspecific
resistance to viruses and recurrent infections
A71-40552 |
| Human body immune status normalization in prolonged
space flight, investigating ribonucleic acid
stimulated antibody formation A71-40556 |
| IMMUNOLOGY |
| Human microbial flora and immunologic response in
long term space missions, describing environmental
parameters and factors and work-test schedules
effects A71-40553 |
| Microflora simplification effects on immunocompetent
organisms systems, observing shifts in guinea pigs
lymphoid tissue with limited flora A71-40555 |
| Spacecraft cabin artificial atmospheric composition
and variation effects on human immunocompetence,
examining lymphoid cell immunity reactions after
lymphocytes blast transformations A71-40556 |
| IMPACT LOADS |
| Effect of hard impact and aeolian erosion on release of
microorganisms from geological formations [NASA-CR-121707] A71-34056 |
| INVOLES |
| External insole-3-acetic acid effect on elongation
and geotopic bending of areas coleoptiles related
to auxin induced electrical responses A71-39986 |
| Insole vapor inhalation and direct injection into
mice, rats and rabbits, examining toxic qualities
A71-42812 |
| INFECTION |
| Antecedent clinical statistics of myocardial
infarction and sudden death in actively employed
middle aged men, noting cardiac rate, rhythm and
conduction abnormalities A71-41798 |
| INFECTIOUS DISEASES |
| Active biological immunity development in long term
space flights, discussing natural and nonspecific
resistance to viruses and recurrent infections
A71-40552 |
| Prolonged manned space flight infections disease
hazards, discussing confinement, zero gravity,
high oxygen content, personal hygiene, waste
disposal and preflight immune status A71-40561 |
| Microorganisms under closed environmental ecological
conditions with reference to astrosaurs infectious
diseases, discussing bacteria growth in
Biomatellite 2 and earth based closed chamber
experiments A71-40562 |
| Peritoneal macrophagocytic ingestive capacity
decrease in mice under hypobaric hypoxia,
indicating infection susceptibility in altitude
environments A71-41832 |
| INFORMATION SYSTEMS |
| Computerized bacterial identification system to
process Apollo spacecraft sample laboratory test
results in NASA Planetary Quarantine Lunar
Information System A71-42233 |
| INFORMATION THEORY |
| Experimental analysis of information content of
aerial electric field of human body, considering
electrotoxic and triboelectric components
A71-40166 |
| Thinking, cybernetics, and information theory
A71-35248 |
| INHIBITION (PSYCHOLOGY) |
| Parasympathetic inhibition effects on hyperkinetic
borderline hypertension, measuring cardiac output,
resting heart rate and intrathoracic blood
pressure A71-40407 |
| INFUSIONAL COMPOUNDS |
| Control of nitosis in biological cells through
inorganic ion hierarchy of cells involved
| INSECTS |
| Reflex mechanisms and programmed command in insect
flight stabilization, discussing gravity
propioreceptors, wind sensing and optomotor control
A71-39987 |
| Gravity effect and lift perception in flying insects
and animals, discussing flapping flight and aerial
locomotion in aerodynamic balance weightless state
A71-39988 |
| Proprioreceptive gravity perception in Hymenoptera,
noting joint located hair plates and constant
angle space orientation in dark A71-39989 |
| Gravity orientation in insects, discussing different
mechanoreceptors role A71-39990 |
| INTELLECT |
| Psychological investigations and theory of thinking
with four types of intellectual associations
A71-35247 |
| INTELLIGIBILITY |
| Time varying aircraft noise effect on speech
intelligibility, discussing test for relation to
articulation index
INTERPLANETARY SPACECRAFT
Evaluation equipment for terminal sterilization process on unmanned landers and determination of thermal inactivation curve of B. subtilis var. alger spore [NASA-CR-127277] A71-40709

INTRAHEMIC PROCEDURES
Pulmonary dissipation of gas emboli produced by oxygen, nitrogen and carbon dioxide intravenous injection in unanaesthetized sheep with chronically implanted ultrasonic Doppler flow probes N71-34054

INVERTEBRATES
Gravity receptor evolution in invertebrates, considering cilia role in reception and transduction into responses A71-40342

IODINE
Spectrophotometric measurement of iodine concentrations in spacecraft potable water supplies [NASA-CR-115134] N71-35264

ION CONCENTRATION
Control of mitosis in biological cells through inorganic ion hierarchy of cells involved [NASA-CASH-LAR-10773-1] N71-34061

IONIZING RADIATION
Radioprotectants effect on mice against ionizing radiation and tolerance to back-to-cHEST accelerations in space flight A71-40345

JOSEPHSON JUNCTIONS
Magnetic recording of heart electrical activity by cryogenic magnetometer with two Josephson junction quantum interference reduction device A71-62341

KIDNEYS
Antidiuretic action of chlorpropamide in mammalian kidney, considering intrarenal infusions effect on urinary concentration, free water clearance, glomerular filtration and sodium excretion A71-41939

KLEBSIELLA
Pulmonary antibacterial defenses with pure oxygen breathing mice, noting inhibition of early interpulmonary clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae A71-62241

LABORATORY EQUIPMENT
Development of NERFL telescopy system to low-duty cycle tone burst system [AD-726406] W71-35277

LABYRINTH
Functional anatomy of vertebrate gravity receptor system in spatial orientation, discussing otolith organs, sensory cells and hair cell topography in elasmobranch labyrinth A71-39994

Gravity sensors and intracranial conduction mechanisms in animals, noting contradictory hypotheses on function of hair cell in labyrinth A71-60009

Plying personnel equilibrium tests with pendulous armchair, investigating labyrinth reflex by induced myastagmus A71-41570

Controlled caloric stimulation of labyrinths in man by water at various temperatures A71-82583

LACTIC ACID
Power derived from aerobic, lactacid and alactacid energy sources during human muscular work under normoxic and hypoxic conditions, noting oxygen consumption A71-41721

LANDING AIDS
Flashing civil aviation lights history, progress and photometric characteristics, discussing navigation and landing aids A71-41489

LEAVES
Pinto beans circadian leaf movements in simulated weightless environment, relating rotational treatment time to rhythm phase A71-40006

LEG (ANATOMY)
Physiological responses to head and neck vs trunk and leg cooling under hyperthermic stress A71-40356

LESIONS
Prefrontal cortex lesions effect on trained anticipatory visual target fixation in cats, noting performance impairment in voluntary eye movement control A71-40174

Dismutal water and food intake and body weight changes patterns in rats with hypothalamic lesions A71-41936

Affrent oculomotor pathways to extracapsular muscle nuclei, considering discrete unilateral lesion role in head posture disturbance production A71-42435

LIFE DETECTORS
Extraterrestrial life detection methods, discussing bacterial cultures growth dynamics in nutrient media and iron porphyrin proteins and ATP content increase A71-40570

LIFE SCIENCES
Earth-like ecology for habitation in space, considering hollow sunlit rotating space chamber for life cycles in controlled weather environment A71-40360

Life science and space research - Conference, Leningrad, Hay 1970 A71-40551

Living organisms life-sustaining possibility under simulated Martian temperature, humidity and atmospheric composition conditions, emphasizing unicellular organisms radiation resistance A71-40572

LIFE SPAN
Chronic acceleration effects on animals, considering growth rate, food intake, oxygen metabolism and life expectancy A71-40003

Death rates, median life span and weight in mice exposed to gamma radiation after intra-abdominal injections of cysteine A71-42712

LIFE SUPPORT SYSTEMS
Extravehicular activity protection systems, discussing resource regeneration, technology, methodology and space station, lunar base and Martian missions schematic configurations A71-41990

Manned 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities A71-42043

Manned spacecraft life support system dehydrated food ration effects on human organisms health, metabolism and immunoactivity during long space flight A71-42823


Environmental control and life support system for space shuttle orbiter A71-35267

Environmental control and life support subsystem for space shuttle orbiter A71-35271

Status of LEC program on space shuttle environmental control and life support systems A71-35272

LIGHT (GLOOMY LIGHT)
Gravity effect and lift perception in flying insects and animals, discussing flapping flight and aerial locomotion in aerodynamic balance weightless state X-2988

LIGHT (VISIBLE RADIATION)
Light flux spatial coherence in visual reception,
LIGHT ADAPTATION
considering aventurine spots perception an point
light source A71-41065

LIGHT ADAPTATION
Flash light angular size, adaptation luminance,
 pulse shape and color effects on broadel-key
 constant tested on observers with good binocular
vision A71-41403

LIGHT SOURCES
Light flux spatial coherence in visual reception,
considering aventurine spots perception an point
light source A71-41065

LIGNS (ANATOMY)
Decompression sickness, investigating surface
exposure diving and selection of liab bends vs
CNS symptoms by tests on goats A71-40344
Sterephotogrammetric measurement of body and liab
volume changes after prolonged space mission
A71-41861

LIPID METABOLISM
Differential lipid and phospholipid composition of
white matter in brain, cervical, thoracic and
lumbosacral sections of spinal cord and sciatic
nerves in dogs A71-41078
Stimulatory effects of hypobetric hyperoxia on lipid
synthesis in rat liver and adipose tissues under
free feeding A71-41825

LIQUID COOLING
Automatic temperature control for liquid cooling
garments used during astronaut extravehicular
activity with external auditory meatus, and skin
temperature as input signals
LIVER
Stimulatory effects of hypobetric hyperoxia on lipid
synthesis in rat liver and adipose tissues under
free feeding A71-41825

LOCOROTION
Gravity receptors and locomotion orientation in
Crustacea, discussing statocyst, stimulation,
input and compensatory eye movements with respect
to gravitational field A71-39992

LONG TERM EFFECTS
Active biological immunity development in long term
space flights, discussing natural and nonspecific
resistance to viruses and recurrent infections
A71-40552
Human microbial flora and immunologic response in
long term space missions, describing environmental
parameters and factors and work-rest schedules
effects A71-40553
Human body immune status normalization in prolonged
space flight, investigating ribonucleic acid
stimulated antibody formation A71-40554
Human microflora variation in long term confinement,
examining anaerobic and aerobic microorganism
responses A71-40557

Composition and colicinogenic and hemolytic
activities changes of Escherichia isolated from
man during long term confinement A71-40558
Bacterial contamination in confined sealed space
during long term human occupation, observing
hemolytic microflora spreading dynamics on bodies,
clothes, wall and air A71-40560
Prolonged manned space flight infectious disease
hazards, discussing confinement, zero gravity,
high oxygen content, personal hygiene, waste
disposal and preflight immune status
A71-40566
Sterephotogrammetric measurement of body and liab
volume changes after prolonged space mission
A71-40561
Prolonged small radiation dosage effects on
vestibular analyzer in normal and antiradiation
drug protected dogs A71-42798

LOW TEMPERATURE TESTS
Magnetic recording of heart electrical activity by
cryogenic magnetometer with two Josephson junction
quanta interference reduction device A71-42341

LUMINANCE
Flashing light stimuli application to clinical
instrument design for detection and quantitative
assessment of early pathological visual loss based
on minus discernible luminance difference
A71-41802
Object recognition with aided and unaided night
vision as function of luminance

LUMINOUS INTENSITY
Subjective brightness of flashing light stimuli
within forces as function of stimulus size, noting
edge effects contribution at suprathreshold levels
A71-41478
Flash threshold perception in relation to flicker,
showing flicker/flink ratio constancy
over large intensity level range A71-41479
Flashing lights effective intensity at threshold and
suprathreshold levels, discussing Broca-
Saltzer effect observance conditions A71-41480

LUNAR ENVIRONMENT
Bacterial spores survival under simulated lunar
surface conditions, comparing results with
vegetable cells experiments A71-40567

LUNAR EXPLORATION
Computerized bacterial identification system to
process Apollo spacecraft sample laboratory test
results in NASA Planetary Quarantine Lunar
Information System A71-42233

LUNGING
Vasomotor effects of vagus nerve on canine lung
blood content in response to electrical
stimulation of vagosympatheticus
A71-42581

LIPPS
Microflora simplification effects on immunocoppетest
organism systems, observing shifts in guinea pigs
lymphoid tissue with limited flora
A71-40555
Spacecraft cabin artificial atmospheric composition
and variation effects on human immunocontrol,
examining lymphoid cell immunity reactions after
lymphocytes blast transformations
A71-40556

LYSOGENESIS
Space conditions exposure of lysogenic strains of
Escherichia coli and monolayer cultures of human
bodcells aboard Zond 5 and 7 flights
A71-40565

MACROPHAGES
Peritoneal macrophagic ingestive capacity
decrease in mice under hypobetric hypoxia,
indicating infection susceptibility in altitude
environments A71-41032

MAGNESIUM
Metabolism of magnesium deficient Escherichia coli
cells under aerobic and anaerobic conditions
[ AM-TC-1472] A71-35525

MAGNETIC RECORDING
Magnetic recording of heart electrical activity by
cryogenic magnetometer with two Josephson junction
quanta interference reduction device A71-42341

MAGNETOCARDIOGRAPHY
Magnetic recording of heart electrical activity by
cryogenic magnetometer with two Josephson junction
quanta interference reduction device A71-42341

MAMMALS
Muscle extracorss muscle fiber structural and
functional properties, discussing histological
arrangement, fiber type classification and motor
nerve endings A71-42434

MAN MACHINE SYSTEMS
Human thinking activity applied to man machine
METABOLIC WASTES

Activation during waiting period

Pilot EEG, behavioral and subjective correlates of natural and drug induced sleep at atypical hours, using calculation and vigilance tests

Human thinking activity applied to man machine systems

Eye movement, mental performance, and problem solving

Human thinking studies using problem solving in chess

Skin resistance during solution of mental problems

METABOLIC WASTES

Antiradiation drugs effects on healthy and irradiated rats gastrointestinal tract evacuatory motor function

Humans under constant diet feeding in closed ecological systems, demonstrating instability in elimination process of various elements

METABOLISM

Antibiotic and chloral hydrate effects on metabolism intensity of rats brain gangliosides components including N-acetylneuramine acid and N-acetylgalactosamine

Glycerides metabolism in rats brain under normal conditions and during hypoxia, showing diglycerides role in triglycerides and phospholipids biosynthesis

Water immersion or bed rest effects on basic metabolism and external respiration under simulated weightlessness

Human nitrogen and water-salt metabolisms and respiratory activity during prolonged confinement in small volume chamber with cyclic varying hypoxic air

Metabolism of magnesium deficient Emmerichia coli cells under aerobic and anaerobic conditions

METAL IONS

Serotonin and gamma-amino butyric acid loss and interaction in rat midbrain slices incubated in media containing Na, K and Ca ions

METAL OXIDES

UV radiation effect on amino acids and peptides in different gas atmospheres in presence of salts and metal oxides

METHYLHYDRAZINE

Monomethylhydrazine effects on glucose carbon metabolism and effects of pure oxygen inhalation in rats

MICROBIOLOGY

Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment

Proceedings of conference on interaction between atmospheric environment and human system at cell level

MICROORGANISMS

Microorganisms under closed environmental ecological conditions with reference to astromats infectious diseases, discussing bacteria growth in Biosatellite 2 and earth based closed chamber experiments

Simulated Martian environment effects on terrestrial microorganisms survival

Mathematical models for microorganism exponential die-off rate and variance estimation from decontamination data

SUBJECT INDEX

Microorganisms survival in simulated Martian environment noting culture cells concentration increase

Uncellular organisms increased tolerance to UV radiation, discussing cells repairing ability in dark and protective compounds screening role

Effect of hard impact and aeolian erosion on release of microorganisms from geological formations [NASA-CR-121707]

RIDDLE BAR PRESSURE

Vertigo due to increased middle ear pressure, discussing etiology from experience of aeromedical consultation service

MILITARY PSYCHOLOGY

Psychopathological causes for French Air Force flying personnel inaptitude, considering motivational problems and age factor

MINERAL DEPOSITS

Human waste product utilization possibility through mineralization by wet combustion method

Thermal combustion produced biocorpus vegetable waste mineralization effect on furnace working surface oxide film

RITOCOCHONIA

Low temperature effects on succinate oxidase activity of mitochondrial membranes in hibernating squirrels

Thyroxine effects on brain glutaminase isoenzymes interaction and deamidation in mitochondrial fractions, comparing with sodium phosphate, bicarbonate and aspartate

Gangliosides inhibitory effects on active Ca ion transport in rat brain mitochondria, using succinate as respiratory substrate

RIYOTIS

Control of mitosis in biological cells through inorganic ion hierarchy of cells involved

MODAL RESPONSE

Taste modality identification by factor analysis technique based on correlation matrix between independent stimuli

MOISTURE CONTENT

Moisture effects on thermal inactivation of microbial spores for spacecraft sterilization

MIRRORS

Operator performance improvement in monitoring automated processes by alternating displays, discussing simulated radar and sonar CDT display laboratory tests

MONKEYS

Macaca nemestrina monkey bone density change during Biosatellite 3 mission

Physiological deterioration of monkey onboard Biosatellite 3 and unexpected demise, presenting collected data for response analysis

Observing behavior in squirrel monkeys under multiple schedule of reinforcement availability

MORPHOLOGY

Gravity influence on plant growth, lateral development, apical dominance, bud initiation, orientation and flower morphology

Composite tissue blocks method for comparative pathomorphological investigation of radiation pathology

MORTALITY

Death rates, median life span and weight in mice exposed to gamma radiation after intra-abdominal injections of cysteamine
MOTION AFTERRIGHTS
Lateral accelerations effect on mice tolerance to toxic doses of aminitol- and indolyalkylamine-
series radiation protection drugs A71-42706

MOTION SICKNESS
Vibration effects on human body, discussing neurophysiological data, safe exposure limits,
therapeutic applications, motion sickness, muscular responses and biomechanical effects A71-40147

MOTION STABILITY
Ventilatory and proprioceptive stabilization of eye movements A71-42488

MOTION
Psychopathological causes for French Air Force flying personnel inaptitude, considering
motivational problems and eye factor A71-41575

MOUTH
Aspects of mouth disorders in space flight and space flight training [JPR5-53894] N71-34062

MULTICANAL COMMUNICATION
Miniaturized multichannel FM/AM biological telemetry system for simultaneous transmission of EEGs,
ERG, EOGs and EKGs A71-41574

MUSCLES
Intracellular pH and carbon dioxide combining curve of muscle tissue in dogs, using DMO method
A71-40631
Physiological relationship of young to old age, considering body composition, aerobic capacity and
capillary-muscle fiber ratio A71-41717
Manual extracocular muscle structural and functional properties, discussing histological
arrangement, fiber type classification and motor nerve endings A71-42634
Afferent ocular motor pathways to extracocular muscle nuclei, considering discrete unilateral lesion
role in head posture disturbance production A71-42435
Extraocular muscle pharmacology, discussing eye twitch and tonic neuromuscular system structure
and function in frogs A71-42439

MUSCULAR FUNCTION
Neosynthesized alpha-glycerophosphate and 2,3-
diphosphoglycerate role in human extracocular
muscle metabolism A71-40099
Vibration effects on human body, discussing neurophysiological data, safe exposure limits, therapeutic applications, motion sickness, muscular responses and biomechanical effects A71-40147
Aquacutus trevor response measurement by muscle force transducer during compression and
depression in 520-foot saturation dive, noting difference among individuals A71-40350
Humoral smooth muscle acting factor and phenyl-
piperazine methyl cyclohexahone effects on
depression sickness production and prevention
in mice A71-40352
Mechanical properties of muscular organs, presenting mathematical model for biological fluid flow
analysis A71-40984
Motor stereotype formation with different muscular loads, noting muscle electrical activity and
static tension changes A71-40162
Noradrenaline induced stimulation of myocardial
oxygen consumption of cat papillary muscles under afterloaded isotonic and isometric conditions A71-42433

MUSCULAR STRENGTH
Training cycle in altitude chamber for human adaptation to hypoxia, high temperatures and transverse myogenic loads A71-42441

MUSCULOSKELETAL SYSTEM
Gas metabolim and electrical activity of skeletal muscles of rats in He/O medium at room temperature, noting rectal temperature drop A71-42805

MUTATIONS
Chloroform viability and mutability aboard Soyuz and Zond spacecraft, noting trend toward growth of anomalies in autopsoros A71-40566

MYOCARDIUM
Heart excitation and membrane permeability effects on two component action potentials in human atrial muscle strips, using microelectrodes A71-40865
Myocardial blood flow and oxidative metabolism in cyanotic congenital heart disease patients, using lactate/pyruvate ratios and coronary sinus catheterization A71-41521
Anoxia effect on laboratory animals cardiac action, discussing ECG injury current relation to myocardial phosphofructokinase content A71-41369
Antecedent clinical statistics of myocardial infarction and sudden death in actively employed middle aged men, noting cardiac rate, rhythm and conduction abnormalities A71-41798
Noradrenaline induced stimulation of myocardial oxygen consumption of cat papillary muscles under afterloaded isotonic and isometric conditions A71-41937

NAVIGATION AIDS
Flashing civil aviation lights history, progress and photometric characteristics, discussing navigation and landing aids A71-41489

NERVES
Single cell responses within cat medulla during constant angular accelerations [AD-724628] N71-34069

NERVOUS SYSTEM
Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system A71-41374
Eye movement neurophysiology, discussing ocular proprioception, oculorotatory muscle innervation
in receptor role, extracocular muscle afferent and efferent innervation and central nervous system control effect A71-42433
Manual extracocular muscle fiber structural and functional properties, discussing histological
arrangement, fiber type classification and motor nerve endings A71-42434

NEURAL NETS
Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements
and smooth pursuit systems A71-42450

NEUROBIOLOGIC TRANSMISSION
Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system A71-41374
Eye movement neurophysiology, discussing ocular proprioception, oculorotatory muscle innervation
in receptor role, extracocular muscle afferent and efferent innervation and central nervous system control effect A71-42433
Manual extracocular muscle fiber structural and functional properties, discussing histological
arrangement, fiber type classification and motor nerve endings A71-42434

NEUROBIOLOGIC TRANSMISSION
Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system A71-41374
Eye movement neurophysiology, discussing ocular proprioception, oculorotatory muscle innervation
in receptor role, extracocular muscle afferent and efferent innervation and central nervous system control effect A71-42433
Manual extracocular muscle fiber structural and functional properties, discussing histological
arrangement, fiber type classification and motor nerve endings A71-42434
Chemical agents protective properties on albino mice

Excitability, reactivity, adequacy, creativity and

Extraocular muscle pharmacology, discussing eye

Extraocular muscle pharmacology, discussing eye
twitch and tonic neuromuscular systems structure

extrusion and function in frogs

Extraocular muscle pharmacology, discussing eye

Nervous system functional characteristics based on

neuron structure and electrical transmission from
electron microscopy, electrophysiology and

biochemical analysis

Sensory transmission of spinal heat and cold

sensitivity in ascending spinal neurones of

anesthetized cats

Visual projection, magnification and retina overlap

on dorsal lateral geniculate nucleus in cats

measured by random scatter in receptive

fields

Inhibitory binocular receptive fields in dorsal

nucleus of lateral geniculate body for dominant

and nondominant eye in cats, using moving slit and

flash spot stimulation

Posterolateral thalamus nucleus neurons response to

visual, auditory and somatic stimuli in cats with

microelectrodes

Vibration effects on human body, discussing

neuropsychophysical data, safe exposure limits,

therapeutic applications, motion sickness, muscular responses and biomechanical effects

Neurophysiological investigation of visual tilt

aftereffect, comparing judgment precision at

vertical and horizontal to oblique orientation

with/without gravity cue

Excitability, reactivity, adequacy, creativity and
guidance at molecular, cellular, systemic and

psychic levels in human biophysical neurodynamics,

plotting stimulus magnitude vs response duration

Eye movement neurophysiology, discussing ocular

proprioception, ocular vestibular muscle sensory

receptor role, extrorsal muscle afferent and
efferent innervation and central nervous system

control effect

Human ocular control system supranuclear disorder

syndromes and signs in terms of physiological

concepts

Human expired air toxicity effect on mice

neurobehavioral changes stimulating inhibitory

reactions in central nervous system

HEPATITIS
Chlorella biomass chemical composition stability
during prolonged cultivation with nitrates

and isoproterenol

NOISE INTENSITY
Unfavorable high intensity noise effects on auditory

and motor analysers during space flight

NOISE REDUCTION
Magnetic recording of heart electrical activity by
cryogenic magnetometer with two Josephson junction

quasist interference reduction device

NOISE TOLERANCE
Unfavorable high intensity noise effects on auditory

and motor analysers during space flight

NORADRENERGIC
Noradrenaline induced stimulation of myocardial

oxygen consumption of cat papillary muscles under

afterloaded isotonic and isometric conditions

NUCLEAR ROCKET ENGINES
Crew radiation dose from plane of high impulse,
gas-core nuclear rocket during Mars mission

[NASA-TM-7-67927]

NUCLEIC
Postflight histological analysis of turtles aboard

Zond 7, noting decrease in cell nuclei size due to

space flight conditions adaptation

NUTRIENTS
Hydroponic plant cultivation with terasurit

substrate, investigating replacement time effect

and regenerative power of nutrient solutions

Biologically mineralized human waste products

utilization in nutrient solutions for higher and

lower autotrophs cultivation

NUTRITION
World championship gliding team medico physiological

problems during competition at Marfa, Texas,
discussing climatic adaptation, nutrition, hypoxia

and pilots general physical and psychomotor

conditions

Hypothermia effect on brain nutritive processes and

regulator activity, considering changes in brain

blood supply, respiration and carbohydrate

metabolism

Nutritional evaluation of Apollo diets and

quantobiological study of mice having diets with

limited microflora

[NASA-CR-115124]

Use of nutritional markers for studies of food

intake, passage, and absorption in

gastrointestinal track of humans and animals

[NASA-CHR-115125]

VESTIGES
Flying personal equilibrium tests with pendulum

arcar, investigating labyrinth reflex by

induced nystagmus

Habituation and suppression of vestibulo-ocular

vertical syntaggic responses to Coriolis

stimulation in pentathlon athletes, comparing to

pilots and airman trainees

Alcohol ingestion effects on vertigo and nystagmic

vestibular responses to angular acceleration,

considering visual fixation and alertness control

[NASA-TH-X-67927]

Visual and vestibular analyzers interaction, noting

duction in duration of counterrotation illusion

and postrotation nystagmus in humans

[71-34079]
alpha rhythm in human electroencephalogram modulated at 10 Hz by tremor in extracranial muscles

OCEANOGRAPHY
Algae and plankton photosynthesis requirements for optimization of oceanographic resources

OCULOMOTOR KINES
Habituation and suppression of vestibulo-ocular vertical saccadic responses to Coriolis stimulation in pentathletes, comparing to pilots and airman trainees

Afferent oculomotor pathways to extracranial muscles, considering discrete unilateral lesion role in head posture disturbance production

Central pathway connection between vestibular and oculomotor nuclei through pontine responsible for horizontal eye movements induced by visual and vestibular stimuli

Saccadic eye movement control system behavior simulation model evaluation, considering oculomotor pathways

Neural control organization in vestibulo-ocular reflex arc, considering afferent and oculomotor neural signals

Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements and smooth pursuit systems

olfactory perception
Human olfactory perception of inspired air composition, noting sensory differentiation improvement with subsequent exposures in space flight training

operator performance
Human response time for urgent signal after operational rest, showing effect of additional activation during waiting period

Operator performance improvement in monitoring automated processes by alternating displays, discussing simulated radar and sonar CRT display laboratory tests

Physiological effects of high altitude and high temperature environments on human performance of complex actions

Analysis of ability of human subjects to visually identify targets at various distances of observation

optical illusion
Visual and vestibular analyzers interaction, noting reduction in duration of counterrotation illusion and postrotation sagnsya in humans

optical measurement
Flashing lights radiation characteristics, photoelectrometric measurement, discussing measuring apparatus sensitivity and errors analysis

Optical properties
Physical and physiological aspects of visual optics in space flight

optical tracking
Flashing lights vision threshold systematic variations, using quadrant adaptometer for continuous tracking of sensitivity fluctuations

Human eye-tracking phase lags representation by time delays depending on target motion class

Organic compounds
Urine preservatives for urine water recovery system, noting ammonia and organic compound contents in condensate

Solar system organic compounds detection and evolution, considering element, isotope and pigment composition, optical activity and polymerization

Organic phosphorus compounds
Neosynthesized alpha-glycerophosphate and 2,3-diphosphoglycerate role in human extracranial muscle metabolism

Halophilic bacteria electron transport chain, studying protein, phoshollipids, flavoproteins and cytochromes sedimentation properties by electron microscopy and light scattering techniques

Organs
Papers on gravitation effects on properties and behavior of living matter

Plants and animals reactions to environment gravitational component, showing organisms perception of accelerating force

Living organisms life-sustaining possibility under simulated Martian temperature, humidity and atmospheric composition conditions, emphasizing unicellular organisms radiation resistance

Oxygen metabolism
Chronic acceleration effects on animals, considering element, isotope and condensates

Respiratory function and gas metabolism shift under hyperoxic medium effects on experimental animal cells, tissues and organ morphology, structure and histochemistry

Orientation
Semicircular canal and otolithic organ function in free swimming fish angular orientation behavior

Orthostatic tolerance
Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and medication sensitivity

Otolith organs
Functional anatomy of vertebrate gravity receptor system in spatial orientation, discussing otolithic organs, sensory cells and hair cell topography in placodobranch larvae

Oxidase
Low temperature effects on succinate oxidase activity of mitochondrial membranes in hibernating squirrels

Oxidation
Oxidation of water in regeneration under spacecraft conditions, measuring organic impurities degree of oxidation in inhabited spacecraft vapor condensates

Oxygen breathing
Pulmonary antibacterial defenses with pure oxygen breathing mice, noting inhibition of early interpulmonary clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae

Oxygen consumption
Power derived from aerobic, lactic acid and lactic acid energy sources during human muscular work under normoxic and hypoxic conditions, noting oxygen consumption

Noradrenaline induced stimulation of myocardial oxygen consumption of cat papillary muscles under afterloaded isotonic and isometric conditions

Oxygen metabolism
Chronic acceleration effects on animals, considering growth rate, food intake, oxygen metabolism and life expectancy

Systolic blood flow and oxidative metabolism in cyanotic congenital heart disease patients, using lactate/pyruvate ratios and coronary sinus catheterization

Respiratory function and gas metabolism shift under high transverse accelerations in reenacted
OXYGEN SUPPLY EQUIPMENT

centrifuged subjects
Gas metabolism and electrical activity of skeletal muscles of rats in N2/O medium at room temperature, noting rectal temperature drop

A71-42795
A71-42003

OXYGEN SUPPLY EQUIPMENT
Oxygen supply to air transported patients by chemical compounds, suggesting use of permanganates and chlorates
Spacecraft closed loop oxygen recovery system using electrochemical carbon dioxide concentrator, Sabatier reactor and water electrolysis subsystem

A71-41571
A71-42017

OXYGEN TENSION
Human expiratory oxygen and carbon dioxide partial pressure and dissociation curves for intrapulmonary gas mixing, using mass spectroscopy
Frequency analysis of blood circulation rhythms and oxygen tension fluctuations in cerebros of rabbits, cats, monkeys and men
Radiation effects on rats peripheral blood state in low pressure environment with sea level value oxygen tension

A71-40096
A71-42580
A71-42732

PAPILLAE
Norepinephrine induced stimulation of myocardial oxygen consumption of cat papillary muscles under afterloaded conditions

A71-41937

PARABOLIC FLIGHT
Transient heart rate response to square wave breathing in man under zero G parabolic flight

A71-41828

PARTIAL PRESSURE
 Coronary blood flow at increased arterial carbonic acid partial pressure, noting induced hypercapnia

A71-40633

PATHOLOGICAL EFFECTS
 Flashing light stimuli application to clinical instrument design for detection and quantitative assessment of early pathological visual loss based on minimum discernible luminance differences
 Pathomorphological and histochemical changes in rat lungs, liver, heart, diaphragm and adrenal glands from acceleration and cytostatine caused tissue oxygen deficiency
 High energy proton irradiation of rats with partial shielding of abdominal region, observing pathomorphological changes in myocardium, nervous system and radiosensitive organs
 Hyperoxia pathological effects on albino rats, subcutaneous connective tissue, noting oxidizing enzyme activity depression and cellular metabolism suppression

A71-41082
A71-42703
A71-42721
A71-42802

PATHOLOGY
 Soviet book on experimental research on human higher nervous activity from growth aspect covering normal and pathological states, cerebral cortex interaction with central nervous system
 Composite tissue blocks method for comparative pathomorphological investigation of radiation pathology

A71-41374
A71-42734

PATIENTS
Oxygen supply to air transported patients by chemical compounds, suggesting use of permanganates and chlorates
Sick and injured transportation aboard regular airliners, considering pathological and psychological contraindications

A71-41571
A71-41572

PATTERN RECOGNITION
Versional eye movement control system models, considering dual mode control, intermittency, plant dynamics and pattern recognition

A71-42844

Sequential, distribution-free pattern classification procedures tested on Gaussian and ZEC patterns [NACA-CR-121750]

A71-38074

PEPTIDES
UV radiation effect on amino acids and peptides in different gas atmospheres in presence of salts and metal oxides

A71-42829

PERFORMANCE PREDICTION
Color defective vision and aviation color signal light flashes recognition, indicating Farnsworth lantern performance prediction test superiority

A71-41490

PERIPHERAL CIRCULATION
Dogs peripheral blood reaction to complex action of transverse accelerations and gamma irradiation
Vibration influence on peripheral blood reaction to gamma radiation in dogs, using clinic-hematological indices
Radiation effects on rats peripheral blood state in low pressure environment with sea level value oxygen tension

A71-42727
A71-42728
A71-42732

PHOTOBIONT
 Peritonal macrophagocytic digestive capacity decrease in mice under hypobaric hypoxia, indicating infection susceptibility in altitude environments

A71-41032

PERMANGANATES
 Oxygen supply to air transported patients by chemical compounds, suggesting use of permanganates and chlorates

A71-41571

PERSONALITY
 Soviet book on psychology and outer space covering astronauts experiences and emotions during training and flights, daily routine, equipment, food, habits and personal characteristics

A71-40876

PERSONNEL
Biomedical evaluations of cardiovascular and overall physical fitness of air traffic control personnel [PH-A-AM-71-19]

A71-35243

PERSONNEL MANAGEMENT
Military pilot handling characteristics, discussing combat operations, accident prevention and blind landing

A71-42239

PH
Intracellular pH and carbon dioxide combining curve of muscle tissue in dogs, using DMO method

A71-40631

PHARMACOLOGY
Extraocular muscle pharmacology, discussing eye twitch and tonic neuromuscular systems structure and function in frogs
Medical preparations use and avoidance by spacecraft and aircraft crew members, discussing aftereffects, allergies and health requirements
Caffeine, euphyllin, cordiamin, morphine, calcium chloride, adrenaline and mesaton effects on organism physiology during hypothermia
Propylactic medication for radiation damage treatment, covering toxicity, pharmacological properties, metabolism, dosage and physiological action
Reactivity changes to pharmacoc hemical preparations under total proton and gamma ray irradiation of abdomen and head shielded rats

A71-42439
A71-42705
A71-42709
A71-42711
A71-42717

PHASE SHIFT
Human eye-tracking phase lags representation by time delays depending on target motion class

A71-42451
A71-42451

PHENOLS
Preservative phenol derivative effects on toxic gas evolution from stored urine in sealed vessels

A71-42808

PHOTOCARDIOGRAPHY
Jet and turbulence mechanism of vascular aumens associated with methemoglobin for minimum flow Reynolds numbers, using sorta orifice plates in dogs

A71-42808
<table>
<thead>
<tr>
<th>SUBJECT INDEX</th>
<th>PHYSIOLOGICAL RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHOSPHORUS METABOLISM</td>
<td>Thermal conditions under varying degrees of physical work inside pressure suits</td>
</tr>
<tr>
<td>Neosynthesized alpha-glycerophosphate and 2,3-diphosphoglycerate role in human extracellular muscle metabolism</td>
<td>[CEA-N-1407]</td>
</tr>
<tr>
<td>Differential lipid and phospholipid composition of white matter in brain, cervical, thoracic and lumbar sacral sections of spinal cord and sciatic nerve in dogs</td>
<td>N71-34078</td>
</tr>
<tr>
<td>PHOTOBIOCHEMISTRY</td>
<td>PHYSIOLOGICAL EFFECTS</td>
</tr>
<tr>
<td>Operative test and evaluation of photochromic goggles for eye protection during exposure to nuclear explosion flash</td>
<td>Vertebrobasilar apparatus effect on brain stem somatic activity</td>
</tr>
<tr>
<td>[AD-726548]</td>
<td>N71-35278</td>
</tr>
<tr>
<td>PHOTOMETRY</td>
<td>Aircraft noise effects on hearing acuity and perceptual and intellectual judgment tasks</td>
</tr>
<tr>
<td>Flashing civil aviation lights history, progress and photometric characteristics, discussing navigation and landing aids</td>
<td>N71-41459</td>
</tr>
<tr>
<td>Flashing lights radiation characteristics, photometric measurement, discussing measuring apparatus sensitivity and errors analysis</td>
<td>N71-41456</td>
</tr>
<tr>
<td>PHOTOSTIMULATION</td>
<td>Sympathomimetic amine effects on central nervous system reflex activity of irradiated and desensitized animals</td>
</tr>
<tr>
<td>Algae and plankton photosynthesis requirements for optimization of oceanographic resources</td>
<td>N71-35476</td>
</tr>
<tr>
<td>Stereophotogrammetric measurement of body and limb volume changes after prolonged space mission</td>
<td>N71-35477</td>
</tr>
<tr>
<td>PHYSICAL EXAMINATIONS</td>
<td>Physiological effects on rates of argon substitution for nitrogens in hermetically sealed chambers under conditions of anoxia and high carbon dioxide concentration</td>
</tr>
<tr>
<td>Correlation of color blindness tests with ability to recognize aviation color signal light flashes</td>
<td>N71-40406</td>
</tr>
<tr>
<td>[FAA-AM-71-27]</td>
<td>N71-35280</td>
</tr>
<tr>
<td>Standards, policies, procedure, and limitations of Federal Aviation Administration medical certification system</td>
<td>N71-35284</td>
</tr>
<tr>
<td>PHYSICAL EXERCISE</td>
<td>Physiological effects on mice of air pollution with gaseous toxic substances from urine and feces, noting increased respiration rate and cholineresterase activity</td>
</tr>
<tr>
<td>Resting and postexercise apexcardiogram correlation with maximal treadmill stress test, noting mean a-wave ratios</td>
<td>N71-41051</td>
</tr>
<tr>
<td>Trace processes as basis for efficiency change during exercise and active rest</td>
<td>N71-41061</td>
</tr>
<tr>
<td>Motor stereotype formation with different muscular loads, noting muscle electrical activity and static tension changes</td>
<td>N71-41062</td>
</tr>
<tr>
<td>Prior muscle exertions effect on reaction time and duration of simple discrete movements, considering electroencephalogram frequency changes</td>
<td>N71-42194</td>
</tr>
<tr>
<td>PHYSICAL FITNESS</td>
<td>Analysis of aviation hazards produced by visual illusions due to spiral aftereffect parameters of perceived size and distance</td>
</tr>
<tr>
<td>Spine radiographical examination for helicopter pilot fitness determination, discussing spinal weakness symptoms, special exercises, medical examinations and vibration reducing seat construction</td>
<td>[FAA-AM-71-31]</td>
</tr>
<tr>
<td>Biomedical evaluations of cardiovascular and overall physical fitness of air traffic control personnel</td>
<td>N71-35254</td>
</tr>
<tr>
<td>[FAA-AM-71-19]</td>
<td>N71-35256</td>
</tr>
<tr>
<td>Standards, policies, procedure, and limitations of Federal Aviation Administration medical certification systems</td>
<td>N71-35258</td>
</tr>
<tr>
<td>PHYSICAL PROPERTIES</td>
<td>Proceedings of conference on interaction between atmospheric environment and human system at cell level</td>
</tr>
<tr>
<td>Ultrasoundics use in physiological and pathophysiological experiments on human organisms, considering ultrasonic vibration physical properties</td>
<td>[AD-726061]</td>
</tr>
<tr>
<td>PHYSICAL WORK</td>
<td>N71-35256</td>
</tr>
<tr>
<td>Power derived from aerobic, lactic acid and alactacid energy sources during human muscular work under normotic and hypoxic conditions, noting oxygen consumption</td>
<td>N71-41834</td>
</tr>
<tr>
<td>Free fatty acids reduced availability effects on physical working capacity in normal man</td>
<td>N71-41720</td>
</tr>
<tr>
<td>N71-41721</td>
<td>N71-41722</td>
</tr>
</tbody>
</table>

I-35
Normal females electrophysiological changes during sensory isolation of water tank variety from EEG, EKG, EOG, EEG and electrodermal measurements, considering cortical activities redaction

A71-40346

Hyperbaric normoxic breathing helium, nitrogen and neon gas mixture effects on EEG and reaction time in man

A71-40347

Altitude and cold acclimatization effects on human basal heart rate, blood pressure, respiration and breath-holding

A71-40349

Aquaman's tremor response measurement by muscle force transducer during compression and decompression in 520-foot saturation dive, noting differences among individuals

A71-40350

Human vascular and extravascular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights

A71-40354

Physiological responses to head and neck to trunk and leg cooling under hyperthermic stress

A71-40356

Physiological deterioration of monkey onboard Biosatellite 3 and unexpected death, presenting collected data for response analysis

A71-40564

Radioprotectants effects on mice and guinea pigs physiological reactions to back-to-chest transverse accelerations

A71-41053

Soviet book on animals morphophysiological changes in cardiovascular and nervous systems and various internal organs under RF wave exposure

A71-41369

Blind goldfish gravity reference response under linear accelerations on motor car and parallel swing from movie camera recording

A71-42228

Hyperoxic medium effects on experimental animal cells, tissues and organs morphology, infrastructure and histochemistry

A71-42601

Animal tolerance to carbon monoxide, nitrogen oxide, triethyamine and freon-12 toxic effects after adaptation to hypoxia from testing on albino mice

A71-42610

Human expired air toxicity effect on mice neurochemical changes stimulating inhibitory reactions in central nervous system

A71-42613

Auditory stimulus conditioning of human skin resistance responses on escape-avoidance schedule

A71-42662

PHYSIOLOGICAL TESTS

Flying personnel equilibrium tests with pendulum arachair, investigating labyrinth reflect by induced sy saintgas

A71-41570

Ultrasoundics use in physiological and pathophysiological experiments on human organisms, considering ultrasonic vibration physical properties

A71-41941

Controlled caloric stimulation of labyrinths in man by water at various temperatures

A71-42583

PHYSIOLOGY

Application of reflected ultrasound to detection of post-operative rejection of heart transplant [NASA-CS-121642]

A71-42050

PILOT ERROR

Epidemiology statistics of USAF spatial disorientation aircraft accidents, noting pilot training, flight environment and indoctrination remedy programs

A71-40359

Physiological factors in fatal aircraft accidents, discussing pilot incapacitation and transient functional disturbances

A71-41834

PILOT PERFORMANCE

Sleep related fatigue in pilot performance and flight safety, considering sleep lack and disruption and irregular duty patterns

A71-40590

Simulated airline pilot cerebral incapacitation etiology, incidence and detection, noting unimpaired crew members conduct and reaction times during approach for landing

A71-41824

In-flight study of work/rest cycle effects on double crew performance and fatigue in flying transport missions

A71-41829

Pilot EKG, behavioral and subjective correlates of natural and drug induced sleep at atypical hours, using calculation and vigilance tests

A71-41835

Military pilot handling characteristics, discussing combat operations, accident prevention and blind landing

A71-42239

Analysis of aviation hazards produced by visual illusions due to spiral aftereffect parameters of perceived size and distance [FAA-AM-71-31]

N71-35254

Physiological effects of alcohol and cockpit illumination levels on pilot performance and flying safety

A71-41836

PILOT SELECTION

Medical rejection statistics of applicants for USA/BOAC pilot training, considering ophthalmic, ear, nose, throat and general health condition

A71-41823

EKG characteristics of cadets and flying personnel, noting spike wave paroxysmal screening and epilepsy detection

A71-41836

PILOT TRAINING

Medical rejection statistics of applicants for USA/BOAC pilot training, considering ophthalmic, ear, nose, throat and general health condition

A71-41823

Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease for further flight training, presenting case histories

A71-41837

PILOTS (PERSONNEL)

World championship gliding team medicophysiological problems during competition at Mars, Texas, discussing climatic adaptation, nutrition, hypoxia and pilots general physical and psychomotor conditions

A71-41576

Military pilot handling characteristics, discussing combat operations, accident prevention and blind landing

A71-42239

PLANTARY ENVIRONMENTS

Infusoria adaptation ability to extreme environmental conditions with emphasis on Mars surface

A71-42625

PLANT

Algae and plankton photosynthesis requirements for optimization of oceanographic resources

A71-35476

Electrical analogy model for ocean ecological system and measurement methods for phytoplankton production

A71-35477

PLANT ROOTS

Hormone movement in geotropism, discussing supronutritional amin content and indoleacetic acid in wheat roots

A71-39981

PLANTS (BOTANY)

Plants and animals reactions to environment gravitational component, showing organisms perception of accelerating force

A71-39970

Gravitational and other forces involved in equilibrium of growing plants, showing gravity sensing ability lower limit existence

A71-39971

Circumnutations in plants under gravitational stimulation

A71-39973

Geotropic stimulus in plants, describing method to test correlations between microscopically visible cell particles and geotropic bending direction

A71-39970
Gravity receptors in lower plants including Phycocystes sporangiophores and Chara rhizoids A71-39975
Gravity receptors in Phycocystes sporangiophores, considering transient and long term geotrophic responses A71-39976
Gravity suspension by higher plants, proving starch statolith hypothesis A71-39977
Gravity suspension by higher plants, analyzing geotonic data for georeception theories A71-39978
Arguments against statolith theory of gravitational perception in plants A71-39980
Auxin transport and geotropic response of roots and shoots, discussing plant growth mechanisms under stimulation-inhibition conditions A71-39982
Linkage mechanism between gravity perceptors and auxin redistribution causing differential growth and geotropic curvatures in plants A71-39983
Geoelectric effects on plants geotropic reaction chain, discussing hormone auxin asymmetric distribution due to gravity A71-39984
External indole-3-acetic acid effect on elongation and geotropic bending of Avena coleoptiles related to auxin induced electrical responses A71-39986
Gravity influence on plant growth, lateral development, apical dominance, bud initiation, orientation and flower morphology A71-39999
Geoeplastic bending of Fritillaria Meleagris axes as a prototype of geocaided plastotropic growth A71-40000
Wheat seedling responses to chronic acceleration, considering total height, coleoptile diameter, root length, sensitivity to growth retardation and histological changes A71-40001
Plants behavioral reactions to continuous gravitational field directional reorientation by clinostat, discussing gravity compensation effects on tropisms and forces required for geotropic response A71-40004
Gravity effects on auxin transport, growth and foliage spread of green plants for efficient radiation capture, using horizontal clinostat experiments A71-40005
Pinto beans circadian leaf movements in simulated weightless environment, relating rotational treatment time to rhythm phase A71-40006
Gravity responses and geotropic behavior at ontogenetic stages of higher green plants, noting tendril movement under mechanical stimulation A71-40008
Hydropic plant cultivation with keramzit substrate, investigating replacement time effect and regenerative power of nutrient solution A71-42816
PLATEHIGHTOGRAPHY
Photoplethysmographic analysis of pulse wave velocity in healthy subjects and in patients with hypertension, heart disease, diabetes and anemia A71-42518
POLYHEBIOLOGY
Solar system organic compounds detection and elimination, considering element, isotope and pigment composition, optical activity and polymerization A71-42824
POSTERIOR SECTIONS
Posterolateral thalamus nucleus neurons response to visual, acoustic and somatic stimuli in cats with microelectrodes A71-42578
POSTFLIGHT ANALYSIS
Postflight histological analysis of turtles aboard Zond 7, noting decrease in cell nuclei size due to space flight conditions adoption A71-40568

POTABLE WATER
Spectrophotometric measurement of iodine concentrations in spacecraft potable water supplies [NASA-CR-115138] A71-35264
Development of bellows-type tasks for long term storage of potable water for space shuttle A71-35273
PRECAMBRIAN PERIOD
Blue-green algae survival or growth ability tests under simulated Precambrian atmospheric conditions A71-42230
PRESERVATIVES
Preservative phenol derivative effects on toxic gas evolution from stored urine in sealed vessels A71-42808
Urine preservatives for urine water recovery system, noting ammonia and organic compound contents in condensate A71-42809
PRESSURE EFFECTS
Physical determinants of gravity receptor mechanisms, discussing hydrostatic stress effects on membranes and gravity influence on enzymatic transport A71-39972
Hyperbaric normoxic breathing helium, nitrogen and neon gas mixture effects on EEG and reaction time in man A71-40347
Aquatic animals tremor response measurement by muscle force transducer during compression and decompression in 520-foot saturation dive, noting differences among individuals A71-40350
Radiation effects on rats peripheral blood state in low pressure environment with sea level value oxygen tension A71-42732
PRESSURE SUITS
Thermal conditions under varying degrees of physical work inside pressure suits [CENA-N-1007] A71-34078
PROBABILITY THEORY
Probability approach to visual effectiveness of signal flashing lights, showing graphically Broca-Sulzer effect A71-41685
PROBLEM SOLVING
Eye movement, mental performance, and problem solving A71-35250
Human thinking studies using problem solving in chess A71-35251
Skin resistance during solution of mental problems A71-35252
Factors creating objective complexity of human problem solving reduced to information processes A71-35253
PRODUCT DEVELOPMENT
Development of MPFR telemetry system to low-duty cycle time burst system [AD-726406] A71-35277
PRODUCTIVITY
Astronaut teleoperators use for space operations cost reduction and future experiments productivity increase A71-42033
PROPELLANTS
Toxicological evaluation of carbon monoxide, atmospheric contaminants, and propellants in environmental pollution [AD-727022] A71-35258
PROPHYLAXIS
Radiation sickness prophylaxis chemical compounds, discussing protection mechanisms, radical inactivation and afflicted cell recovery A71-42710
Prophylactic medication for radiation damage treatment, covering toxicity, pharmacological properties, metabolism, dosage and physiological action A71-42711
PROPHECIES
Eye movement neurophysiology, discussing ocular
Psychological investigations and theory of thinking with four types of intellectual associations
A71-35567

Factors creating objective complexity of human problem solving reduced to information processes
A71-35553

PSYCHOLOGICAL TESTS
Computer generated buffered displays for psychological experiments involving interception, tracking, steering, memory and calculation tasks
A71-40136

Flashing lights attention attraction classification based on experimental results conversion into psychometric scale
A71-41886

Pilot EEG, behavioral and subjective correlates of natural and drug induced sleep at atypical hours, using calculation and vigilance tests
A71-41835

Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease for further flight training, presenting case histories
A71-41837

Visual stimulus control removal and restoration in rhesus monkeys, analyzing test errors
A71-42860

Measurement of effects of stress on air traffic control personnel through use of mood adjective check lists
A71-34067

PSYCHOMETRICS
Flashing lights attention attraction classification based on experimental results conversion into psychometric scale
A71-41846

PSYCHOMOTOR PERFORMANCE
Computer generated buffered displays for psychological experiments involving interception, tracking, steering, memory and calculation tasks
A71-35567

Human perceptual motor skill development in tracking performance, using feedback control system gain and effective time delay as measures
A71-40906

Human adaptive behavior under psychological stress of astronauts tasks posture-motor characteristics, discussing stabilographic platform test results
A71-42861

Healthy male immersion in water containing NaCl, determining modified gravitational field effect on motor functions
A71-42792

PSYCHOPHYSIOLOGY
Psychophysiologico reactions to understimulation and overstimulation, noting catecholamine output, heart rate and performance efficiency in humans
A71-40177

Psychophysiological and conversion mechanisms as unconscious expression of student pilot motivation decrease for further flight training, presenting case histories
A71-41837

PULMONARY FUNCTIONS
Human respiratory oxygen and carbon dioxide partial pressure and dissociation curves for intrapulmonary gas mixing, using mass spectrometry
A71-40098

Pulmonary dissipation of gas emboli produced by oxygen, nitrogen and carbon dioxide intravenous injection in unanesthetized sheep with chronically implanted ultrasonic Doppler flow probes
A71-40362

Pulmonary antibacterial defenses with pure oxygen breathing mice, noting inhibition of early intrapulmonary clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae
A71-42241

Respiratory function and gas metabolism shift under high transverse accelerations in reclined centrifuge subjects
A71-42795

PULSE DURATION
Absolute foveal thresholds as function of flashes pulse length and null period
A71-41480

PULSED RADIATION
Absolute foveal thresholds as function of flashes pulse length and null period
A71-41480
RADIATION SICKNESS

Radiation damage diagnosis in humans, investigating free amino acid excretion with urine by paper chromatography method
A71-12736

Prolonged small radiation dosage effects on vestibular analyzer in normal and antiradiation drug protected dogs
A71-12798

UV radiation effect on amino acids and peptides in different gas atmospheres in presence of salts and metal oxides
A71-12729

RADIATION PROTECTION

Radiation protection drugs effects on albino rats hypoxia resistance, discussing hypoxic hypoxia response to intraperitoneally and perorally administered cysteamine and aminoethylisothiouronium
A71-12704

Radiation sickness prophylaxis chemical compounds, discussing protection mechanisms, radical inactivation and afflicted cell recovery
A71-12710

Prophylactic medication for radiation damage treatment, covering toxicity, pharmacological properties, metabolism, dosage and physiological action
A71-12714

Cysteamine hydrochloride or vitamin B complex with vitamin C for radiation sickness prevention and therapy
A71-12723

Dose acceleration before and after gamma irradiation, determining protective effect of cysteamine in adrenaline and aspematine mixture
A71-12726

Radioprotective effectiveness of cysteamine and S-beta-aminoethylisothiouronium in mice under combined gamma irradiation and transverse acceleration loads
A71-12730

RADIATION SHIELDING

Partial body shielding effects on rats radiation sickness survival rates under gamma-neutron radiation, comparing head and belly shielding effectiveness at different intensities
A71-12716

Reactivity changes to pharmacochecal preparations under total proton and gamma ray irradiation of abdomen and head shielded rats
A71-12717

Head and abdomen shielding effects on radiation sickness evolution in dogs under lethal gamma irradiation
A71-12718

Abdomen shielding effects on chromosomal aberrations in bone marrow cells of guinea pigs and rats under gamma irradiation
A71-12719

High energy proton irradiation of rats with partial shielding of abdominal region, observing pathomorphological changes in myocardium, nervous system and radiosensitive organs
A71-12721

Bat organs pathomorphological changes under gamma neutron irradiation with head and abdomen shielding, noting intestines early damage
A71-12722

RADIATION SICKNESS

Radiation sickness prophylaxis chemical compounds, discussing protection mechanisms, radical inactivation and afflicted cell recovery
A71-12710

Partial body shielding effects on rats radiation sickness survival rates under gamma-neutron radiation, comparing head and belly shielding effectiveness at different intensities
A71-12720

RADIATION DOSE

Chemical agents protective properties on albino mice abdomen shielding effects on chromosome aberrations in bone marrow cells of guinea pigs and rats under gamma irradiation
A71-12710

Cysteamine elimination rates in rats, extending radiation protective action by reinfusion of eliminated portions
A71-12714

Death rates, median life span and weight in mice exposed to gamma radiation after intra-abdominal injections of cysteamine
A71-12712

Chemical agents protective properties on albino mice under gamma-neutron radiation, noting dose and composition effects
A71-12713

Cysteamine elimination rates in rats, extending radiation protective action by reinfusion of eliminated portions
A71-12714
BADIATION THERAPY

Rapid Eye Movement State
Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements and smooth pursuit systems

RADIATION THERAPY

Head and abdomen shielding effects on radiation sickness evolution in dogs under lethal gamma irradiation

White rats resistance to acute anoxic, anemic and histotoxic hypoxia during various phases of radiation sickness, studying adrenal cortex histophysiological state

Radiation Tolerance
Radioprotectants effect on mice against ionizing radiation and tolerance to back-to-chest accelerations in space flight

Living organisms life-sustaining possibility under simulated Martian temperature, humidity and atmospheric composition conditions, emphasizing unicellular organisms radiation resistance

High energy proton irradiation of rats with partial shielding of abdominal region, observing pathomorphological changes in myocardium, nervous system and radiosensitive organs

Mice under combined gamma radiation and vibration and acceleration dynamic factors, studying radioprotection rate

Vibration influence on peripheral blood reaction to gamma radiation in dogs, using clinic-hematological indices

Unicellular organisms increased tolerance to UV radiation, discussing cells repairing ability in dark and pigments and protective compounds screening role

Radio Equipment
Radiolocation equipment used in Interrogation and tracking of aircraft and satellite, using photographic and radar technique [NASA-CR-121893]

Radio Saturate
Soviet book on animals morphophysiological changes in cardiovascular and nervous systems and various internal organs under RF wave exposure

Radiation Isotopes
Measurement of radiation exposure of Apollo 7, 8, 9, and 10 astronauts by determination of radionuclide content of feces and urine [NASA-CR-121860]

Radiobiology
Soviet papers on radiobiological aspects of reactivity of organisms in space flight covering radiation protection drugs, hypoxia, flight conditions, radiation pathology, etc

Composite tissue blocks method for comparative pathomorphological investigation of radiation pathology

Relative biological effectiveness of fast neutrons, allowing for gamma component contribution

Radiology
Spine radiological examination for helicopter pilot fitness determination, discussing spinal weakness symptoms, special exercises, medical examinations and vibration reducing seat construction

Radiopathology
Rat organs pathomorphological changes under gamma and neutron irradiation with head and abdomen shielding, noting intestines early damage

Bioregulation (Extraterrestrial)
Cravitation and other forces involved in equilibration of growing plants, showing gravity sensing ability lower limit existence

SUBJECT INDEX

Rapid Eye Movement State
Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements and smooth pursuit systems

Rats
Monomethylhydrazine effects on glucose carbon metabolism and effects of pure oxygen inhalation in rats [AD-727008]

Reaction Kinetics
Urea hydrolysis reaction rates by urease at low water activity, noting use for Mars surface bioscan

Reaction Time
Hyobaric normoxic breathing helium, nitrogen and neon gas mixture effects on EEG and reaction time in man

Prior muscle exertions effect on reaction time and duration of simple discrete movements, considering electromyogram frequency changes

Reactivity
Reactivity changes to pharmacological preparations under total proton and gamma ray irradiation of abdomen and head shielded rats

Receptors (Physiology)
Visual projection, magnification and retina overlap on dorsal lateral geniculate nucleus in cats measured by random scatter in receptive field

Inhibitory binocular receptive fields in dorsal nucleus of lateral geniculate body for dominant and nondominant eye in cats, using moving slit and flash spot stimulation

Eye movement neurophysiology, discussing ocular proprioception, ocularotatory muscle sensory receptor role, extracocular muscle afferent and efferent innervation and central nervous system control effect

Recognition
Object recognition with aided and unaided night vision as function of luminance

Recording Instruments
Airbone audio-video recording system designs and requirements

Reflexes
Reflex mechanisms and programmed command in insect flight stabilization, discussing gravity proprioceptors, wind sensing and optomotor control

Flying personnel equilibrium tests with a pendulum, arachnoid control, investigating labyrinth reflex by induced nystagmus

Vestibulo-collic reflex control of head movement in seated man under sinusoidal and stepwise rotational velocity stimulation, comparing with ocular stabilization

Neural control organization in vestibulo-ocular reflex arc, considering afferent and oculomotor neural signals

Oculomotor neural organization models, considering vestibular ocular reflex, saccadic eye movements and smooth pursuit system

Sympathetic enhance effects on central nervous system reflex activity of irradiated and demyelinated animals

Regeneration (Engineering)
Artificial ecological regenerative life support system design for space environments, discussing biotechnological properties

Extravehicular activity protection systems, discussing resource regeneration, technology, methodology and space station, lunar base and Martian missions schematic configurations

I-40
Oxidation of water in regeneration under spacecraft conditions, measuring organic impurities degree of oxidation in inhabited cabin atmospheric vapor condensates

**REGENERATION (PHYSIOLOGY)**
Hydroponic plant cultivation with keratin substrate, investigating replacement time effect and regenerative power of nutrient solution

**REINFORCEMENT (PSYCHOLOGY)**
Observing behavior in squirrel monkeys under multiple schedule of reinforcement availability

**RELATIVE BIOLOGICAL EFFECTIVENESS (RBE)**
Relative biological effectiveness of fast neutrons, allowing for gamma component contribution

**RENAI FUNCTION**
Water immersion effect on plasma renin activity, urinary aldosterone excretion and renal sodium and potassium handling in normal men

Antidiuretic action of chlorpropamide in mammalian kidney, considering intracellular infusion effects on intracellular concentration, free water clearance, glomerular filtration and sodium excretion

Hibernation effects on hedgehog electrolyte distributions and renal function, determining Na, K, Mg and Cl concentrations in muscles, liver, kidney, plasma red blood cells and bladder urine

**RESEARCH**
Bioscience research and applications to biological and medical problems

**RESEARCH AND DEVELOPMENT**
Status of LCC program on space shuttle environmental, control and life support systems

**RESEARCH PROJECTS**
Transfer of aerospace technology to nonaerospace problems -NASA project (NASA-CH-121638)

**RESPIRATION**
Human olfactory perception of inspired air composition, noting sensory differentiation improvement with subsequent exposures in space flight training

Isokale vapor inhalation and direct injection into mice, rats and rabbits, examining toxic qualities

**RESPIRATORY PHYSIOLOGY**
Heart rate and atrial pressure variability control through visual feedback of physiological information, obtaining respiratory measurements and ECG

Ganglionides inhibitory effects on active Ca ion transport in rat brain mitochondria, using succinate as respiratory substrate

Physiological relationship of young to old men, considering body composition, aerobic capacity and capillary-muscle fiber ratio

Water immersion or bed rest effects on basic metabolism and external respiration under simulated weightlessness

**RESPIRATORY RATE**
Hypothermia effect on brain nutritive processes and regulatory activity, considering changes in brain blood supply, respiration and carbohydrate metabolism

Respiratory function and gas metabolism shift under high transverse accelerations in reclined centrifuged subjects

Human nitrogen and water-salt metabolism and respiratory activity during prolonged confinement in small volume chamber with cyclic varying hypoxic air

Physiological effects on mice of air pollution with gaseous toxic substances from urine and feces, noting increased respiration rate and choline esterase activity

**RESPIRATORY REFLEXES**
Transient heart rate response to square wave breathing in man under zero G parabolic flight

**RESPIRATORY SYSTEM**
Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment

**REST**
Resting and postexercise apexcardiograms correlation with maximal treadmill stress test, noting mean a-wave ratios

Human response time for urgent signal after operational rest, showing effect of additional activation during waiting period

**RETINA**
Corned-retinal potential as generator of occipital alpha rhythms in human electroencephalograms modulated at 10 Hz by tremor in extracranial muscles

Retinal directional effect measurements confirming mathematical model based on Gaussian distribution of retinal cones orientation, explaining brightness stimuli effectiveness and hue shift

**RETINAL ADAPTATION**
Visual performance and retinal vascular changes under hypobaric elevation and hypoxia, noting stereoscopic, binocular depth perception, critical flicker fusion, dark adaptation, etc

**RETINAL IMAGES**
Visual projection, magnification and retin implicit exposure on dorsal lateral geniculate nucleus in cats measured by random scatter in receptive field

Human cerebral EEG phenomena and evoked potential relationships to eye and retinal image movements

Stochastic model for observing motion of retinal image of target during visual fixation (NASA-CH-121640)

**RHETOR (BIOLOGY)**
Chronobiology purposes, techniques and applications, discussing rhythmic or cyclic variation calculation, biological rhythms spectra and classification and time structure alteration of organisms

Corned-retinal potential as generator of occipital alpha rhythms in human electroencephalograms modulated at 10 Hz by tremor in extracranial muscles

Electric heart activity and ECG mathematical model with nonlinear oscillator system construction for normal and abnormal rhythms

Vectorcardiographic analysis of patients with ECG diagnosed inferior atrial rhythms

Frequency analysis of blood circulation rhythms and oxygen tension fluctuations in cerebra of rabbits, cats, monkeys and men

**RIBONUCLEIC ACIDS**
Human body tissue status normalization in prolonged space flight, investigating ribonucleic acid stimulated antibody formation

Combined and individual effects of UV light, X-ray irradiation and freezing-thawing cycles on ribonucleic acid

**ROCKET EXHAUST**
Crew radiation dose from plume of high impulse gas-core nuclear rocket during Mars mission (NASA-PM-X-67927)

**ROTATING BODIES**
Cat and human eye movement control system measurements, studying isolated ocularobitory muscles and globe restraining tissues dynamics
ROTATING ENVIRONMENTS

Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centripetal force effects on work tasks

Earth-like ecology for habitation in space, considering hollow suilt rotating space chamber for life cycles in controlled weather environment

BURST LIGHTS

Flashing civil aviation lights history, progress and photometric characteristics, discussing navigation and landing aids

SAFETY DEVICES

Extravehicular activity protection systems, Earth-like ecology for habitation in space, Artificial gravity field produced by rotating Halophilic bacteria electron transport chain, Badiolocation equipment used in Interrogation Effective flashes by scintillating Xe arc flash

Five year panel study to determine effects of time DV radiation effect on amino acids and peptides in Spacecraft closed loop oxygen recovery system using electrochemical carbon dioxide concentrator, Sabatier reactor and water electrolysis subsystem

SAFETY DEVICES

Extravehicular activity protection systems, discussing resource regeneration, technology, methodology and space station, lunar base and Martian missions schematic configurations

SATELLITE OBTAINATION

Urine conservation in spacecraft cabin sanitation facilities by phenol-containing preparations, emphasizing PFP method for long period operation

SATELLITE OBTAINATION

Radiolocation equipment used in Interrogation Recording Location System, and results in remote ground, aircraft, and satellite tracking of elk and black bear

[ NASA-CR-121893]

SATELLITE OBTAINATION

Artificial gravity field produced by rotating spacecraft in earth orbit, examining astronaut physical responses and centrifugal force effects on work tasks

SCIATIC REGION

Differential lipid and phospholipid composition of white matter in brain, cervical, thoracic and lumbar sacral sections of spinal cord and sciatic nerve in dogs

SCIENTISTS

Five year panel study to determine effects of time pressure on performance of scientists and engineers

[ NASA-CR-121884]

SCIENTISTS

Effective flashes by scintillating Xe arc flash tube, considering perception by human eye

SEMICIRCULAR CANALS

Semicircular canal and otolith organ function in free swimming fish angular orientation behavior

SENSORY DEPRIVATION

Visual perceptual masking under binocular and dichoptic conditions separating peripheral and central interference effects

Normal female rabbits electrophysiological changes during sensory isolation of water tank variety from EEG, EMG, EEG, EKG and electrodermal measurements, considering cortical activities reduction

SENSORY DISCRIMINATION

Human olfactory perception of inspired air composition, noting sensory differentiation improvement with subsequent exposures in space flight training

SENSORY PERCEPTION

Plants and animals reactions to environment gravitational component, showing organisms perception of accelerating force

Gravitational and other forces involved in equilibrium of growing plants, showing gravity sensing ability lower limit existence

Gravity susceptibility by higher plants, proving starch statolith hypothesis

Gravity susceptibility by higher plants, analyzing geotonic data for georeception theories

SENSORY STIMULATION

Central nervous tissue sensitivity, considering direct sensing of gravitational stimuli of Vibratory character

Taste modalities identification by factor analysis technique based on correlation matrix between independent stimuli

Psychophysiological reactions to understimulation and overstimulation, noting catecholamine output, heart rate and performance efficiency in humans

Functional ability of human tactual analyzer by measuring minimum interval between two discrete controlled stimuli

Posterior lateral thalamus nucleus neurons response to visual, acoustic and somatic stimuli in cats with microelectrodes

SEQUENTIAL ANALYSIS

Sequential, distribution-free pattern classification procedures tested on Gaussian and EEG patterns

[ NASA-CR-121750]

SIGNAL ANALYSIS

Analog computer analysis of EEG wave asymmetry for organism functional state detection illustrated on human reaction response to threshold acoustic stimuli

SIGNAL ANALYZERS

Analog statistical analyzer for measuring one dimensional EEG amplitude distribution functions, illustrating reaction response to threshold acoustic stimuli

SIGNAL TO NOISE RATIOS

Effect of time between transmission, number of transmissions, and signal to noise ratios on sonar operators performance in long range target acquisition

[SIGNAL TO NOISE RATIOS

Effect of time between transmission, number of transmissions, and signal to noise ratios on sonar operators performance in long range target acquisition

SIGNS AND SYMPTOMS

Decompression sickness, investigating surface excursion diving and selection of limb bends vs CNS symptoms by tests on goats

Human ocular control system supranuclear disorder syndromes and signs in terms of physiological concepts

SKIN (ANATOMY)

Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment

Skin resistance during solution of mental problems
<table>
<thead>
<tr>
<th>SUBJECT INDEX</th>
<th>SPACE ORIENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SKIN RESISTANCE</strong></td>
<td><strong>SOYU SPACECRAFT</strong></td>
</tr>
<tr>
<td>Auditory stimulus conditioning of human skin resistance responses on escape-avoidance schedule</td>
<td>Astronaut work capacity and adaptation during long term flight of space vehicle Soyuz 9</td>
</tr>
<tr>
<td><strong>SKIN TEMPERATURE (BIOLOGY)</strong></td>
<td><strong>SPACE ENVIRONMENT SIMULATION</strong></td>
</tr>
<tr>
<td>Mean body temperature computation in neutral and hot environments from rectal and skin temperatures</td>
<td>Living organisms life-sustaining possibility under simulated Martian temperature, humidity and atmospheric composition conditions, emphasizing unicellular organisms radiation resistance</td>
</tr>
<tr>
<td><strong>SLEEP</strong></td>
<td><strong>SPACE FLIGHT</strong></td>
</tr>
<tr>
<td>Human blood pressure in brachial artery during spontaneous eight sleep, recording EEGs and horizontal eye movements</td>
<td>Biomedical effects of Apollo 14 space flight, considering weightlessness adaptation</td>
</tr>
<tr>
<td>Transport aircrew sleep patterns effects on fatigue and sleep disturbances, discussing physiologic debt and stresses</td>
<td>Unfavorable high intensity noise effects on auditory and motor analyzers during space flight</td>
</tr>
<tr>
<td>Young adult males split-period sleep regimes dependence on intervening wakefulness time interval, periods length and onset sidereal time</td>
<td>Aspects of sleep disorders in space flight and space flight training</td>
</tr>
<tr>
<td><strong>SLEEP DEPRIVATION</strong></td>
<td><strong>SPACE FLIGHT FEEDING</strong></td>
</tr>
<tr>
<td>Sleep related fatigue in pilot performance and flight safety, considering sleep lack and disruption and irregular duty patterns</td>
<td>Manned spacecraft life support system dehydrated food ration effects on human organisms health, metabolism and immunoreactivity during long space flight</td>
</tr>
<tr>
<td>Physiological effects of sleep deprivation produced by simulated aircraft noise</td>
<td>Nutritional evaluation of Apollo diets and gnotobiological study of mice having diets with limited microflora</td>
</tr>
<tr>
<td><strong>SMOOTHING</strong></td>
<td><strong>SPACE FLIGHT STRESS</strong></td>
</tr>
<tr>
<td>Volume, diaphragm elasticity and area, orifice area, and I/D ratio effects on pulsation dampener efficiency for smoothing personal respirable dust sampler flows</td>
<td>Astronaut work capacity and adaptation during long term flight of space vehicle Soyuz 9</td>
</tr>
<tr>
<td><strong>SOCIAL ISOLATION</strong></td>
<td><strong>SPACE FLIGHT TRAINING</strong></td>
</tr>
<tr>
<td>Human microflora variation in long term confinement, examining anaerobic and aerobic microorganisms responses</td>
<td>Radioprotectants effect on mice against ionizing radiation and tolerance to back-to-chest accelerations in space flight</td>
</tr>
<tr>
<td>Microbial contamination of human skin and upper respiratory tract during long term isolation in sealed environment</td>
<td>Soviet papers on radiobiological aspects of reactivity of organisms in space flight covering radiation protection drugs, hypoxia, flight conditions, radiation pathology, etc</td>
</tr>
<tr>
<td>Bacterial contamination in confined sealed space during long term human occupation, observing homolytic microflora spreading dynamics on bodies, clothes, wall and air</td>
<td>Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and medication sensitivity</td>
</tr>
<tr>
<td>Prolonged manned space flight infectious disease hazards, discussing confinement, zero gravity, high oxygen content, personal hygiene, waste disposal and preflight immune status</td>
<td><strong>SPACE MISSIONS</strong></td>
</tr>
<tr>
<td>Time sense modifications among human groups isolated in underground environment and deprived of timekeeping means, evaluating average individual behavior</td>
<td>Stereophotogrammetric measurement of body and limb volume changes after prolonged space mission</td>
</tr>
<tr>
<td><strong>SOLAR SYSTEM</strong></td>
<td><strong>CREW</strong></td>
</tr>
<tr>
<td>Solar system organic compounds detection and evaporation, considering element, isotope and pigment composition, optical activity and polymerization</td>
<td>Astronaut teleoperators use for space operations cost reduction and future experiments productivity increase</td>
</tr>
<tr>
<td><strong>SONAR</strong></td>
<td><strong>CREW Radiation</strong></td>
</tr>
<tr>
<td>Effect of time between transmission, number of transmissions, and signal to noise ratios on sonar operators performance in long range target acquisition</td>
<td>Crew radiation dose from plume of high impulse gas-core nuclear rocket during Iores mission</td>
</tr>
<tr>
<td><strong>SORBENTS</strong></td>
<td><strong>SPACE ORIENTATION</strong></td>
</tr>
<tr>
<td>Decontaminating methods for water regenerated from urine under space flight conditions by filtering water condensate through sorbents</td>
<td>Proprioceptive gravity perception in bees and swallows, noting joint located hair plates and constant angle space orientation in dark</td>
</tr>
<tr>
<td><strong>SOUND INTENSITY</strong></td>
<td><strong>GRAVITY</strong></td>
</tr>
<tr>
<td>Comparative residual and reversed microinterval masking signals and human auditory perception capacity measurements using sound level estimates</td>
<td>Gravity receptors and locomotion orientation in Crustacea, discussing statocyst, stimulation, input and compensatory eye movements with respect to gravitational field</td>
</tr>
<tr>
<td><strong>SOUND WAVES</strong></td>
<td><strong>GRAVITY</strong></td>
</tr>
<tr>
<td>Jet and turbulence mechanism of vascular surrus associated with stenosis for minimum flow Reynolds numbers, using aorta orifice plates in dogs</td>
<td><strong>GRAVITY</strong></td>
</tr>
</tbody>
</table>

---

I-43
Functional anatomy of vertebrate gravity receptor system in spatial orientation, discussing otolith organs, sensory cells and hair cell topography in elasmobranch labyrinth

Epidemiology statistics of USSF spatial disorientation aircraft accidents, noting pilot training, flight environment and indoctrination remedy progress

Perceived distance effect on induced movement from stereoscopic cues

Depth perception variability under central and peripheral illumination conditions, using Duscan multiple range test for data analysis

Manned spacecraft life support system dehydrated food cation effects on human organisms health, metabolism and immunoreactivity during long space flight

Conference on space shuttle environmental control and life support systems - Vol. 2

Environmental control and life support system for space shuttle orbiter

Design, fabrication, and tests of energy absorbing seat integrated with extraction tractor rocket for space shuttle

Liquid spray flash evaporator for space shuttle thermal control

Cargo handling, transfer, and stowage under weightlessness conditions of space shuttle

Environmental control and life support subsystems for space shuttle orbiter

Status of LRC program on space shuttle environmental control and life support systems

Development of hollow-type tanks for long term storage of potable water for space shuttle

Incipient fire and toxic gas caution and warning system for space shuttles

Fire prevention, protection, and fighting systems at ESC for space shuttle operations

Spacecraft cabin artificial atmospheric composition and variation effects on human immunocompetence, examining lymphoid cell immunity reactions after lymphocytes blast transformations

Oxidation of water in regeneration under spacecraft conditions, measuring organic impurities degree of oxidation in inhabited cabin atmospheric vapor condensates

Manned 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities

Urine conservation in spacecraft cabin sanitation facilities by phenol-containing preparations, emphasizing PNF method for long period operation

Decontamination of spacecraft components with ethylene oxide as function of parameters of gas concentration, time, temperature, and relative humidity

Microorganisms under closed environmental ecological conditions with reference to astronauts infectious diseases, discussing bacteria growth in Biosatellite 2 and earth based closed chamber experiments
**SUBJECT INDEX**

- [NASA-CS-121668] A71-40503
- Simulated Martian environment effects on terrestrial microorganisms survival A71-42227

- **STAPHYLOCOCCUS**
  - Pulmonary antibacterial defenses with pure oxygen breathing mice, noting inhibition of early interpulmonary clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae A71-42241

- **STATISTICAL ANALYSIS**
  - Probability approach to visual effectiveness of signal flashing lights, showing graphically Broca-Salter effect A71-41495
  - Statistical analysis of effects of acclimatization on hematopoiesis of Antarctic expeditionary personnel [JIPSS-53668] A71-43063

- **STEREOGRAPHY**
  - Stereophotogrammetric measurement of body and limb volume changes after prolonged space mission A71-41861

- **STEREOSCOPY**
  - Retinal distance effect on induced movement from stereoscopic cues A71-41199

- **STOCHASTIC PROCESSES**
  - Stochastic model for observing motion of retinal image of target during visual fixation [NASA-CS-121640] N71-34071
  - Storage tanks: Development of bellows-type tanks for long term storage of potable water for space shuttle N71-35273

- **STRESS (PHYSIOLOGY)**
  - Resting and postexercise apexcardiogram correlation with maximal treadmill stress test, noting mean a-wave ratios A71-40406
  - Rat plasma creatine phosphokinase activity, hyperthermia and stress, considering cold restraint A71-41938
  - Analysis of psychological and physiological variables for predicting human performance during extended periods of stress N71-35236
  - Five year panel study to determine effects of time pressure on performance of scientists and engineers [NASA-CS-121884] N71-35261

- **STRESS (PSYCHOLOGY)**
  - Human adaptive behavior under psychological stress of astronauts task posture-motor characteristics, discussing stabilographic platform test results N71-42041
  - Physiological and psychological reactions to sonic boom and effects on efficiency of air traffic control personnel [FAA-AM-71-29] A71-43068

- **STROBOSCOPE**
  - Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness A71-41993

- **SUBMERGING**
  - Water immersion effect on plasma resin activity, urinary aldosterone excretion and renal sodium and potassium handling in normal man A71-41720
  - Healthy male immersion in water containing NaCl, determining modified gravitational field effect on motor functions A71-42792
  - Water immersion or bed rest effects on basic metabolism and external respiration under simulated weightlessness A71-42794

- **SURFACE REACTIONS**
  - Thermal combustion produced biocomplex vegetable waste mineralization effect on furnace working surface oxide film A71-42821

- **SURVIVAL**
  - Bacterial spores survival under simulated lunar surface conditions, comparing results with vegetable cells experiments A71-40507

- **SURVIVAL**
  - Survival of freshwater polychaetes, noting inhibition of early interpeduncular clearance of Staphylococcus aureus and enhanced clearance of Klebsiella pneumoniae A71-42241

- **SYMBOLS**
  - Character size, case and symbol generation effects on CRT display search time A71-42195

- **SYMPATHETIC NERVOUS SYSTEM**
  - Parasympathetic inhibition effects on hyperkinetic borderline hypertension: measuring cardiac output, resting heart rate and intraarterial blood pressure A71-40407
  - Hypoxia and hypercapnia induced anphetic differentiation of cutaneous and visceral sympathetic activity in anesthetized paralized rabbits A71-40629
  - Cardiac sympathetic nervous control of right ventricular pressure-flow dynamics in outflow tract in anesthetized dogs A71-41522

- **SYSTOLIC PRESSURE**
  - Heart rate and systolic pressure variability control through visual feedback of physiological information, obtaining respiratory measurements and ECG A71-41037
  - Cardiac sympathetic nervous control of right ventricular pressure-flow dynamics in outflow tract in anesthetized dogs A71-41522

- **TACTILE DISCRIMINATION**
  - Functional lability of human tactual analyzer by measuring minimum interval between two discrete controlled stimuli A71-41064

- **TARGET ACQUISITION**
  - Visual performance in simulated target acquisition tasks as function of flare-ignition altitude A71-42196
  - Effect of time between transmissions, number of transmissions, and signal to noise ratio on sonar operators performance in long range target acquisition [AD-726741] A71-42581

- **TARGET RECOGNITION**
  - Prefrontal cortex lesions effect on trained anticipatory visual target fixation in cats, noting performance impairment in voluntary eye movement control A71-40174
  - Analysis of ability of human subjects to visually identify targets at various distances of observation [FOA-2-C-2375-72] A71-35257

- **TASK COMPLEXITY**
  - Human performance as function of task and environmental factors, using psychological and physiological references A71-42193

- **TASKS**
  - Aircraft noise effects on hearing acuity and perceptual and intellectual judgment tasks A71-40351

- **TASTE**
  - Taste modalities identification by factor analysis A71-40351
TELEOPERATORS
Transfer of aerospace technology to non-aerospace problems - NASA project
[NASA-CR-121560] N71-34072
Technological utilization in biomedical areas, particularly for infants and handicapped persons
[NASA-CR-121567] N71-34070
Transfer of aerospace technology to non-aerospace problems - NASA project
[NASA-CR-121568] N71-34072
Utilization of electronic and computerized techniques for undergraduate medical education
[CR-6180-BLBB] N71-34081
TELEMETRY
Miniature biopotential transmitter suitable for telemetry, giving ECG and circuit and performance characteristics
A71-60184
TELEOPERATORS
Astronaut teleoperators use for space operations cost reduction and future experiments productivity increase
A71-60233
TEMPERATURE CONTROL
Automatic temperature control for liquid cooling garments used during astronaut extravehicular activity with external auditory meatus, and skin temperature as input signals
[NASA-CR-115621] N71-34077
Liquid spray flash evaporator for space shuttle thermal control
N71-35269
TEMPERATURE EFFECTS
Physiological responses to head and neck vs trunk and leg cooling under hyperthermic stress
A71-60356
Sensory transmission of spinal heat and cold sensitivity in ascending spinal neurons of anesthetized cats
A71-60630
Cutaneous and intestinal blood flow differentiation during hypothalamic heating and cooling in anesthetized dogs
A71-60632
Low temperature effects on succinate oxidase activity of alchocorial blood in hibernating squirrels
A71-60854
Ambient temperature effects on spontaneous rewarming of ground squirrels during awakening after hibernation
A71-42562
Gaseous sodium composition and multiple freezing temperature effects on catalase activity
A71-62831
Moisture effects on thermal inactivation of microbial spores for spacecraft sterilization
[NASA-CR-121920] N71-35239
TEMPERATURE MEASUREMENT
Mean body temperature computation in neutral and hot environments from rectal and skin temperatures
A71-4723
TEST CHAMBERS
Manned 90 day test of closed chamber regenerative life support system simulator, describing subsystems, crew nutrition, hygiene, maintenance and leisure activities
A71-92043
THALAMUS
Arousal and activation in nonspecific reticulo-thalamo-cortical systems due to underlying emotion expressed through cortical, visceral and somatosensory channels
A71-60267
Posterolateral thalamus nucleus neurons response to visual, acoustic and somatic stimuli in cats with microelectrodes
A71-62578
THERMAL ENVIRONMENTS
Thermal conditions under varying degrees of physical work inside pressure suits
[CR-41-6077] N71-34078
THERMOREGULATION
Ambient temperature effects on spontaneous rewarming of ground squirrels during awakening after hibernation
A71-42582
THIOLS
Mercaptoalkylamine group radiation protection preparations on resistance of rats and mice to lateral acceleration rate
A71-42700
Aminothiol group radioprotective drugs effect on guinea pigs cardiac function during lateral acceleration
A71-42702
Aminothiol class radiation protector influence on tissue damage of white rats under single and two-fold gamma irradiation at various test conditions
A71-42729
THROMBIOSIS
Radioprotective effectiveness of cysteamine and S beta-aminothioetheroethanes in mice under combined gamma irradiation and transverse acceleration loads
A71-42730
THRESHOLDS (PERCEPTION)
Visual processes involved in flash perception, considering attention attraction at suprathreshold levels, unreliability at threshold levels and latency effects
A71-41477
Subjective brightness of flashing light stimulus within fovea as function of stimulus size, noting edge effects contribution at suprathreshold levels
A71-41478
Flash threshold perception in relation to flicker, showing flicker/flash sensitivity ratio constancy over large intensity level range
A71-41479
Absolute foveal thresholds as function of flash pulse length and null period
A71-41480
Flashing lights effective intensity at threshold and suprathreshold levels, discussing Broca- Sulzer effect observance conditions
A71-41484
Flashing lights vision threshold systematic variations, using quadrant adaptometer for continuous tracking of sensitivity fluctuations
A71-41498
THROMBOSIS
Thrombi growth in stagnation point flow of fresh blood
[NASA-CR-121668] N71-34053
THYROXINE
Thyroxine effects on brain glutaminase isoenzymes interaction and desamidation in somatochondrial fractions, comparing with sodium phosphate, bicarbonate and aspartate
A71-41069
TIME DEPENDENCE
Young adult males split-period sleep regimes dependence on intervening wakefulness time intervals, periods length and onset sidereal time
A71-40348
Time varying aircraft noise effect on speech intelligibility, discussing test for relation to articulation index
A71-40709
TIME DISCRIMINATION
Time scene modifications among human groups isolated in underground environment and deprived of timekeeping means, evaluating average individual behavior
A71-41577
TIME LAG
Bicarbonate requirement for elimination of lag period of cheosautrophically grown Hydrogenomonas eutrophs
A71-40213
Human eye-tracking phase lags representation by time delays depending on target motion class
A71-42451
TIME MEASUREMENT
Chronobiology purposes, techniques and applications, discussing rhythmic or cyclic variations calculation, biological rhythms spectra and classification and time structure alteration of organisms
A71-40149
TIME RESPONSE
Hypoxia effects on response time to peripheral visual signals, noting direct relation to exposure
A71-40149
TOXIC DISEASES

**TOXIC TISSUES (BIOLOGY)**

Central nervous tissue sensitivity, considering direct sensitization of gravitational stimuli of vibratory character

Intracellular pH and carbon dioxide combining curve of muscle tissue in dogs, using BTO method

Cat and human eye movement control system measurements, studying isolated oculocutaneous muscles and globe restraining tissues dynamics

Aminothiol class radiation protectors influence on tissue damage of white rats under single and two-fold gamma irradiation at various test conditions

Composite tissue blocks method for cooperative pathomorphological investigation of radiation pathology

Hyperoxic media effects on experimental animal cells, tissues and organs morphology, infrastructure and histochemistry

**TOLERANCES (PHYSIOLOGY)**

Lateral accelerations effect on mice tolerance to toxic doses of amphetamine- and indolylalkylamine-series radiation protection drugs

Healthy males immersion in water containing NaCl, determining modified gravitational field effect on motor functions

Toxic gaseous compounds effects on low pressure tolerance of rats under hypoxic hypoxia in atmosphere containing polymer decomposition products

Animal tolerance to carbon monoxide, nitrogen oxide, triethylamine and freon-12 toxic effects after adaptation to hypoxia from tests on albino mice

**TOXIC DISEASES**

Toxic biological effects of life functions gaseous products in albino rats

**TOXIC SHEARS**

Time of useful function after mice exposure to life threatening toxic mixtures of carbon monoxide, carbon dioxide and ammonia produced by combustion

Toxic gaseous compounds effects on low pressure tolerance of rats under hypoxic hypoxia in atmosphere containing polymer decomposition products

Physiological effects on mice of air pollution with gaseous toxic substances from urine and feces, noting increased respiration rate and choline esterase activity

Incipient fire and toxic gas caution and warning system for space shuttles

**TOXICITY**

Preservative phenol derivative effects on toxic gas evolution from stored urine in sealed vessels

Animal tolerance to carbon monoxide, nitrogen oxide, triethylamine and freon-12 toxic effects after adaptation to hypoxia from tests on albino mice

Indole vapor inhalation and direct injection into mice, rats and rabbits, examining toxic qualities

Human expired air toxicity effect on mice neurohumoral changes stimulating inhibitory reactions in central nervous system

**TOXICOLOGY**

Toxicological evaluation of carbon monoxide, atmospheric contaminants, and propellants in environmental pollution

Human perceptual motor skill development in tracking performance, using feedback-control-system gain.

and effective time delay as measures

**TRAINING DEVICES**

Training cycle in altitude chamber for human adaptation to hypoxia, high temperatures and transverse myogenic loads

**TRANSIENT RESPONSE**

Gravity receptors in Phycomyces sporangiophores, considering transient and long term geotropic responses

Vergence eye movements control, discussing transient and frequency responses

**TRANSMITTERS**

Miniature biopotential transmitter suitable for telemetry, giving ECG and circuit and performance characteristics

**TRANSIT PROPERTIES**

Auris transport and geotropic response of roots and shoots, discussing plant growth mechanisms under stimulation-inhibition conditions

**TRANSVERSE ACCELERATION**

Dogs peripheral blood reaction to complex action of transverse accelerations and gamma irradiation

**THRASHELLS**

Recovery and postexercise apexcardiogram correlation with maximal treadmill stress test, noting mean a-wave ratios

**THERMOS**

Aquannauts temperature measurement by muscle force transducer during compression and decompression in 520-foot saturation dive, noting differences among individuals

**TROPISM**

Plants behavioral reactions to continuous gravitational field directional reorientation by clinostat, discussing gravity compensation effects on tropism and forces required for geotropic response

Pinto beans circadian leaf movements in simulated weightless environment, relating rotational treatment time to rhythm phase

**TRYPTAMINES**

Serotonin and gamma-aminobutyric acid loss and interaction in rat midbrain slices incubated in media containing Na, K and Ca ions

**TURTLES**

Postflight histological analysis of turtles aboard Zond 7, noting decrease in cell nuclei size due to space flight conditions adaptation

**ULTRAVIOLET RADIATION**

Space environment simulation for ultrahigh vacuum effects on crystalline enzymes activity, measuring by chemiluminescence techniques

Application of reflected ultrasound to detection of post-operative rejection of heart transplant

Ultrasound use in physiological and pathophysiological experiments on human organisms, considering ultrasonic vibration physical properties

Scanning ultrasonic imaging technique for in vivo monitoring of microscopic bubble formation in decompression sickness, presenting image displays

Unicellular organisms increased tolerance to UV radiation, discussing cells repairing ability in dark and pigments and protective compounds screening role
UNCONSCIOUSNESS

UV radiation effect on amino acids and peptides in different gas atmospheres in presence of salts and metal oxides

Combination and individual effects of UV light, X ray irradiation and freezing-thawing cycles on ribonucleic acid

Potential epilepsy determination in flight personnel, suggesting systematic EEG with hyperventilation and photic stimulation tests and personal history data of head trauma and unconsciousness

UNIVERSITIES

Articles concerning undergraduate education in biological sciences

VASCULAR SYSTEM

Human vascular and extravascular fluid changes during six days bedrest based on fluid volume and ideal body weight from individual heights

VASODILATION

Coronary dilating substances of low molecular weight separated through dialysis from hypothalamic protein carriers

VECTORCARDIOGRAPHY

Vectorcardiographic analysis of patients with ECG diagnosed inferior atrial rhythms

VEGETABLES

Thermal combustion produced biocomplex vegetable waste immobilization effect on furnace working surface oxide film

VESTIBULARES

Functional anatomy of vertebrate gravity receptor system in spatial orientation, discussing otolith organs, sensory cells and hair cell topography in elasmobranch labyrinths

VESTIBULAR

USAF aeromedical consultation service experience on vertigo cases covering symptoms and related diseases

Alcohol ingestion effects on vertigo and nystagmic vestibular responses to angular acceleration, considering visual fixation and alertness control

Vertigo due to increased middle ear pressure, discussing etiology from experience of aeromedical consultation service

VESTIBULAR TESTS

Vestibular apparatus effect on brain stem somatic activity

Bull frog activity at rest and response to centripetal acceleration by on-board centrifuge in vestibular space experiment OP-1

Vestibulo-collic reflex control of head movement in seated man under minoxidial and stepwise rotational velocity stimulation, comparing with ocular stabilization

Habituation and suppression of vestibuloocular vertical nystagmic responses to Coriolis stimulation in pentathlon athletes, comparing to pilots and airman trainees

Alcohol ingestion effects on vertigo and nystagmic vestibular responses to angular acceleration, considering visual fixation and alertness control

Central pathway connection between vestibular and oculomotor nuclei through pons responsible for horizontal eye movements induced by visual and vestibular stimuli

VESTIBULAR AND PROPRIOCEPTIVE STABILIZATION OF EYE MOVEMENTS

Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and medication sensitivity

Visual and vestibular analyzers interaction, noting reduction in duration of counterrotation illusion and postrotation nystagmus in humans

Prolonged small radiation dosage effects on vestibular space experiment OFO-1

Central vestibular and proprioceptive stabilization of eye movements

VESTIGES

Gravity sensing mechanisms of inner ear, discussing steteceptors existence in vestibular
WORD INDEX

VIABILITY
VIRUSES
VIDEO EQUIPMENT
VIEW EFFECTS
VISUAL ACCOMMODATION
VISUAL ACUITY
VISUAL DISCRIMINATION
VISUAL EFFECTS
VISUAL FIELDS

Test field size, brightness and retinal location effect on observer assessment of stimulus at subthreshold frequencies, flicker suggesting inherent clock mechanisms within human brains

VISUAL OBSERVATION
 _Stochastic model for observing motion of retinal image of target during visual fixation

VISUAL PERCEPTION

Visual perceptual masking under binocular and dichoptic conditions separating peripheral and central interference effects

Effect on accommodation under conflicting cues, using laser scintillation measurement

Light flux spatial coherence in visual perception, considering aventurine spots perception as point light source

Peripheral visual field and perceptual factors

Flashing lights perception and application - Conference, London, April 1971

Visual processes involved in flash perception, considering attention attraction at suprathreshold levels, unreliability at threshold levels and latency effects

Flash threshold perception in relation to flicker, showing flicker/flicker sensitivity ratio constancy over large intensity level range

Depth perception variability under central and peripheral illumination conditions, using Duncan multiple range test for data analysis

Flash light angular size, adaptation luminance, pulse shape and color effects on Blondel-Rey constant tested on observers with good binocular vision

Flashing lights attention attraction classification based on experimental results conversion into psychoacoustic scale

Apparent motion effects associated with stationary flashing lights configurations, noting frequency response characteristics analogous to motion effects in human visual system model

Successively presented flashing lights detection, discrimination and brightness measurements with four channel binocular Maxwellian viewing system

Color defective vision and aviation color signals, noting direct relation to exposure severity and duration

Effective flashes by scintillating Xe arc flash tube, considering perception by human eye

Flashing lights vision threshold systematic variations, using quadrant adaptometer for continuous tracking of sensitivity fluctuations

Visual performance and retinal vascular changes under hypobaric elevation and hypoxia, noting stereopsis, binocular depth perception, critical flicker fusion, dark adaptation, etc

Eye movement effect on visual system input and information use in perception

Physical and physiological aspects of visual optics in space flight

Visual performance compared using highly illuminated CRT similar to those encountered in high altitude
Phenomenal flight in direct sunlight
[NASA-CP-114651] N71-34073
Correlation of color blindness tests with ability to recognize aviation color signal light flashes
[FPA-AM-71-1-37] N71-35240
Analysis of aviation hazards produced by visual illusions due to spiral aftereffect parameters of perceived size and distance
[FPA-AM-71-31] N71-35254
Analysis of ability of human subjects to visually identify targets at various distances of observation
[FOA-2-C-2375-72] N71-35257

VISUAL STIMULI
Probability approach to visual effectiveness of signal flashing lights, showing graphically Broca-Seizer effect
Hyposia effects on response time to peripheral visual signals, noting direct relation to exposure severity and duration

VISUAL TASKS
Subjective brightness of flashing light stimulus within fovea as function of stimulus size, noting edge effects contribution at suprathreshold
Flash light angular size, adaptation luminance, character size, case and symbol generation effects on CRT display search time
Visual performance in simulated target acquisition tasks as function of flare-ignition altitude

VOSTOK 2 SPACECRAFT
Vostok 2 spacecraft physiological data, presenting heart beat, respiration rates, oculomotor activity and blood composition

WAKEFULNESS
Young adult males split-period sleep regimes dependence on intervening wakefulness time interval, periods length and onset sidereal time

WARNING SYSTEMS
Canadian Forces experiments on aircraft flashing lights covering warning signals, navigation and anticollision displays and autokinetic phenomena
Strobe lighting for aircraft midair collision hazard reduction, comparing Collision Avoidance System and Pilot Warning Indicator effectiveness
Incipient fire and toxic gas caution and warning system for space shuttles

WASTE DISPOSAL
Urine conservation in spacecraft cabin sanitation facilities by phenol-containing preparations, emphasizing P6F method for long period operation

WASTE UTILIZATION
Oxidation of water in regeneration under spacecraft conditions, measuring organic impurities degree of oxidation in inhabited cabin atmospheric vapor condensates

Decontaminating methods for water regenerated from urine under space flight conditions by filtering water condensate through sorbents
Biologically mineralized human waste products utilization in nutrient solutions for higher and lower autotrophs cultivation
Human waste product utilization possibility through mineralization by wet combustion method

WATERS
Physiological effects on mice of air pollution with gaseous toxic substances from urine and feces, noting increased respiration rate and choline esterase activity
Thermal combustion produced biocomplex vegetable waste mineralization effect on furnace working surface oxide film

WATER
Growth hydrolysis reaction rates by urease at low water activity, noting use for Mars surface bioassay
Nonaqueous biosystems likelihood from consideration of enzymatic activity possibility and liquid water unique ability for complexity required by carbonaceous biosystems

WATER BALANCE
Human nitrogen and water-salt metabolisms and respiratory activity during prolonged confinement in small volume chamber with cyclic varying hypoxic air

WATER INTAKES
Diurnal water and food intake and body weight changes pattern in rats with hypobulamic lesions

WATER MANAGEMENT
Oxidation of water in regeneration under spacecraft conditions, measuring organic impurities degree of oxidation in inhabited cabin atmospheric vapor condensates
Development of bellows-type tanks for long term storage of potable water for space shuttle

WATER RECLAMATION
Urine preservatives for urine water recovery system, noting amonia and organic compound contents in condensate
Decontaminating methods for water regenerated from urine under space flight conditions by filtering water condensate through sorbents

WAVEFORMS
Flash light angular size, adaptation luminance, pulse shape and color effects on Blondel-Rey constant tested on observers with good binocular vision

WEIGHTLESSNESS
Biosatelites 2 onboard experiments studying weightlessness effects on biological processes and interaction with radiation from Sr 85 gamma ray source
Transient heart rate response to square wave breathing in man under zero G parabolic flight
Biomedical effects of Apollo 14 space flight, considering weightlessness adaptation
Human orthostatic and vestibular stability responses to weightlessness during extended space flights noting acceleration tolerance, physical efficiency, infection resistance and sedication sensitivity
Restrain system for exerciser used under zero gravity conditions or earth atmosphere in unconventional positions
Cargo handling, transfer, and stowage under weightlessness conditions of space shuttle
SUBJECT INDEX

WEIGHTLESSNESS SIMULATION
Pinto bean circadian leaf movements in simulated weightless environment, relating rotational treatment time to rhythm phase
A71-35270

Water immersion or bed rest effects on basic metabolism and external respiration under simulated weightlessness
A71-40066

WORK CAPACITY
Astronaut work capacity and adaptation during long term flight of space vehicle Soyuz 9
A71-42794

WORK-REST CYCLE
Trace processes as basis for efficiency change during exercise and active rest
A71-40259

In-flight study of work/rest cycle effects on double crew performance and fatigue in flying transport missions
A71-41829

X

X RAY IRRADIATION
Combined and individual effects of UV light, X ray irradiation and freezing-thawing cycles on ribonuclease
A71-42830

X RAYS
Gangliosides and cerebrosides content in rat brain under normal conditions, during hypoxia and under small X ray doses action
A71-41057

White rats resistance to acute anoxic, anemic and histotoxic hypoxia during various phases of X radiation sickness, studying adrenal cortex histophysiological state
A71-42731

XENON
Effective flashes by scintillating Xe arc flash tube, considering perception by human eye
A71-41492

Z

ZOND 7 SPACE PROBE
Postflight histological analysis of turtles aboard Zond 7, noting decrease in cell nuclei size due to space flight conditions adaptation
A71-40568
## Personal Author Index

**AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Suppl. 96) DECEMBER 1971**

### Typical Personal Author Index Listing

<table>
<thead>
<tr>
<th>PERSONAL AUTHOR</th>
<th>TITLE</th>
<th>REPORT NUMBER</th>
<th>ACCESSION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHLEY, A.</td>
<td>Physiologic responses to short duration G sub z</td>
<td>AD-710986</td>
<td>N71-10662</td>
</tr>
</tbody>
</table>

The title of the document is used to provide the user with a brief description of the subject matter. The NASA or AIAA accession number is included in each entry to assist the user in locating the abstract in the abstract section of this supplement. If applicable, a report number is also included as an aid in identifying the document.

### A

| ABIDIN, B. I. | Effect of some toxic gaseous compounds on the stability of animals under acute hypoxic hypoxia | A71-42806 |
| ABEND, C. | Using alternating displays to improve operator performance | A71-14136 |
| ADOM, W. E. | Central nervous responses to gravitational stimuli | A71-39997 |
| AGER, H. W., JH. | Variables associated with split-period sleep regimes | A71-40346 |
| AICHAH, A. | The significance of alpha-glycero phosphate and 2,3-diphosphoglycerate in human extracellular muscle metabolism | A71-40059 |
| AFRATEFA, S. A. | Toxic effects of gaseous products of the organism's vital activity | A71-42811 |
| AKOPAN, Y. P. | Age-dependent changes in the free amino acid content of the cerebral arteries and carotid artery in man and in dogs | A71-41107 |
| ALBENS, C. | Intracellular pH and CO2 combining curve of skeletal musculature in dogs | A71-40631 |
| ALLENE, T. H. | Absolute thresholds as a function of pulse length and null period | A71-41480 |
| ALLETT, H. P. | Comparison of the encephalographic, behavioral and subjective correlates of natural and drug-induced sleep at atypical hours | A71-41835 |
| ALTMANN, H. | The significance of alpha-glycero phosphate and 2,3-diphosphoglycerate in human extracellular muscle metabolism | A71-40059 |

| AMBROSE, C. A. | Bicarbonate requirement for elimination of the lag period of hydrocarbonomass eutropha | A71-40213 |
| AMAN, N. H. | Influence of preliminary administration of the radiation protector phopham on the reactivity of tissues of irradiated animals under various test conditions | A71-42729 |
| ANDERSEN, H. T. | A fifth modality of taste | A71-40073 |
| ANDERSON, F. J. | The physics of gravity and equilibrium in growing plants | A71-39971 |
| ANDERSON, J. | Continuous dynamic sampling calorimeter for measurement in man | A71-42155 |
| ANDREWS, F. R. | Temperature and performance of scientists and engineers: a five-year panel study | A71-35261 |
| ANDERSON, R. | The concept of time experienced among small human groups isolated in an underground environment | A71-41577 |
| ANGERMEY, I. D. | Survival and mutability of Chlorella aboard the Zoand vehicles | A71-40566 |
| ANIKIN, R. V. | Changes in the colicinogenic and hemolytic activities of Escherichia isolated from man during long-term confinement | A71-40558 |
| ANNAKOV, B. V. | Chemical prophylaxis of radiation sickness | A71-42710 |
| ANSCHEN, R. D. | Pharmacological properties of prophylactic medication of radiation damages | A71-42711 |
| ANSTEIN, R. D. | Experiments with microorganisms and human cell cultures in the Zoand 5 and Zoand 7 flights | A71-40565 |
| ANTOYOV, V. V. | Study of reactivity of the organism exposed to transverse accelerations and radioprotectants | A71-40345 |
| ANTOYOV, V. V. | Study of reactivity to transverse accelerations and radioprotectants | A71-40531 |
| Tolerance of mice to aminothiol- and indolylalkylamine-series radiation-protective drugs in the after-effects period following lateral accelerations | A71-42706 |
| Radiation-protective action of cystamine under different conditions of gamma irradiation | A71-42712 |
| Effect of gamma emission on the elimination of the toxic effect of cystamine | A71-42715 |
| Changes in the reactivity of animals to certain pharmacocological preparations when parts of the body are shielded during total irradiation | A71-42717 |
| Pathomorphological changes in the organs of white rats, subjected to irradiation by 120-MeV protons and the role of partial shielding in the attenuation of radiation damage | A71-42721 |
PERSONAL AUTHOR INDEX

BERTONI, R.  
Equilibrium tests with the aid of the pendulum arachair as applied to flying personnel  A71-41570

BILLINGS, C. E.  
Energy sources during muscular work under normoxic and hypoxic conditions  A71-41721

BISHOP, P. O.  
The properties of the binocular receptive fields of lateral geniculate neurons  A71-40669

BLANC, C.  
Epilepsy and medical examinations of flight personnel - Importance and difficulty of diagnosis  A71-40357

BOGDANOVA, G. V.  
Comparison of residual and reversed microinterval blanking by measurement of absolute sound level estimates  A71-42579

BOGDANOVA, N. A.  
Pathomorphological changes in the organs of white rats subjected to irradiation by 120-Mev protons and the role of partial shielding in the attenuation of radiation damage  A71-42721

BOGDANOVA, N. P.  
Influence of ultraviolet radiation on amino acids and peptides in different gas atmospheres in the presence of salts and metal oxides  A71-42829

BOLEK, W. W.  
A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights  A71-42823

BOORSKE, J.  
Radioteleoelectric equipment for continuous subsatellite measurements of the circadian temperature rhythm in rats  A71-40634

BONNER, H. H.  
Epidemiology of USAF spatial disorientation aircraft accidents, 1 Jan 1958-31 Dec 1968  A71-40359

BORISOVA, O. K.  
Changes in the microflora of man during long-term confinement  A71-40557

BROOKS, J. T.  
Analysis of the relation between the hypothalamic anterior and the limbic system  A71-42577

BROOKS, L. I.  
A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights  A71-42823

BURRENDON, P.  
Relation between the appearance of the injury current on the ECG in anoxia and the fall of the phosphorylcreatine content of the myocardium. II  A71-41568

BOSCHERNO, V. V.  
Study of a method of urine conservation under space flight conditions  A71-42822

BOSCHIS  
Primary production in ocean biology  A71-35476

BOULANGE, H.  
The world gliding championships of Harfa, Texas - Survey of the aedicophysiological supervision of the French team  A71-41576

BOUWELEER, C.  
Computation of mean body temperature from rectal and skin temperatures  A71-41723

BOUL, R. C.  
Perceptual blanking - Peripheral vs central factors  A71-40225

BRACCHI, P.  
The vestibular space experiment OPO-A - Some results and conclusions  A71-41690

BRAGINA, N. P.  
Changes in the colicinogenic and hemolytic activities of Escherichia isolated from man during long-term confinement  A71-40558

BRADWELL, E.  
Mechanism of norpinephrine-induced stimulation of myocardial oxygen consumption  A71-41937

BRESLAV, I. S.  
Conditions for recognition and the training of human capability in distinguishing the composition of the respiratory medium  A71-42800

BRETS, H.  
Applications of advanced technology to undergraduate medical education [ER-6180-BLM]  N71-34081

BRENNER, F. C.  
Aircraft flashing lights - A summary of Canadian Forces investigations  A71-41491

BRIEUX, Y.  
Arterial pressure changes during spontaneous sleep in man  A71-40185

BRODERICK, R. L.  
Determination of the radionuclide content of feces and urine from astronauts engaged in space flight [NASA-CR-1218661]  N71-34058

Determination of the radionuclide content of feces and urine from astronauts engaged in space flight [NASA-CR-1218660]  N71-34059

BROOKS, R.  
Electrophysiological changes in humans during sensory isolation  A71-40346

BROUGILLET, A. O.  
Space shuttle orbiter environmental control and life support systems  N71-35267

BROWN, A. H.  
The organism and gravity - An introduction  A71-39970

BROWN, F. M.  
Vertigo due to increased middle ear pressure - Six-year experience of the aeromedical consultation service  A71-40358

BROWN, H. M.  
A miniature transmitter suitable for telemetry of a wide range of biopotentials  A71-40184

BUCHEK, D. N.  
Using alternating displays to improve operator performance  A71-41636

Operator target detection performance as a function of the number of sonar echoes, interval between transmissions, and signal-to-noise ratio [AD-726741]  N71-35279

BOUCKER, R. C.  
Survival of bacterial spores under some simulated lunar surface conditions  A71-40567

Bughov, S. A.  
The state of metabolism during extended confinement of man in a small-volume chamber with a gas medium varying in cycles  A71-42799

BUKANOVI, P. V.  
Possibility of using adaptation of hypoxial hypoxia in a training system  A71-42805

BURIANIA, V. H.  
Participation of thyroxine in the interaction of the isoenzymes of brain glutaminase, and some thyroxine action peculiarities  A71-41069

BURKE, E. T.  
Variability of depth perception under conditions of intermittent illumination  A71-41481

BURNHAN, C. A.  
Research on physical and physiological aspects of visual optics in space flight [NASA-CR-115120]  N71-34060
BURTON, R. R.

CHAKUVA, O. V.

CASSIDT, J.

CBPENTEB, B. B.

C4EA, H.

CAILLEE, B.

CHAFFIH, D. B.

CHAEVA, L. S.

CASE, B.

CABPENTEB, W. B.

CAEPENTEB, B.

CAHPBELL, F. W.

CAHPBELL, J. E.

CAHPBELL, V. P.

CASE-GSC-11169-2

CAHPBOD, C.

CBBETIEB, L.

CHILES, W. D.

CHILDS, P.

CHMORETZ, A.

CHMNEVSKII, Y. B.

CHROMEVA, D.

CHROMEVA, I. L.

CHROMEVA, L. V.

CHRYSANTHOU, C.

CIAO, C. B.

CIAO, V. N.

CIAO, F. D.

CIAO, F. W.

CIAO, J.

CIAO, J. N.

CIAO, J. S.

CIAO, M. L.

CIAO, M. T.

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CIAO, M. V.

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CIAO, M. X.

CIAO, M. X.

CIAO, M. X.

CIAO, M. X.

CIAO, M. X.
DIAZY, A. G.
Study of the physiological effect of substituting inert gases for atmospheric nitrogen under conditions of anoxia and high carbon dioxide concentrations
A71-42804

DIDIER, A.
Hyperventilation in flying personnel /Report of 13 cases/
A71-41569

DILLOR, R. T.
A computerized bacterial identification system as applied to planetary quarantine
A71-42233

DOBROV, N. E.
The rate of recovery of radioreistance after exposure of the organism to the combined action of ionizing radiation and dynamic flight factors
A71-42725

The effect of cystamine in a mixture with sympathomimetic amines on repar processes after exposure to radiation and accelerations
A71-42726

Influence of preliminary administration of the radiation protector phinas on the reactivity of tissues of irradiated animals under various test conditions
A71-42729

The state of peripheral blood in irradiated animals during prolonged exposure to conditions of reduced barometric pressure
A71-42732

DOOREKHA, Y. A.
Operator target detection performance as a function of the number of sonar echoes, interval between transmissions, and signal-to-noise ratio
A71-26791

DOROSHEKO, V. A.
Certain studies of electroencephalogram wave asymmetry
A71-41068

DOST, P. N.
Effects of monoethylhydrazine upon carbohydrate metabolism
A71-35259

DOUGLAS, C. A.
A survey of the use of flashing lights in aviation
A71-41489

DOW, P. J.
Relationship of pentathlon sports skills to vestibulo-ocular responses to Coriolis stimulation
A71-41826

DEETS, R. E.
Specific banding patterns of human chromosomes
A71-40853

DEW-CHEL, T. B.
Vascular and extravascular fluid changes during six days of bedrest
A71-40354

DECHOS, H.
The interest of chemical oxygen in air evacuations to hospital
A71-41571

DUNBAR, S. A.
Research on physical and physiological aspects of visual optics in space flight
A71-34050

DODIK, V. S.
A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights
A71-42823

DEHARBAZIAN, T. A.
Formation of coronary-dilating compounds from 'inert' proteins, carriers of the hypothalamus
A71-41072

E

EAKINS, R. E.
The pharmacology of extraocular muscle
A71-42839

EARLEY, L. E.
Mechanism of antidiuretic action of chlorpropamide in the mammalian kidney
A71-41939

EBERS, R. W.
Evaluation of photochromic goggle system for nuclear flash protection
A71-41072

ECKHARDT, L.
Southwest Research Institute assistance to NASA in biomedical areas of the Technology Utilization Program
A71-34070

EDGE, G. H.
A miniature transmitter suitable for telemetry of a wide range of biopotentials
A71-40184

EDWARDS, B. F.
Plant responses to chronic acceleration
A71-40001

EDWARDS, H. A.
The relative conspicuities of flashing lights by a comparison method
A71-41486

EGOBBO, I. A.
Influence of a set of extremal factors on ribonucleic acid
A71-42830

EGOBOVA, N. N.
Studies of the stability of the chemical composition of a Chlorella biomass during prolonged cultivation with recycling of the medium in the form of nitrates
A71-42818

EISSLER, E.
Body composition, aerobic capacity, and density of muscle capillaries in young and old men
A71-41717

ELIARI, M.
Palm wave velocity in healthy subjects and in patients with various disease states
A71-42518

EGERLEIN, E. J.
Atrial function during volume loading
A71-41718

EISEN, J. A.
The corneo-retinal potential as the generator of alpha rhythms in the human electroencephalogram
A71-40176

EPSTEIN, E.
Effect of water immersion on renin-aldosterone and renal sodium handling in normal men
A71-41720

EBERN, A. V.
Possibility of using adaptation of hypoxial hypoxia in a training system
A71-42805

ESAIRAN, H. A.
Changes in serotonin and gamma-aminobutyric acid on the release of ionic composition, and the effect of alpha rhythm in the human electroencephalogram
A71-41073

ETTINGER, B.
Mechanism of antidiuretic action of chlorpropamide in the mammalian kidney
A71-41939

EVORKISOVA, K. D.
Methods of search for extraterrestrial life
A71-40570

EVEKCHUK, W. I.
The state of peripheral blood in irradiated animals during prolonged exposure to conditions of reduced barometric pressure
A71-42732

F

FABER, W.
Radiotelemetrical equipment for continuous subcutaneous measurements of the circadian temperature rhythm in rats
A71-40534

FABIATO, A.
The two components of the human atrial action potential
A71-40566

FABIATO, F.
The two components of the human atrial action potential
A71-40565

PALEVRA, V. N.
Use of products of biological mineralization for the cultivation of higher and lower autotrophs
A71-42819
PARQUAN, J. A.
Applications of advanced technology to undergraduate medical education
[NASA-6180-BLM]
FARIS, C. P.
Time pressure and performance of scientists and engineers: A five-year panel study
[NASA-CR-121884]
FEDOROV, V. P.
Frequency analysis of slow fluctuations in the local blood circulation and the oxygen tension in the cerebrum
A17-42580
FENDLER, C.
Development of a bladderless tank for space shuttle
N71-35273
FELLES, D. D.
Effects of hypobaric hypoxia in vivo on lipid synthesis in rat liver and adipose tissue slices
A17-41825
FENDER, D. H.
Time delays in the human eye-tracking system
A17-42051
FESTINGER, L.
Eye movements and perception
A71-62440
FILATYKH, I. A.
Mineralization of the vegetable wastes of a biocomplex by the thermal combustion method
A17-42821
FIONICA, V.
Autoasted differential fluorometric analysis of noradrenaline and epinephrine in blood plasma and urine
[FAA-AM-71-15]
NFLEROV, M. A.
Metabolism of glycerides in the brain under normal conditions and during hypoxia
A17-41056
FLEDGER, T. N.
Seminar on Cell and Cell System Ecology
[AB-720601]
FORKIN, V. S.
Possibility of using adaptation of hypoxic hypoxia in a training system
A17-42050
FOSTER, D. H.
Some theoretical aspects of an apparent motion phenomenon associated with certain configurations of flashing lights
A17-41487
FOSTER, R. B.
Highly articulate full pressure glove
[NASA-CR-113635]
FOX, E. L.
Energy sources during muscular work under normoxic and hypoxic conditions
A17-42721
FOX, L.
The ecology of micro-organisms in a closed environment
A17-42824
FRAMESHEID, M.
Psychophysiological reactions to understimulation and overstimulation
A17-40177
FRASER, S. J.
Survival of microorganisms in a simulated Martian environment
A17-42227
FREDMAN, S. L.
Characteristic effects of drugs under hypothermia conditions
A17-42709
FREED, G. D.
The physics of gravity and equilibrium in growing plants
A17-39971
FUCHS, A. P.
The saccadic system
A17-42483
FUCHS, C. W. G.
Control of a liquid cooling garment for extravehicular astronauts by cutaneous and external auditory heat temperatures
[NASA-CR-115122]
FONG, T. C.
Muscle controlled flow
A17-40984
GADDIS, J. L.
The flash evaporator for transient heat loads
A17-35269
GAGATIN, T. A.
Psychology and outer space /2nd edition/
A17-40876
GADJABAROV, N. A.
Influence of mercaptanalkylamine-group radiation-protection preparations /cystamine, S, beta-aminethiolsulfonium/ on the stability of animals to lateral accelerations
A17-42700
Mechanism responsible for the reduction in tolerance to accelerations under the influence of radiation-protection pharmacological preparations
A17-42703
Pathomorphological changes in the organs of white rats subjected to irradiation by 120-MeV protons and the role of partial shielding in the attenuation of radiation damage
A17-42721
Significance of radiosensitivity of various regions of the body in the development of radiation pathology
A17-42722
Influence of pharmacochemical substances on the reactivity of the organism to the combined effect of gamma-irradiation and transverse loads
A17-42730
Method of composite tissue blocks for comparative pathomorphological investigation of radiation pathology
A17-42734
GALAB, P.
The concept of time experienced among small human groups isolated in an underground environment
A17-41577
GALKAI, T. T.
Cinine and pyrimidine derivatives of the hypothalamus
A17-41071
GALKINA, T. B.
Studies of the stability of the chemical composition of a Chlorella biomass during prolonged cultivation with recycling of the medium in the form of nitrates
A17-42818
GALL, E. J.
Responses of single cells within the cat sedulla during prolonged constant angular acceleration
[AB-724628]
GALLOCUSI, V. F.
An electrostatic computer model of a biological membrane
A17-42119
GALOVA, A. A.
Purine and pyrimidine derivatives of the hypothalamus
A17-41071
Formation of coronary-dilating compounds from 'inert' proteins, carriers of the hypothalamus
A17-41072
GALSTON, A. W.
Responses to gravity in plants - A summary
A17-40008
GARIFA, V. I.
Specific tissue responses in changed gaseous environments
A17-40556
GARGEE, J. G.
Experimental results on time of useful function /EUV/ after exposure to mixtures of serious contaminants
A17-41830
GARSE, J. L.
Restraint system for ergometer
[NASA-CASE-RPS-21046]
GABEL, C. Jr.
Biosciences at RAND
[BM-6047-BC]
GEBEK, E. J.
Energy sources during muscular work under normoxic and hypoxic conditions
A17-41721
GIDION, W. P.
Electrophysiological changes in humans during
sensory isolation

GILSON, R. D.
Alcohol and disorientation-related responses. 4: Effects of different alcohol dosages and display illumination on tracking performance during vestibular stimulation

GINSBERG, A. S.
Applications of advanced technology to undergraduate medical education

GINSBERG, H. S.
Immune states in long-term space flights

GITELSOHN, I. T.
Theoretical and experimental decisions in the creation of an artificial ecosystem for human life support in space

GOGETZ, W. C.
The effect of perceived distance on induced movement

GOLDIN, S. N.
Comparison of residual and reversed microinterval masking by measurement of absolute sound level estimates

GOLDEN, J. G.
Strobe lighting - A strengthening factor for the 'see and be seen' backbone of collision avoidance

GOPINATH, P. H.
Experimental analysis of the information content of the aural electric field of the human body

GORDIENKO, V. A.
Experimental analysis of the information content of the aural electric field of the human body

GORDON, S. A.
Gravity and the organism

GORDON, R. V.
Morphophysiological alterations under the action of electromagnetic waves at radio frequencies / Experimental studies

GORGIAZENKO, G. I.
A universal apparatus for caloric stimulation of the labyrinth

GRANDPREZIER, R.
Comparative study of hyperoxemic convulsions and their prevention in two primates, Macacus nemestrinus and Papio papio

GRAY, S. P.
Changes in human urine and blood chemistry during a simulated oxygen-helium dive to 1,500 feet

GRAY, S. W.
Plant responses to chronic acceleration

GRAY, T. H.
Rotating vivarium concept for earth-like habitation in space

GREENE, R. R.
Survival of microorganisms in a simulated Martian environment

GREENE, W. A.
Stimulus control of skin resistance responses on an escape-avoidance schedule

GREYBELSKA, V. I.
A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights

GROSSBERG, R.
Heart rate response to square wave breathing - One G compared to zero G

H

HAGEN, W. H.
Airborne audio-video recording design considerations

HALL, J. F., JR.
Physiological responses to cooling the head and neck versus the trunk and leg areas in severe hyperthermic exposure

HANNEFORD, C. R.
Study of simulated aircrew pilot incapacitation. Phase II - Subtle or partial loss of function

HARRIS, D. A.
Performance and fatigue in experimental double-crew transport missions

HARRISON, D. C.
Circulatory responses to hypoxia in experimental myocardial infarction

HARRISON, E. C.
Random error in the early detection and study of post-transplantation cardiac rejection

HARRISON, G. O.
Field study of transport aircrew workload and rest

HARRISON, A. G.
A fifth modality of taste
PERSONAL AUTHOR INDEX

BOEHLASD, B. C.
BOBBECR, G.
BOBHE, B. A.
HOBB, G.
HOPKIH, T. D.
BOLDBIDGE, D.
BOFFBAB, D. B.
BIBKLE, L. E., JB.
BILLS, B. A.
BILGEHDOBF, B. L.
HEBTEL, B.
BOODAS, I.
BOSBIZAKI, t.
BNATIOR, B.
BIGGINS, K. E.
HIGGINS, E. A.
BEBBOB, B. E.
BEIHLICH, P. F.
HECKEB, B. H. L.

Computer-generated displays for psychological research
Centrifugally obtained artificial gravity
Computation of mean body temperature from rectal and skin temperatures
Learned control of heart rate and blood pressure
Combined effects of altitude and high temperature on complex performance
An investigation of the effective intensity of flashing lights at threshold and supra-threshold levels
Visual performance with simulated flare light - Effects of flare-ignition altitude
Decompression sickness - A fundamental study of 'surface excursions' diving and the selection of liab bends versus C.N.S. symptoms
The antecedents of myocardial infarction and sudden death in a cohort of actively employed men
Learned control of heart rate and blood pressure
Centrifugally obtained artificial gravity
A computerized bacterial identification system as applied to planetary quarantine
Computer-generated displays for psychological research
A miniature transmitter suitable for telemetry of a wide range of biopotentials
On the unlikelihood of non-aqueous biosystems
Survival of bacterial spores under some simulated surface conditions
Primitive examples of gravity receptors and their evolution
Effect of net zero gravity on the circadian leaf movements of pinto beans
Computation of mean body temperature from rectal and skin temperatures
Semicircular canal and otolithic organ function in free-swimming fish

HOYT, W. F.
HUGG, J. E.
HURTADO, J. -P.
HYANS, L.
HYDE, J. E.
IAPETRO, P. F.
INBESENSKI, A. A.
IKIRI, M.
IPATEVA, H. V.
IPABOVA, L. T.
IVANOV-SBOLENSKII, 4. G.
IVANOV, S.
IVASBCBEHKO, G. H.
HEBTEL, B.
HEFTZ, C. H.
HICKE, L. S.
HILL, E. K.
HENEK, M.
HOPKIH, T. D.
HOPFER, D. H.
HOLDIDGE, D.
HOPKIN, V. D.
HORN, C.
HORN, R. A.
HORNKE, G.
HORRIDGE, G. A.
HOSHIZAKI, T.
HODDA, T.
HOWLAND, H. C.

SUBJECT INDEX

471-40073
471-40769
471-41990
471-41198
471-41818
471-41848
471-42196
471-40344
471-41798
471-41037
471-40255
471-42233
471-40136
471-40184
471-42229
471-40567
471-39991
471-40006
471-41723
471-39996
471-42438
471-41861
471-41573
471-40670
471-42342
471-35242
471-40630
471-39999
471-35271
471-42043
471-39971
471-35242
471-42582
471-39999
471-42792
471-42811
471-41832
471-42438
471-42792
471-42811
471-39999
471-34062
471-42043
471-39999
471-35271

I-61
JESSE, C.

Differentiation of cutaneous and intestinal blood flow during hypothalamic heating and cooling in anesthetized dogs A71-40632

JOHNSON, B.

Observation distance and probability of detection [VOL-K-2-C-375-72] B71-35257

JOHNSON, R. C.

The astronaut–teleoperator team for space operations A71-42033

JOHNSON, D. K.

Effects of monomethylhydrazine upon carbohydrate metabolism (AD-727008) B71-35259

JOHNSON, P. C.

Vascular and extravascular fluid changes during six days of bedrest A71-40354

JOHNSON, A.

Oscillatory movements in plants under gravitational stimulation A71-39973

JOHNSON, W. L.

Variability of depth perception under conditions of intermittent illumination A71-41461

JOLLY, R.

Radiological examination of the spine and fitness for employment as a helicopter pilot A71-41578

JONES, G. M.

Reflex vestibular control of head movement in man A71-41622

Organization of neural control in the vestibulo-ocular reflex arc A71-42449

JONES, R. H.

The effects of simulated sonic booms on tracking performance and autonomic response [FAA-MR-71-29] B71-34068

JUDGE, D. L.

Magnetic recordings of the heart's electrical activity with a cryogenic magnetometer A71-42341

JULIUS, S.

Role of parasympathetic inhibition in the hyperkinetic type of borderline hypertension A71-40407

K

KAROLZKIS, J. W.

Stimulation experience and incentive variables as determinants of behavior elicited by hypothalamic stimulation A71-40706

Diurnal patterns in water and food intake and body weight changes in rats with hypothalamic lesions A71-41936

KALDEWEY, H.

Geopsynasty, an example of gravisorphism A71-40000

KARAGODINA, A. M.

Urine preservation in a system for urine water recovery A71-42809

KASATKINA, A. G.

A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights A71-42823

KASIAN, I. I.

Some results of medical studies on the 'Voskhod 2' spaceship A71-42791

KATZ, R.

The pharmacology of extraocular muscle A71-42439

KAPARIAN, B. A.

Age-dependent changes in the free amino acid content of the cerebral arteries and carotid artery in man and in dogs A71-41070

KEILBAUGH, B. W.

Automatic instrument for chemical processing to detect microorganisms in biological samples by measuring light reactions [NASA-CASE-65C-11169-2] B71-34079

PERSONAL AUTHOR INDEX

KELLAWAY, P.

Evaluation of the neurophysiological electrode-amplifier-harness system for physiological data acquisition [NASA-CR-115512] B71-35263

KEEB, S. K.

Operator target detection performance as a function of the number of sonar echoes, interval between transmissions, and signal-to-noise ratio [AD-726741] B71-35279

KLECHUTJN, L. S.

Some results of medical studies on the 'Voskhod 2' spaceship A71-42791

KLEBNIKOV, G. F.

Some results of medical studies on the 'Voskhod 2' spaceship A71-42829

KIDEBA, G. J.

Study of simulated airline pilot incapacitation. Phase II - Subtle or partial loss of function A71-41828

KIZTEN, N. L.

Perceptual masking - Peripheral vs central factors A71-40225

KIRKOGIAN, L. G.

The phospholipid composition of white matter in different parts of the brain, spinal cord, and sciatic nerve in dogs A71-41074

KIBERSKII, L. V.

Theoretical and experimental decisions in the creation of an artificial ecosystem for human life support in space A71-40563

KISSER, A.

Physiological responses to cooling the head and neck versus the trunk and leg areas in severe hyperthermic exposure A71-40356

KITAIORODSKII, H. G.

The Potontet-1 facility for studying the reactions of organisms to the physical conditions of the planet Mars A71-42827

KLEIN, M.

Study and perfection of a miniaturized multichannel F6/HN biological telemetry system adapted to psychophysiological studies A71-41574

KLEIN, F. K.

Physiological responses to cooling the head and neck versus the trunk and leg areas in severe hyperthermic exposure A71-40356

KNOLES, W. B.

Visual performance with high contrast cathode ray tubes at high levels of ambient illumination [NASA-CE-114361] B71-36073

KOBIR, J. L.

Effects of hypoxia on response time to peripheral visual signals A71-41945

Effects of extended hypoxia on visual performance and retinal vascular state A71-41719

KOLCHIN, K. V.

A food link based on stocks of dehydrated products in the life-support systems of manned spacecraft during long flights A71-42823

KOLGOV, T. S.

Toxic effects of gaseous products of the organism's vital activity A71-42811

KOROLOVA, G. S.

Influence of a set of extramural factors on ribonuclease A71-42830

Influence of the gaseous medium on the cryolysis of catalase A71-42831

KOBNOVA, N. I.

Post-flight histological analysis of turtles aboard
Influence of preliminary administration of the radiation protector phina on the reactivity of tissues of irradiated animals under various test conditions

Effect of preliminary administration of the radiation protector phina on the reactivity of tissues of irradiated animals under various test conditions

Krasny, I. G.
Noise disturbance and sleep. The relationship of noise disturbed sleep to post-sleep behavior: An exploration study

Krasnokobay, A. G.
Influence of preliminary administration of the radiation protector phina on the reactivity of tissues of irradiated animals under various test conditions

Krabbe, H.
Study of the characteristics of high-intensity noise effects during space flight

Krotsch, V. A.
Features of determining the oxidizability of water in the process of its regeneration

Kubrick, A. C.
A proposed incipient fire and toxic gas caution and warning for shuttle

Krylov, Iu. V.
Study of the characteristics of high-intensity noise effects during space flight

Kudla, D. G.
Changes in the colicinogenic and hemolytic activities of Escherichia isolated from man during long-term confinement

Kudko, B. V.
The state of metabolism during extended confinement of man in a small-volume chamber with a gas medium varying in cycles

Kulachenko, A. R.
Experiments with micro-organisms and human cell cultures in the Zond 5 and Zond 7 flights

Kulkin, S. G.
Post-flight histological analysis of turtles aboard Zond 7

Kurman, S. G.
Influence of pharmacocchemical substances on the reactivity of the organism to the combined effect of gamma-irradiation and transverse load

Kustov, V. V.
Influence of certain radiation protection drugs on the resistance of albino rats to acute hypoxia

Kustov, V. V.
Influence of certain radiation protection drugs on the resistance of albino rats to acute hypoxia

Kustov, V. V.
Influence of certain radiation protection drugs on the resistance of albino rats to acute hypoxia
Effect of a chemical preservative on the evolution rates of some gaseous toxic substances from stored urine

Tolerance of animals to the toxic effects of certain gases after adaptation to hypoxia

Toxic effects of gaseous products of the organism’s vital activity

Problems of the toxicity of expired air

Influence of preliminary administration of the radiation protector phinam on the reactivity of tissues of irradiated animals under various test conditions

Study of the characteristics of high-intensity noise effects during space flight

Analysis of the relation between the hypothalamic anterior and the limbic system

Coronary flow at increased arterial pressure of hyperkinetic type of borderline hypertension

The state of metabolism during extended confinement of man in a small-volume chamber with a gas medium varying in cycles

Changes in the microflora of man during long-term confinement in space

Color defective vision and the recognition of aviation color signal light flashes

Hyperventilation in flying personnel (Report of 13 cases)

EEG, evoked potentials, and eye and image movements

The effect of a peripheral stimulus on accommodation

Toxic effects of gaseous products of the organism's vital activity

Myocardial metabolism in cyanotic congenital heart disease

Tolerance of animals to the toxic effects of certain gases after adaptation to hypoxia

Effect of prefrontal lesions on trained anticipatory visual attending in cats

Perceptual masking - Peripheral vs central factors

The role of nonspecific reticulo-thalamo-cortical systems in emotion

Expiratory pO2 and pCO2 curves during breathing of gas mixtures of N2-O2, Ne-O2, and Ar-O2

Hyocardial metabolism in cyanotic congenital heart disease

EEG, evoked potentials, and eye and image movements

The effect of a peripheral stimulus on accommodation

The effect of prefrontal lesions on trained anticipatory visual attending in cats

Perceptual masking - Peripheral vs central factors

The role of nonspecific reticulo-thalamo-cortical systems in emotion

Expiratory pO2 and pCO2 curves during breathing of gas mixtures of N2-O2, Ne-O2, and Ar-O2

Hyocardial metabolism in cyanotic congenital heart disease

EEG, evoked potentials, and eye and image movements

The effect of a peripheral stimulus on accommodation

The effect of prefrontal lesions on trained anticipatory visual attending in cats

Perceptual masking - Peripheral vs central factors

The role of nonspecific reticulo-thalamo-cortical systems in emotion

Expiratory pO2 and pCO2 curves during breathing of gas mixtures of N2-O2, Ne-O2, and Ar-O2
Determination of the influence of vibration on the 

Arterial pressure changes during spontaneous sleep 

Mineralization of the vegetable wastes of a 

Effect of acclimatization to altitude and cold on 

Effect of altitude acclimatization and cold on cold 

Arterial pressure changes during spontaneous sleep 

The phospholipid composition of white matter in 

different parts of the brain, spinal cord, and 

Arterial pressure changes during spontaneous sleep 

Interactions of analyzers and the intensity of 

Proprioceptive gravity perception in hymenoptera 

Variability of depth perception under conditions of 

arsenal effects of the vagus nerve on the lung 

Effect of acclimatization to altitude and cold on 

Effect of altitude acclimatization and cold on cold 

Biocomplex by the thermal combustion method 

Gas mixtures of N2-02, He-02, and Ar-02 

Functional anatomy of the vertebrate gravity 

The tilt after-effect - A fresh look 

Criteria for the onset of vascular surces 

Bone density changes in a maccas nemestrina monkey 

Ultrasonic imaging of in vivo bubbles in 

decompresion sickness 

The spiral aftereffect. 3: Some effects of 

some possibilities of living organisms under 

simulating martian conditions 

The effect on infusoria of physical conditions 

simulating the medium on the surface of the planet 

The fotostat-1 facility for studying the reactions 

of organisms to the physical conditions of the 

planet Mars 

Tolerance of unicellular organisms to UV radiation 

in connection with the problem of the existence of 

extraterrestrial life 

Growth responses of plants to gravity 

Hibernation - Alteration of mitochondrial membranes 

as a requisite for metabolism at low temperature 

The influence of ultra-high vacuum on crystalline 

enzymes 

Determiniation of the influence of vibration on the 

reaction of dogs to radiation with the aid of 

certain clinic-ehematological indices 

Tilt after-effect - A fresh look 

Experiments with micro-organisms and human cell 
cultures in the Zond 5 and Zond 7 flights 

Adequometry, discreetometry, and creativity in the 

biophysical neurochemodynamics of man 

Some results of medical studies on the 'Voskhod 2' 
spaceship 

Effect of the frequency of change of the nutrient 
solution on the productivity of plants grown on 

kerasit 

Use of products of biological mineralization for 

the cultivation of higher and lower autotrophs 

The possibility of using human waste products 

mineralized by the 'wet combustion' method 

Mineralization of vegetable wastes by a 

biocomplex by the thermal combustion method 

Effect of acclimatization to altitude and cold on 

basal heart rate, blood pressure, respiration and 

breath-holding in man 

Effect of altitude acclimatization and cold on cold 

pressor response in man 

Arterial pressure changes during spontaneous sleep 

in man 

Arterial pressure changes during spontaneous sleep 

in man 

Arterial pressure changes during spontaneous sleep 

in man 

Interactions of analyzers and the intensity of 

vestibular reactions to extrantinuli 

Proprioceptive gravity perception in hymenoptera 

Crew radiation dose from the plume of a high impulse 

gas-core nuclear rocket during a mars mission 

Gastrointestinal reactions to extrastimuli 

in the process of its regeneration 

A food link based on stocks of dehydrated products 

in the life-support systems of manned spacecraft 
during long flights 

The possibility of using it in 

physiological studies 

Effect of acclimatization to altitude and cold on 

basal heart rate, blood pressure, respiration and 

breath-holding in man 

Variability of depth perception under conditions of 

intermittent illumination 

Vasomotor effects of the vagus nerve on the lung 

Affect adjective check list assessment of mood 

variations in air traffic controllers 

Evaluation of an improved flotation device for 

infants and small children 

Centrifugally obtained artificial gravity 

Urease reaction rates at low water activity 

Resistance of test animals to acute hypoxia during 

various phases of radiation sickness 

Bias in a physiological interpretation 

The spiral aftereffect. 3: Some effects of 

perceived size, retinal size, and retinal speed on 

the duration of illusory motion 

Vestibular and proprioceptive stabilization of eye 
movements
MOBGAH, B.

HOOSES, B.

BOBSE, A. 1.

BOBOZOY, V. S.

BOLLEB, D.

BKHEIAH, E. E.

BIRZOIAI, S. A.

HI1CHAILOYA, I. G.

BILLEB, O. D.

BILHAOD, C.

BIKIBTOHOYA, K. S.

HIKHAILOY, V. I.

BIASHIKOY, Y. I.

BEIGES, P. J.

HELESHKO, G. I.

BELTZEE, B. Y.

HELBSAKOY, B. G.

HE1LOHE, B. J.

Automated differential fluorometric analysis of
Changes in the reactivity of animals to certain
Magnetic recordings of the heart's electrical
Keeping the pilot happy - The contribution of
Badiotelemetrical equipment for continuous
Effects of gangliosides on active Ca+/plus plus/
Age-dependent changes in the free amino acid content
Effect of a chemical preservative on the evolution
Problem of the formation of a motor stereotype with
Problem of the toxicity of expired air
Affect adjective check list assessment of mood
Plasma creatine phosphokinase activity, hypothermia, and stream

N

NAYRI, C. S.

Effect of acclimatization to altitude and cold on
basal heart rate, blood pressure, respiration and
breath-holding in man
Effect of altitude acclimatization and cold
pressor response in man

NAYRI, A.

Inferior atrial rhythms - Vectorcardiographic study
and electrophysiologic considerations

NEFEDOV, I. G.

Microbiological and immunological aspects of
extended manned space flights

Normalization of the immune status of the human body
during prolonged space flight

NEYEBEE, G.

Comparative study of hyperoxic convulsions and
their prevention in two primates, Macacus
bennettianus and Papio papio

NEVILLE, E. D.

Effects of hypoxic hyperoxia in vivo on lipid
synthesis in rat liver and adipose tissue slices

NEKROPOVA, E. H.

Bacterial contamination of confined, sealed space
habitats during long-term human occupation

NKOLAEV, A. G.

Some results of the flight of the Soyuz 9 spacecraft

NISHI, T.

Characteristics of personal monitoring dosimeter

NORDHEDER, B.

Psychophysiological reactions to understimulation
and overstimulation

NORDHAN, T. W.

Content of gangliosides and cerebrosides in the
brain under normal conditions, during hypoxia, and
under the action of small doses of X-ray radiation

NORWOOD, G. E.

The philosophy and limitations of FAA aerosomedical
standards, policies and procedures

Nowotny, G. E.

The corneo-retinal potential as the generator of
alpha rhythms in the human electroencephalogram

O

OCONNOH, P. J.

Comparison of the encephalographic, behavioral and
subjective correlates of natural and drug-induced
sleep at atypical hours

OGABERIAN, V. S.

Participation of thyroxine in the interaction of the

PERSONAL AUTHOR INDEX
Vasomotor effects of the vagus nerve on the lung

Problem of studying the toxicity of indole

Preliminary results of space shuttle EC/LSS studies

Release of microorganisms from solid materials [NASA-CH-121707] N71-34056

A preliminary theory of the effects of task and environmental factors on human performance

A computerized bacterial identification system as an aid to medical diagnosis

Survival of microorganisms in a simulated Hartian environment

Pulmonary capacity for dissipation of venous gas emboli

Effect of immersion on some motor function characteristics

A computerized bacterial identification system as applied to planetary quarantine

Reflex vestibular control of head movement in man

Study of the physiological effect of substituting inert gases for atmospheric nitrogen under conditions of anoxia and high carbon dioxide concentrations

Comet-generated displays for psychological research

The significance of alpha-glycerophosphate and some other substances as indicators of the intensity of anaerobic metabolism

Pathomorphological changes in the organs of white rats subjected to irradiation by 120-MeV protons and the role of partial shielding in the attenuation of radiation damage

The structure of the extraocular muscle fibers of mammals

Speech intelligibility in the presence of time-varying aircraft noise

The transport of sick and injured aboard regular airliners

Pulmonary antibacterial defenses with pure oxygen breathing

Availability of substrates and capacity for prolonged heavy exercise in man

Mechanism responsible for the reduction in tolerance to accelerations under the influence of radiation-protection pharmacological preparations

Pathomorphological changes in the organs of white rats subjected to irradiation by 120-MeV protons and the role of partial shielding in the attenuation of radiation damage

Method of composite tissue blocks for comparative pathomorphological investigation of radiation pathology

Two quantitative measures of skill development

A stochastic model for eye movements during fixation on a stationary target [NASA-CH-121660] N71-34071

The retinal directional effect - A model based on the Gaussian distribution of cone orientations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations

The effect of cystamine in a mixture with sympathomimetic amines on repair processes after exposure to radiation and accelerations
Gravity receptors and gravity orientation in
Hyocardial metabolism in cyanotic congenital heart
The influence of the angular size, adaptation
Effect of prefrontal lesions on trained anticipatory
The experiments of Biosatellite II
The concept of time experienced among small human
Pulse wave velocity in healthy subjects and in
Chemical prophylaxis of radiation sickness
Radiation-protective action of cystamine under
different conditions of gamma irradiation
Effect of gamma emission on the elimination of the
toxic effect of cystamine
Changes in the reactivity of animals to certain
pharmacochemical preparations when parts of the
body are shielded during total irradiation
Pathomorphological changes in the organs of white
rats subjected to irradiation by 120-keV protons and the role of partial shielding in the
attenuation of radiation damage
Rate of recovery of radioresistance after exposure
of the organism to the combined action of ionizing
radiation and dynamic flight factors
The effect of cystamine in a mixture with
sympathoinhibitory amines on repair processes after exposure to radiation and accelerations
Influence of preliminary administration of the
radiation protector phinam on the reactivity of tissues of irradiated animals under various test
groups isolated in an underground environment
Availability of substrates and capacity for
prolonged heavy exercise in man
Post-flight histological analysis of turtles aboard
Zond 7
Visual field projection columns and magnification
factors in the lateral geniculate nucleus of the
cat
The properties of the binocular receptive fields of
lateral geniculate neurons
Post-flight histological analysis of turtles aboard
Zond 7
Effect of water immersion on renin-aldosterone and
renal sodium handling in normal man
The concept of time experienced among small human
The experiments of Biosatellite II
Subjective brightness of a flashing light stimulus
within the fovea as a function of stimulus size
Myocardial metabolism in cyanotic congenital heart
disease
Effect of prefrostal lesions on trained anticipatory
visual attending in cats
The influence of the angular size, adaptation
luminance, pulse shape, and light colour on the
Blondel–Hey constant α
Ingestive capacity of peritoneal macrophages from
mice exposed to hypobaric hypoxia
Gravity receptors and gravity orientation in
Crustacea
body are shielded during total irradiation  471-42717
SHAYER, J. A.
Hypocardial metabolism in cyanotic congenital heart disease  471-41521
SHAY, R. W.
Specific banding patterns of human chromosomes  471-40853
SHELGLOVA, G. V.
Bacterial contamination of confined, sealed space during long-term human occupation  471-40560
SHEEH-MILLER, J.
Simulated weightlessness studies by compensation  471-40004
SHELLINGER, G. L., Jr.
Behavioral responses to linear accelerations in blind goldfish. I - The gravity reference response  471-42228
SHETOV, V. S.
Microbiological and immunological aspects of extended manned space flights  471-40553
Normalisation of the immune status of the human body during prolonged space flight  471-40554
Changes in the microflora of man during long-term confinement  471-40557
Changes in the colicinogenic and hemolytic activities of Escherichia coli isolated from man during long-term confinement  471-40558
SHIBAEV, N.
Vestibular influences on the brain stem  471-39998
SHIBKOVICH, L. L.
Influence of a hyperoxic medium on the cells, tissues, and organs of experimental animals  471-42801
Influence of hyperoxia on the connective tissue  471-42802
SHIBAREVA, M. N.
The microflora of the human integument during prolonged confinement  471-40559
SHILPPHREBB, N. Ia.
Experimental analysis of the reaction content of the aural electric field of the human body  471-41066
SHIBNER, A. H.
Conditions for recognition and the training of human capability in distinguishing the composition of the respiratory medium  471-42800
SHORT, A.
Continuous dynamic sampling calorimeter for measurement in man  471-42155
SHOBAY, H. P.
Ultrasound in the early detection and study of post-transplantation cardiac rejection  [NASA-CR-121642]  471-34050
SHOBIN, P. A.
Pulmonary antibacterial defenses with pure oxygen breathing  471-42241
SHOBLY, J. T.
Electrophysiological changes in humans during sensory isolation  471-40346
SHOBRTS, E.
Heat acclimatization by the prevention of evaporative cooling  471-40355
SIDMAN, E.
The removal and restoration of stimulus control  471-42860
SIEFFER, A.
Gravity receptors in lower plants  471-39975
SINCO, E.
Hypoxia and hypercapnia in asphyctic differentiation of regional sympathetic activity in the anesthetized rabbit  471-40629
Sensory transmission of spinal heat and cold sensitivity in ascending spinal neurons  471-40630
Differentiation of cutaneous and intestinal blood flow during hypothermic heating and cooling in anesthetized dogs  471-40632
SINCOV, E. E.
Blood serum aminotransferases in dogs after total exposure to gamma rays under conditions of shielding of the abdomen or head regions  471-42720
SINPO, S. F.
Alteration of some characteristics of the external respiratory function under the action of accelerations  471-42795
SINSO, L. R., Jr.
Investigation of fatal aircraft accidents - 'Physiological incidents'  471-41834
Siskovina, E. F.
Influence of anamazine and chloral hydrate on the intensity of the metabolism of individual components of the brain gangliones  471-41055
SOKJINS, J.
Grease reaction rates at low water activity  471-42226
SLOGER, J. L.
Development of parametric data for the establishment of an ethylene oxide cycle for the decontamination of spacecraft  [NASA-CR-121764]  471-34057
SMSTD, B.
Expiratory pO2 and pCO2 curves during breathing of gas mixtures of N2, O2, and Ar-O2  471-40098
SINBOV, Y. A.
An analog method of measuring one-dimensional EEG amplitude distribution functions  471-41067
SINBOEVA, E. V.
Tolerance of mice to anisothiol- and indolylalkylamine-series radiation-protection drugs in the after-effects period following lateral accelerations  471-42706
SITH, A. R.
Chronic acceleration of animals  471-40002
SITH, J. D.
A stochastic model for eye movements during fixation on a stationary target  [NASA-CR-121640]  471-34071
SITH, B. C.
Affect adjective check list assessment of mood variations in air traffic controllers  [NASA-AR-71-27]  471-34067
SOKLOKOV, V. I.
Basic metabolism under conditions of simulated weightlessness  471-42794
SOKLOV, M. L.
Comparison of residual and reversed microinterval rankings by measurement of absolute sound level estimates  471-42799
SOKIN, E. N.
Post-flight histological analysis of turtles aboard Zond 7  471-42579
SOHRENBLICK, E. H.
Mechanism of norepinephrine-induced stimulation of myocardial oxygen consumption  471-41937
SOPHINDROV, G. G.
Methods of search for extraterrestrial life  471-40570
The influence of ultra-high vacuums on crystalline enzymes  471-40573
SOFSSKI, O. P.
Effects of gangliones on active Ca++ plus flux transport in brain mitochondria  471-41075
SPENCER, R. F.
Pulmonary capacity for dissipation of venous gas emboli
SPIER, R. A.

Restraint system for ergometer [NASA-CR-123042]

SPOZIEN, J.

Microbiological problems of manned space flight [NASA-CRS-123042]

STROEB, B. A.

Detection, discrimination and brightness of successively presented flashing lights [NASA-CR-123042]

STERN, J. A.

Colour defective vision and the recognition of aviation colour signal light flashes [NASA-CR-123042]

Color defective vision and the recognition of aviation color signal light flashes [NASA-CR-123042]

STERNBERG, B. B.

Possibility of using adaptation of hypoxial hypoxia in a training system [NASA-CR-123042]

STINSON, E. B.

Electrolyte distribution and renal function in the hibernating hedgehog [NASA-CR-123042]

STOKES, E. A.

Pathomorphological changes in the organs of white rats subjected to irradiation by 120-Mev protons and the role of partial shielding in the attenuation of radiation damage [NASA-CR-123042]

STOKES, E. A.

Influence of preliminary administration of the radiation protector phinam on the reactivity of tissues of irradiated animals under various test conditions [NASA-CR-123042]

STOKES, E. A.

The state of metabolism during extended confinement of man in a small-volume chamber with a gas medium varying in cycles [NASA-CR-123042]

STOKES, E. A.

Influence of preliminary administration of the radiation protector phinam on the reactivity of tissues of irradiated animals under various test conditions [NASA-CR-123042]

STOKES, E. A.

Pathomorphological changes in the organs of white rats subjected to irradiation by 120-Mev protons and the role of partial shielding in the attenuation of radiation damage [NASA-CR-123042]

STOKES, E. A.

Influence of preliminary administration of the radiation protector phinam on the reactivity of tissues of irradiated animals under various test conditions [NASA-CR-123042]
Resistance of test animals to acute hypoxia during various phases of radiation sickness A71-42731
Tolerance of animals to the toxic effects of certain gases after adaptation to hypoxia A71-42810
Toxic effects of gaseous products of the organism's vital activity A71-42811
TITIN, L. A. Influence of certain radiation-protection preparations on the evacuation motor function of the gastrointestinal tract of healthy and irradiated rats A71-42707
Certain ways of preventing radiation sickness A71-42723
Excretion of free amino acids with urine as a test for early diagnosis of radiation damage A71-42736
Effect of accelerations on the reactivity of the gastrointestinal tract to pharmacological agents A71-42796
TIVARI, G. P. Effect of altitude acclimatization and cold on cold pressor response in man A71-41031
TOCHELOV, E. S. Study of the state of 'operational rest' in man A71-41060
TOCKSKAIA, M. S. Morphophysiological alterations under the action of electromagnetic waves at radio frequencies /Experimental studies/ A71-41369
TOKLEIBA, I. V. Analysis of the relation between the hypothalamus anterior and the limbic system A71-42577
TOWSEND, R. E. Effect of increased pressures of norxonic helium, nitrogen, and neon on EEG and reaction time in man A71-40347
THOSHEREM, G. V. Gaseous metabolism and electrical activity of animal skeletal muscles in a helium/oxygen medium A71-42803
TRUCHET, L. V. Post-flight histological analysis of turtles aboard Zond 7 A71-40568
TRUSHBAY, R. V. Pathomorphological changes in the organs of white rats subjected to irradiation by 120-MeV protons and the role of partial shielding in the attenuation of radiation damage A71-42721
TSITROVICH, S. L. Use of products of biological mineralization for the cultivation of higher and lower autotrophs A71-42819
TSYTRKOV, I. V. Effect of the frequency of change of the nutrient solution on the productivity of plants grown on Keramit A71-42816
Use of products of biological mineralization for the cultivation of higher and lower autotrophs A71-42819
The possibility of using human waste products mineralized by the 'wet combustion' method A71-42820
Mineralization of the vegetable wastes of a biocomplex by the thermal combustion method A71-42821
TURAEVA, S. D. Influence of amanin and chloral hydrate on the intensity of the metabolism of individual components of the brain gangliosides A71-41055
TUPBROVA, T. N. Participation of butyric acid in the biosynthesis of brain carbohydrates A71-41058
TUNOCAIA, B. S. Energy sources during muscular work under normoxic and hypoxic conditions A71-41721

UKHIN, V. M. Study of the state of 'operational rest' in man A71-41060
UKHIN, A. N. Influence of certain radiation protection drugs on the resistance of albino rats to acute hypoxia A71-42731
RESISTANCE OF TEST ANIMALS TO ACUTE HYPOXIA DURING VARIOUS PHASES OF RADIATION SICKNESS A71-42731

USINGER, W. Intracellular pH and CO2 combining curve of skeletal musculature in dogs A71-40631
UTKINA, T. G. The microflora of the human integument during prolonged confinement A71-40559
UYZINA, E. N. Resting and postexercise apexcardiogram correlated with maximal treadmill stress test in normal subjects A71-40406

VALENTIONZI, E. E. A mathematical model of the electrocardiographic QT-RR relationship A71-40586

VAN KEETEN, A. Visual processes involved in seeing flashes A71-41077
Object recognition is aided and unaided night vision [IFR-1971-7] N71-34065
VARABOV, V. P. Use of products of biological mineralization for the cultivation of higher and lower autotrophs A71-62819
VARNEN, J. B. Development of satellite-related biotelemetry equipment [NASA-GR-121893] N71-35260
VARTANIAN, A. G. The effects of letter size, case, and generation method on CEF display search time A71-62195

VASHEOV, V. I. Bacterial contamination of confined, sealed space during long-term human occupation A71-40560
Study of a method of urine conservation under space flight conditions A71-42822

VASILYEV, G. A. Influence of certain radiation protection drugs on the resistance of albino rats to acute hypoxia A71-42731
Resistance of test animals to acute hypoxia during various phases of radiation sickness A71-42731
Tolerance of animals to the toxic effects of certain gases after adaptation to hypoxia A71-42731
Toxic effects of gaseous products of the organism's vital activity A71-42811

VASILYEV, P. V. Responses of the organism under conditions of extended space flight A71-42890
Effect of accelerations on the reactivity of the gastrointestinal tract to pharmacological agents A71-42790

X-73
W

WACHTLOV, H.
Body composition, aerobic capacity, and density of muscle capillaries in young and old men
A71-41717

WAGNER, H.
Differentiation of cutaneous and intestinal blood flow during hypothalamic heating and cooling in anesthetized dogs
A71-40632

WALTER, O.-E.
Hyoxia and hypercapnia in asphyctic differentiation of regional sympathetic activity in the anesthetized rabbit
A71-40629

WANG, C. H.
Effects of monoanethyldrazine upon carbohydrate metabolism [AD-727008] N71-35259

WARD, B.
Research on physical and physiological aspects of visual optics in space flight [NASA-CR-115120] N71-34060

WEBB, W. B.
Variables associated with split-period sleep regimes N71-60388

WEBNH, J.
Pulse wave velocity in healthy subjects and in patients with various disease states N71-42518

WEIS-TOGH, T.
Flying insects and gravity N71-39588

WELCH, A. J.
Heart rate response to square wave breathing - One G compared to zero G N71-41828

WELDLE, G.
Gravity orientation in insects - The role of different mechanoreceptors N71-39990

WEDDEES, B.
Climatic conditions of work in pressurized suits [CEA-W-1407] N71-34078

WEST, G.
Combined effects of altitude and high temperature on complex performance [FAA-AM-71-17] N71-35242

WEITEMBERG, G.
Discussion of the control of eye vergence movements N71-62447

WESTING, A. H.
A case against statollths N71-39979

WILKINS, R. B.
Hormone movement in geotropism N71-39980

WILLIAMS, C. R.
Speech intelligibility in the presence of time-varying aircraft noise N71-40709

WILLIAMS, D. R.
Absolute thresholds as a function of pulse length and null period N71-41480

WILSON, D. R.
Stabilizing mechanisms in insect flight N71-39987

WILSON, P. W.
Research on physical and physiological aspects of visual optics in space flight [NASA-CR-115120] N71-34060

WOLLENHAUPP, H.
Survival of bacterial spores under some simulated lunar surface conditions N71-40567

WOOD, R. E.
Airborne audio-video recording design considerations [AD-727025] N71-35260

WULFRICK, J. W.
Visual performance with high contrast cathode ray tubes at high levels of ambient illumination [NASA-CR-114361] N71-34073

WUNDER, C. C.
The effects of chronic acceleration of animals - A commentary N71-40003
A study of the apparent flicker rate at subfusional frequencies
A study of the apparent flicker rate at subfusional frequencies
Evaluation of an improved flotation device for infants and small children
Evaluation of an improved flotation device for infants and small children
Pursuit eye tracking movements
Pursuit eye tracking movements
Object recognition in aided and unaided night vision
Object recognition in aided and unaided night vision
Mechanism of antidiuretic action of chlorpropamide in the mammalian kidney
Mechanism of antidiuretic action of chlorpropamide in the mammalian kidney
Some potentialities of living organisms under simulated Martian conditions
The effect on Infusoria of physical conditions simulating the medium on the surface of the planet Mars
The Fotostat-1 facility for studying the reactions of organisms to the physical conditions of the planet Mars
Experimental analysis of the information content of the aural electric field of the human body
Experiments with micro-organisms and human cell cultures in the Zond 5 and Zond 7 flights
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