

P 77

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 227 reports, articles and other documents recently announced in the NASA STI Database. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue include:

Scientific and Technical Aerospace Reports (STAR) (N-10000 Series) N93-15659 — N93-17808
International Aerospace Abstracts (A-10000 Series) A93-17521 — A93-21225

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are 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. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1993 will be published in early 1994.

Information on availability of documents listed, addresses of organizations, and CASI price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED
ON MICROFICHE

ACCESSION NUMBER → N93-12195*# Lockheed Engineering and Sciences Co., Houston, TX. ← **CORPORATE SOURCE**
TITLE → **ASTRONAUT CANDIDATE STRENGTH MEASUREMENT USING THE CYBEX 2 AND THE LIDO MULTI-JOINT 2 DYNAMOMETERS Final Report**
AUTHORS → AMY E. CARROLL and ROBERT P. WILMINGTON May 1992 ← **PUBLICATION DATE**
CONTRACT NUMBER → (Contract NAS9-17900)
REPORT NUMBERS → (NASA-CR-185679; NAS 1.26:185679; LESC-30277) Avail: CASI HC ← **AVAILABILITY SOURCE**
PRICE CODE → A03/MF A01

The Anthropometry and Biomechanics Laboratory in the man-Systems division at NASA's Johnson Space Center has as one of its responsibilities the anthropometry and strength measurement data collection of astronaut candidates. The anthropometry data is used to ensure that the astronaut candidates are within the height restrictions for space vehicle and space suit design requirements, for example. The strength data is used to help detect abnormalities or isolate injuries to muscle groups that could jeopardize the astronauts safety. The Cybex II Dynamometer has been used for strength measurements from 1985 through 1991. The Cybex II was one of the first instruments of its kind to measure strength and similarity of muscle groups by isolating the specific joint of interest. In November 1991, a LIDO Multi-Joint II Dynamometer was purchased to upgrade the strength measurement data collection capability of the Anthropometry and Biomechanics Laboratory. The LIDO Multi-Joint II Dynamometer design offers several advantages over the Cybex II Dynamometer including a more sophisticated method of joint isolation and a more accurate and efficient computer based data collection system. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

ACCESSION NUMBER → A93-11150
TITLE → **STUDIES TOWARDS THE CRYSTALLIZATION OF THE ROD VISUAL PIGMENT RHODOPSIN**
AUTHORS → W. J. DE GRIP, J. VAN OOSTRUM, and G. L. J. DE CALUWE ← **JOURNAL TITLE**
AUTHORS' AFFILIATION → (Nijmegen Catholic Univ., Netherlands) Journal of Crystal Growth (ISSN 0022-0248) vol. 122, no. 1-4 Aug. 1992 p. 375-384. ← **PUBLICATION DATE**
 Research supported by SRON refs
 (Contract NWO-SON-328-050)
 Copyright

Results are presented of crystallization experiments on bovine rhodopsin, which established a restricted range of conditions which reproducibly yield rhodopsin crystals. Several parameters were optimized, including the detergent, the precipitant, additives, and pH. The crystals obtained so far are too small (less than 50 microns in any direction) or of insufficient order to allow high-resolution diffraction analysis. Several approaches are proposed for improving the average size, stability, and order of the rhodopsin crystals.

I.S.

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 374)

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LIFE SCIENCES (GENERAL)

A93-17541

PHARMACODYNAMIC ASPECTS OF SPACEFLIGHT

GERHARD LEVY (New York State Univ., Amherst) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 956-961. refs

Copyright

Laboratory data are presented which suggest that there is a reasonable likelihood that the pharmacodynamics (defined as the relationship between drug concentrations and the intensity of pharmacologic effects) of certain medicinal agents may be altered during spaceflight. It is suggested that the formal studies should be initiated, initially in ground-based animal models and human volunteers subjected to prolonged head-down bed rest, and, eventually, in animals and humans exposed to microgravity, of pharmacodynamics and pharmacokinetics of drugs used by astronauts. I.S.

A93-17822

EXPERIMENTAL STUDIES ON THE ORIGIN OF THE GENETIC CODE AND THE PROCESS OF PROTEIN SYNTHESIS - A REVIEW UPDATE

JAMES C. LACEY, JR., NALINIE S. M. D. WICKRAMASINGHE, and GARY W. COOK (Alabama Univ., Birmingham) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 5 1992 p. 243-275. refs

Copyright

A review by Lacey and Mullins (1983) on the origin of the genetic code and the process of protein synthesis is updated focusing on experimental evidence published since then. Relevant data on the evolution of tRNAs and the recognition of tRNAs by aminoacyl-tRNA-systems are addressed. It is concluded that most evidence supports the anticodon hypothesis for the code origin. The hypothesis is that the code arose based on physicochemical relationships between amino acids and their anticodons. Attention is also given to the coding problem and peptide bond synthesis. O.G.

A93-17823

AN EFFICIENT LIGHTNING ENERGY SOURCE ON THE EARLY EARTH

R. D. HILL (California Univ., Santa Barbara) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 5 1992 p. 277-285. refs

Copyright

A hypothesis is proposed that the lightning associated with early earth volcanoes have been a much more effective source of the prebiotic synthesis process than the general earth lightning that has been inherently assumed by Miller and Urey (1959) and Chyba and Sagan (1991). The high efficiency of volcanic lightning could have been associated with the highly localized character of lightning over a water containment area that was both shallow and area-limited and could therefore have led to more highly

concentrated solutions of synthesized organic molecules. The fact that the electric discharges actually occurred in the reducing gases of the volcanic plume itself is also considered to be responsible for a higher efficient production by volcanic lightning. O.G.

A93-17825

THE EVOLUTION OF AMINOACYL-TRNA SYNTHETASES, THE BIOSYNTHETIC PATHWAYS OF AMINO ACIDS AND THE GENETIC CODE

MASSIMO DI GIULIO (CNR, Ist. Internazionale di Genetica e Biofisica, Naples, Italy) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 5 1992 p. 309-319. refs

Copyright

In this paper the partition metric is used to compare binary trees deriving from (i) the study of the evolutionary relationships between aminoacyl-tRNA synthetases, (ii) the physicochemical properties of amino acids and (iii) the biosynthetic relationships between amino acids. If the tree defining the evolutionary relationships between aminoacyl-tRNA synthetases is assumed to be a manifestation of the mechanism that originated the organization of the genetic code, then the results appear to indicate the following: the hypothesis that regards the genetic code as a map of the biosynthetic relationships between amino acids seems to explain the organization of the genetic code, at least as plausibly as the hypotheses that consider the physicochemical properties of amino acids as the main adaptive theme that lead to the structuring of the code. Author

A93-18001

WHY ARE HYDROTHERMAL SYSTEMS PROPOSED AS PLAUSIBLE ENVIRONMENTS FOR THE ORIGIN OF LIFE?

NILS G. HOLM (Stockholm Univ., Sweden) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 5-14.

Copyright

Hydrothermal systems located at global plate spreading centers have attracted the attention of geochemists as viable environments for chemical evolution and the origin of life. Among the reasons for the interest in hydrothermal systems is that the primitive organisms found in modern environments are thermophiles, and hydrothermal systems and deep sediments are about the only environments where primitive life would have been protected from postulated meteorite impacts and partial vaporization of the ocean. In addition, the presence of supercritical fluids is known (CO₂, H₂O) or postulated (CH₄) in hydrothermal systems; supercritical fluids such as CO₂ and H₂O are excellent solvents of organic compounds and would probably be of great potential for several of the chemical reactions eventually leading to the origin of life. L.M.

A93-18002

HYDROTHERMAL SYSTEMS - THEIR VARIETIES, DYNAMICS, AND SUITABILITY FOR PREBIOTIC CHEMISTRY

NILS G. HOLM (Stockholm Univ., Sweden) and REMY J.-C. HENNET (S.S. Papadopoulos and Associates, Inc., Bethesda, MD) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 15-31.

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The dynamic chemical and physical processes occurring in

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crustal hydrothermal systems are examined along with the different types of contemporary submarine hydrothermal systems. Whenever possible, comparisons are made with evidence of fossil systems. Attention is given to sediment-free on-axis systems at spreading centers, sediment-covered on-axis systems at spreading centers, off-axis systems at spreading centers, systems associated with backarc basins and backarc spreading centers, hydrothermal systems at hot spots, systems associated with subduction zones, and continental hydrothermal systems. L.M.

A93-18003

MODERN LIFE AT HIGH TEMPERATURES

ROY M. DANIEL (Waikato Univ., Hamilton, New Zealand) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 33-42.

Copyright

A variety of microorganisms are known which grow optimally at temperatures above 65 C; they are defined as extreme thermophiles. All extreme thermophiles are eubacteria or archaeobacteria, and only the latter are known to have temperature optima for growth at temperatures above 85 C. Attention is given to thermophily and evolution with particular reference to the archaeobacteria. The metabolism of the most extreme thermophiles, thermal stability in thermophiles, and the growth temperature of the ancestral organism are examined. L.M.

A93-18005* National Aeronautics and Space Administration, Washington, DC.

CHEMICAL ENVIRONMENTS OF SUBMARINE HYDROTHERMAL SYSTEMS

EVERETT L. SHOCK (Washington Univ., Saint Louis, MO) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 67-107.

(Contract NSF EAR-90-18468; NAGW-2818)

Copyright

The paper synthesizes diverse information about the inorganic geochemistry of submarine hydrothermal systems, provides a description of the fundamental physical and chemical properties of these systems, and examines the implications of high-temperature, fluid-driven processes for organic synthesis. Emphasis is on a few general features, i.e., pressure, temperature, oxidation states, fluid composition, and mineral alteration, because these features will control whether organic synthesis can occur in hydrothermal systems. L.M.

A93-18006

CHEMICAL MARKERS OF PREBIOTIC CHEMISTRY IN HYDROTHERMAL SYSTEMS

JAMES P. FERRIS (Rensselaer Polytechnic Inst., Troy, NY) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 109-134.

Copyright

Some organic compounds are suggested which may be indicative of prebiotic processes in hydrothermal systems or laboratory simulations of them. The types of molecules formed in primitive earth simulation experiments and observed in the interstellar medium, and on comets and meteorites are reviewed. Some reactions involving these molecules which may have been important in prebiotic synthesis are outlined. The properties and aspects of organic chemistry in supercritical water at high temperature and pressure are also discussed. In addition, Fischer-Tropsch type reactions, which are a potential source of the building blocks of biological molecules in hydrothermal systems, are examined. Finally, the possible formation in hydrothermal systems of organic molecules which are believed to have been important for the origins of life is considered. L.M.

A93-18007* National Aeronautics and Space Administration, Washington, DC.

HYDROTHERMAL ORGANIC SYNTHESIS EXPERIMENTS

EVERETT L. SHOCK (Washington Univ., Saint Louis, MO) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol.

22, no. 1-4 1992 p. 135-146.

(Contract NSF EAR-90-18468; NAGW-2818)

Copyright

Ways in which heat is useful in organic synthesis experiments are described, and experiments on the hydrothermal destruction and synthesis of organic compounds are discussed. It is pointed out that, if heat can overcome kinetic barriers to the formation of metastable states from reduced or oxidized starting materials, abiotic synthesis under hydrothermal conditions is a distinct possibility. However, carefully controlled experiments which replicate the descriptive variables of natural hydrothermal systems have not yet been conducted with the aim of testing the hypothesis of hydrothermal organic systems. L.M.

A93-18008

AN EXPERIMENTAL APPROACH TO CHEMICAL EVOLUTION IN SUBMARINE HYDROTHERMAL SYSTEMS

HIROSHI YANAGAWA (Mitsubishi Kasei Inst. of Life Sciences, Machida, Japan) and KENSEI KOBAYASHI (Yokohama National Univ., Japan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 147-159.

(Contract MOESC-63540445)

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Experimental results are presented on the formation of amino acids under simulated submarine hydrothermal system conditions and on the formation of thermophilic microspheres and peptidolike polymers under such conditions. The results indicate that abiotic synthesis of organic compounds may be possible in submarine hydrothermal systems. In addition, the results suggest that polymerization reactions may occur among organic compounds in hydrothermal fluids. Extremely thermophilic cellular structures may be possible if they are somehow analogous to the microspheres produced from amino acids at 250 C. L.M.

A93-18009

MINERAL THEORIES OF THE ORIGIN OF LIFE AND AN IRON SULFIDE EXAMPLE

A. G. CAIRNS-SMITH, ALAN J. HALL, and MICHAEL J. RUSSELL (Glasgow Univ., United Kingdom) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 161-180. Research supported by Scientific Committee on Oceanic Research

(Contract NERC-GR/3/7779)

Copyright

So-called conservative and radical mineral theories of the origin of life are discussed. Particular attention is given to the origin of life under hydrothermal conditions. A mineral model based on iron sulfides is examined. L.M.

A93-18010

FUTURE RESEARCH

NILS G. HOLM (Stockholm Univ., Sweden), A. G. CAIRNS-SMITH (Glasgow Univ., United Kingdom), ROY M. DANIEL (Waikato Univ., Hamilton, New Zealand), JAMES P. FERRIS (Rensselaer Polytechnic Inst., Troy, NY), REMY J.-C. HENNET (S.S. Papadopoulos and Associates, Inc., Bethesda, MD), EVERETT L. SHOCK (Washington Univ., Saint Louis, MO), BERND R. T. SIMONEIT (Oregon State Univ., Corvallis), and HIROSHI YANAGAWA (Mitsubishi Kasei Inst. of Life Sciences, Machida, Japan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 1-4 1992 p. 181-190.

Copyright

Future trends of research on marine hydrothermal systems and the origin of life are projected. Particular attention is given to the physical and chemical characterization of natural systems, supercritical fluids, and the mineral catalysis of organic transformations in hydrothermal systems. Also considered are organic synthesis simulations, macromolecules and membranes, and the ultimate limits for life in hydrothermal environments. L.M.

A93-18039**THERMOGENESIS INDUCED BY INHIBITION OF SHIVERING DURING COLD EXPOSURE IN EXERCISE-TRAINED RATS**

OSAMU KASHIMURA, AKIO SAKAI, YASUNORI YANAGIDAIRA, and GOU UEDA (Shinshu Univ., Matsumoto, Japan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1082-1086. refs

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The present investigation was conducted to examine the role of nonshivering and shivering thermogenesis caused by cold exposure in exercise-trained rats. Wistar rats were divided into warm-acclimated (WA), exercise-trained (ET) and cold-acclimated (CA) groups. The trachea was cannulated and a ventilator was connected under light anesthesia and in the supine position. Shivering, oxygen consumption, colonic temperature, blood glucose, and free-fatty acids were measured at 25 C and then at 0 C room temperatures. D-tubocurarine chloride (curare, 0.04 mg/100 g body weight, ip) was given to inhibit muscular activity. Cold-induced oxygen consumption in the ET and WA groups did not decrease when shivering was inhibited, whereas it increased in the CA. The magnitude just after shivering onset for the ET and CA groups as significantly greater than for the WA group. Colonic temperature at the onset of shivering was significantly higher in the WA group than in the ET and the CA groups. The blood glucose concentration during cold exposure and curarization was elevated in the ET group, and did not change in the CA or WA groups. The present results suggest that endurance training at a thermoneutral environment increases cold-induced thermogenic capacity in rats, which may be attributed to preferential carbohydrate utilization. Author

A93-18073* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

TRACK STRUCTURE MODEL FOR DAMAGE TO MAMMALIAN CELL CULTURES DURING SOLAR PROTON EVENTS

F. A. CUCINOTTA, J. W. WILSON, L. W. TOWNSEND, J. L. SHINN (NASA, Langley Research Center, Hampton, VA), and R. KATZ (Nebraska Univ., Lincoln) International Journal of Radiation Applications and Instrumentation, Part D: Nuclear Tracks and Radiation Measurements (ISSN 0735-245X) vol. 20, no. 1 1992 p. 177-184. refs

Copyright

Solar proton events (SPEs) occur infrequently and unpredictably, thus representing a potential hazard to interplanetary space missions. Biological damage from SPEs will be produced principally through secondary electron production in tissue, including important contributions due to delta rays from nuclear reaction products. We review methods for estimating the biological effectiveness of SPEs using a high energy proton model and the parametric cellular track model. Results of the model are presented for several of the historically largest flares using typical levels and body shielding. Author

A93-18286**INFRAFLOW BIOELECTRIC ACTIVITY OF THE MONKEY'S BRAIN IN THE DEVELOPMENT OF THE HIGH-PRESSURE NEURAL SYNDROME [SVERKHMEDLENNIA BIOELEKTRICHESKAIA AKTIVNOST' MOZGA OBEZ'IAN PRI RAZVITII NERVNOGO SINDROMA VYSOKOGO DAVLENIIA]**

I. T. DEMCHENKO and O. I. SHARAPOV (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 1-6. In Russian. refs

Copyright

The relationship between the rise in atmospheric pressure and the cerebral infraslow bioelectric activity was investigated by monitoring the infraslow bioelectric activity during the development of the high-pressure neural syndrome in monkeys placed in a helium-nitrogen-oxygen atmosphere, with the atmospheric pressure rising up to 70 ata. It was found that, at pressures between 25 and 35 ata and higher, the ECG oscillation amplitudes increased threefold, and the oscillations in different structures became synchronized. The ECG changes were found to be correlated with

changes in EEG and with the occurrence of motion disturbances (tremor, cramps, myoclonia). The feasibility of using measurements of bioelectrical changes in the infraslow range for diagnosing the occurrence and the stage of the high-pressure neural syndrome is discussed. I.S.

A93-18287**FUNCTIONAL STATE OF THE CENTRAL NERVOUS SYSTEM OF GUINEA PIGS AFTER A PROLONGED STAY IN ARTIFICIAL ATMOSPHERES WITH DIFFERENT GAS COMPOSITIONS [FUNKTSIONAL'NOE SOSTOIANIE TSENTRAL'NOI NERVNOI SISTEMY MORSKIKH SVINOK POSLE DLITEL'NOGO PREBYVANIIA V ISKUSSTVENNOI GAZOVOI SREDE RAZLICHNOGO SOSTAVA]**

A. I. SELIVRA, V. B. KOSTKIN, and I. L. PONOMAREVA (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 7-13. In Russian. refs

Copyright

The effect of a prolonged (4-5 days) stay in atmospheres of different gas compositions on the function of the central nervous system (CNS) was investigated in guinea pigs placed in chambers with O₂-He or O₂-N₂-He atmospheres at 71 ata. The functional state of CNS was assessed by examining the dynamics of the statistic and correlational-spectral parameters of the heart rhythm. It was found that the occurrence of signs of activation of subcortical CNS centers was significantly lower in guinea pigs subjected to the O₂-N₂-He atmosphere than in those staying in the O₂-He mixture. The increase of oxygen partial pressure to 0.3 ata in the O₂-N₂-He mixture had a beneficial effect. I.S.

A93-18289**THE EFFECT OF ELEVATED NITROGEN PRESSURE ON MOTOR ACTIVITY AND RELATIONSHIPS AMONG BRAIN CENTERS IN MONKEYS [DEISTVIE POVYSHENNOGO DAVLENIIA AZOTA NA DVIGATEL'NIU AKTIVNOST' I MEZHTSENTRAL'NYE OTNOSHENIIA MOZGA OBEZ'IAN]**

A. N. VETOSH, E. E. FEIGMAN, O. I. SHARAPOV, and M. N. SHILINA (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 26-32. In Russian. refs

Copyright

The effect of an elevated (up to 19 ata) nitrogen pressure on motor activity of monkeys was investigated in monkeys (*Macaca irus*) with electrodes embedded into the frontal and the motor cortical regions as well as into the head of the caudal nucleus, the black substance, and the reticular formation of the left hemisphere's midbrain. Compression with nitrogen at a rate of 1 ata/min revealed a biphasic nature of motor activity. There was an increase in the spectral density of the EEG average voltage within the frequency range 4-20 Hz and a deterioration of the relation between the electrogenesis in the reticular formation and the bioelectric processes in the substantia nigra, the head of the caudate nucleus, and the frontal and motor cortical regions. I.S.

A93-18290**MOTOR ACTIVITY OF ANIMALS UNDER ELEVATED PRESSURE [MOTORNOE POVEDENIE ZHIVOTNYKH V USLOVIAKH POVYSHENNOGO DAVLENIIA]**

G. E. SVIDERSKAIA and L. E. DMITRIEVA (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 33-39. In Russian. refs

Copyright

The effect of elevated atmospheric pressure on the motor activity of guinea pigs was investigated in animals kept for 5 to 19 days in pressure chambers filled with He-O₂ mixtures at 6, 36, 70, or 100 ata; the guinea pigs were observed through a window during all phases of the experiment. It was found that pressure increases were accompanied by sharp increases of the number of grooming movements (up to tenfold compared with controls), with the greatest increase occurring during the first days of compression, followed by a subsequent decrease and stabilization

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of grooming activity. During the decompression, an instability of the motor activity was observed, but the number of grooming movements still exceeded the control level. It is suggested that the results may help identify early stages of the high-pressure nervous syndrome. I.S.

A93-18293

LOCAL BLOOD SUPPLY OF THE BRAIN OF GUINEA PIGS DEVELOPING THE HIGH-PRESSURE NEURAL SYNDROME [LOKAL'NOE KROVOSNABZHENIE GOLOVNOGO MOZGA MORSKIKH SVINOK PRI RAZVITII NERVENNOGO SINDROMA VYSOKOGO DAVLENIIA]

S. I. U. ZHILIAEV, D. N. ATOCHIN, and I. T. DEMCHENKO (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 50-57. In Russian. refs
Copyright

Guinea pigs subjected to continuous compression up to 100 ata in a normoxic He-O₂ mixture were found to develop tremor, followed by myoclonia and, finally, by seizures of clonic and tonic types. It was found that the blood supply of the cortex, the black substance, and the caudate nucleus increased during these motor disorders, depending on the stage of the development of the high-pressure neural syndrome. I.S.

A93-18294

THE STATE OF BRAIN OXYGENATION IN GUINEA PIGS BREATHING HIGH-DENSITY GAS MIXTURES [SOSTOIANIE OKSIGENATSII GOLOVNOGO MOZGA MORSKIKH SVINOK PRI DYKHANII GAZOVYMI SMESIAMI VYSOKOI PLOTNOSTI]

D. N. ATOCHIN, S. I. U. ZHILIAEV, and A. I. KRIVENKO (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 58-64. In Russian. refs
Copyright

The pO₂ dynamics in brain tissues of guinea pigs breathing high-density normoxic Ne-O₂ and He-O₂ mixtures was investigated. It was found that gas compression caused pO₂ changes in the black substance, the caudate nucleus, and the occipital cortex. The extent and the direction of these changes depended on both the pressure and the composition of gas mixtures. I.S.

A93-18295

DISTRIBUTION OF OXYGEN TENSION IN PIAL ARTERIOLES OF RATS UNDER NORMOBARIC HYPEROXIA [RASPREDELENIE NAPRIAZHENIIA KISLORODA NA PIAL'NYKH ARTERIOLAKH KRYSY PRI NORMOBARICHESKOI GIPEROKSII]

E. P. VOVENKO and I. B. SOKOLOVA (RAN, Inst. Fiziologii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 65-72. In Russian. refs
Copyright

The effect of substituting oxygen for air on the distribution of pO₂ among the pial arterioles of the rat was investigated in animals fitted with platinum electrodes and a window exposing an area in the pia mater, and who were breathing (through a tracheotomic cannule) first air and then pure-O₂. It was found that, in rats breathing air, the pO₂ did not depend on the diameter of pial vessels, while in rats breathing pure oxygen the pO₂ values decreased sharply along the course of the microvessel bed. I.S.

A93-18296

POLYPHOSPHOINOSITIDE RESPONSE TO VARIOUS NEUROTRANSMITTERS AFTER AN EXPOSURE TO A HELIUM-OXYGEN ATMOSPHERE AT A HIGH PRESSURE [POLIFOSFOINOZITIDNYI OTVET, VYZVANNYI RAZLICHNYMI NEIROMEDIATORAMI, POSLE VOZDEISTVIA GELIOKISLORODNOI SREDY POD POVYSHENNYM DAVLENIEM]

E. I. TIULKOVA (RAN, Inst. Fiziologii, St. Petersburg, Russia) and A. I. U. SLEDKOV (NII Gigieny Morskogo Transporta, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no.

3 March 1992 p. 73-77. In Russian. refs
Copyright

The effect of an exposure of rats to a He-O₂ atmosphere at 40 kg sq cm, followed by a stepwise decompression, on the in vitro incorporation by cortical synaptosomes of P-32-orthophosphate into polyphosphoinositides as a response to administrations of acetylcholine, dopamine, adrenaline, glutamate, aspartate, or substance P was investigated. It was found that, in most cases, high partial pressures of He caused variable and nonspecific changes in the P-32 incorporation into polyphosphoinositides. I.S.

A93-18297

MAXIMAL LUNG VENTILATION AND FORCED EXPIRATION RATE UNDER HYPERBARIA [MAKSIMAL'NAIA VENTILIATSIIA LEGKIKH I SKOROST' FORSIROVANNOGO VYDOKHA V USLOVIAKH GIPERBARII]

M. A. POGODIN and A. E. OVCHINNIKOV (RAN, Inst. Fiziologii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 78-83. In Russian. refs
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It was found that, in humans placed into high-pressure chambers, breathing artificial gas mixtures at elevated (up to 14.3 g/l) density, both the maximal lung ventilation and the maximal rate of forced expiration decreased with increased gas density. These results suggest that the values of these parameters are limited by the expiratory dynamic compression of the respiratory pathways, rather than by the exhaustion of respiratory muscles. I.S.

A93-18298

PARAMETERS OF EXTERNAL BREATHING IN AN EXCESS-PRESSURE ATMOSPHERE [PARAMETRY VNESHNEGO DYKHANIIA V SREDE PRI IZBYTOCHNOM DAVLENI]

A. S. IVANOV and F. P. TULBAEVA (RAN, Inst. Fiziologii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 84-88. In Russian. refs
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The effect of an excessive resistive pressure on the respiratory system parameters was investigated in alert rabbits breathing in atmospheric-pressure air or a normoxic N₂-O₂ gas mixture at a pressure of 6 kg/sq cm, by measuring respiratory parameters and the electric activity of inspiratory muscles. Results indicate that the increased loading on the respiratory muscles induced compensatory responses directed at the preservation of the necessary level of lung ventilation. I.S.

A93-18299

AN ANALYSIS OF THE RESPIRATORY MUSCLE FATIGUE UNDER RESISTIVE LOADING WHEN BREATHING GAS MIXTURES CONTAINING DIFFERENT AMOUNTS OF OXYGEN [ANALIZ UTOMLENIIA DYKHATEL'NYKH MYSHTS PRI REZISTIVNOI NAGRUZKE NA FONE DYKHANIIA GAZOVYMI SMESIAMI S RAZLICHNYM SODERZHANIEM KISLORODA]

N. P. ALEKSANDROVA (RAN, Inst. Fiziologii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 89-98. In Russian. refs
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The effect of prolonged inspiratory loading when breathing gas mixtures containing different amounts of oxygen on the relation between the central and the peripheral components of the respiratory muscle fatigue was investigated in anesthetized cats. It was found that the respiratory muscle fatigue under normoxia occurred at a heavy inspiratory load equal to 80 percent of maximal inspiratory effort. During respiration in hypoxic atmosphere, the force of the diaphragm contraction did not decrease, whereas a weakening of the contractile ability occurred under 70 percent of maximal load. It is suggested that breathing under hypoxia, combined with an additional mechanical load, affected primarily the peripheral components of the respiratory system's motor muscles, since the diaphragm nerve was not affected. I.S.

A93-18300

ELECTROPHYSIOLOGICAL AND ULTRASTRUCTURAL ASPECTS OF THE EFFECT OF HIGH-PRESSURE OXYGEN ON THE SENSORIMOTOR CORTEX OF THE RAT BRAIN [ELEKTROFIZIOLOGICHESKIE I UL'TRASTRUKTURNYE ASPEKTY VLIANIYA POVYSHENNOGO DAVLENIIA KISLORODA NA SENSORIMOTORNIJU KORU GOLOVNOGO MOZGA KRYZ]

A. M. MENDZHERITSKII, P. E. POVILAITITE, and A. A. BURIKOV (Rostovskii Gosudarstvennyi Univ., Rostov-on-Don, Russia) *Fiziologicheskii Zhurnal* (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 99-105. In Russian. refs

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Results are presented of an analysis of electrophysiological and ultrastructural changes in the II-V layers of the rat brain cortex during respiration in hyperoxic gas mixtures. It was found that the ECGs of rats kept for 2 hrs under 0.3 MPa oxygen pressure indicated the occurrence of single sharp waves, with no generalization along the cortex surface. The spasmodic activity of the cortex became generalized at 0.7 MPa oxygen, affecting a part of the neuronal pool, due probably to irreversible changes in inhibitory axosomatic synapses. I.S.

A93-18301

GAS COMPOSITION IN THE BLOOD OF RABBITS EXPOSED TO A HIGH-PRESSURE ATMOSPHERE UNDER CONDITIONS OF SPONTANEOUS AND FORCED VENTILATION [GAZOVYI SOSTAV KROVI U KROLIKOV V SREDE POD POVYSHENNYM DAVLENIEM V USLOVIAKH ESTESTVENNOI I PRINUDITEL'NOI VENTILIATSII]

ZH. A. DONINA and G. V. TROSHIKHIN (RAN, Inst. Fiziologii, St. Petersburg, Russia) *Fiziologicheskii Zhurnal* (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 106-108. In Russian. refs

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The effect of artificially increased lung ventilation on the gas composition of blood during hyperbaria was investigated in rabbits whose carotid artery was fitted with a ring with a T-joint connected to a pressure-chamber valve, making it possible to take blood samples directly from the pressure chamber. Results of blood analyses and measurements of respiration parameters indicated that the hyperbaria-induced deficiency of the respiratory exchange was caused by a sharp decrease of the respiratory volumes, due to increased resistance to the inhaled gas flow. When the lung ventilation was artificially maintained at a high level, the blood gas composition remained unchanged even in a high-density atmosphere. I.S.

A93-18302

A DEVICE FOR THE PROLONGED RESTRAINT OF PRIMATES IN CLOSED-SPACE CONDITIONS [USTROISTVO DLIYA PRINUDITEL'NOGO SODERZHANIYA PRIMATOV V USLOVIAKH ZAMKNUTOGO PROSTRANSTVA]

A. K. DOBRYLKO, B. A. SMORODIN, E. E. FEIGMAN, and M. B. SMIRNOV (RAN, Inst. Evoliutsionnoi Fiziologii i Biokhimmii, St. Petersburg, Russia) *Fiziologicheskii Zhurnal* (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 109-113. In Russian. refs

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A restraining device is described for fixing a primate subject in a closed space for periods from 10 to 40 days. The system can be adapted to primates of different sizes and can be used to restrain the subject in standing or sitting positions. By using this system, it is possible to register for an extended period of time the physiological conditions at rest and during food intake, and to evacuate the animal during an experiment. Design diagrams are included. I.S.

A93-18407

K.E. TSIOLKOVSKY ON THE PROBLEM OF HUMAN SURVIVAL IN EXTREME ENVIRONMENTS (ON THE EARTH AND IN SPACE) [K.E. TSIOLKOVSKII O PROBLEME VYZHIVANIYA CHELOVEKA V EKSTREMAL'NYKH USLOVIAKH VNESHNEI SREDY /NA ZEMLE I V KOSMOSE/]

F. P. KOSMOLINSKII and L. N. MEL'NIKOV *In* K.E. Tsiolkovsky

and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 3-12. In Russian. refs

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Tsiolkovsky's ideas concerning the survival of man on the earth and in space are discussed. It is noted that Tsiolkovsky had recognized the need for planning gradual environmental improvements on the earth prior to attempting an access to outer space. Tsiolkovsky emphasized that (1) the fact that conditions on earth are acceptable to good is in turn due to the fact that life on earth appeared as a result of evolution rather than a result of sudden colonization, (2) continuous growth of population and the evolution of technology on earth will create environmental problems which will eventually make life on earth nearly impossible, and (3) colonization of other planets by man in the future is inevitable. I.S.

A93-18419

ENGINEERING AND TECHNICAL SUPPORT OF EXPERIMENTS ON BOARD THE COSMOS-2044 BIOSATELLITE [INZHENERNO-TEKHNICHESKOE OBESPECHENIE EKSPERIMENTOV NA BIOSPUTNIKE 'KOSMOS-2044']

A. O. ALEKIN, M. V. BOIARINOVA, V. M. GALKIN, V. N. GORBACHEV, L. N. KONDAKOVA, T. N. NOZHNITSKAIA, B. L. PEREPECH, S. S. RVACHEV, V. P. RUMIANTSEV, S. V. TUBOLT'SEV et al. *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 84-88. In Russian.

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The program of studies of the effect of microgravity on various biological systems, planned for the Cosmos-2044 mission, required the development of a number of unique technologies without analogues in the previous practice of space instrument design. This paper describes the experimental life-support system (SBS9) and the measurement instruments designed for the Cosmos-2044 biosatellite. Various subsystems of the facility include the BIOS-Primate and Bios-Vivarium systems and the complex of the Cytos, Aquarium, and BBI-Zh instruments for biological experiments. Data obtained from Cosmos-2044 experiments during its flight and the results of postflight analyses of data stored on the Cosmos-2044 recorders showed that the SBS9 system was able to provide adequate technological support for all experiments planned for the mission. I.S.

A93-19994

EFFECTS OF VITAMIN D AND PHOSPHORUS LEVEL IN DIET ON BONE, SKELETAL MUSCLE AND KIDNEY IN SUSPENDED RATS

CHENG-LIN LIU (Inst. of Space Medico-Engineering, Beijing, China) et al. *Space Medicine and Medical Engineering* (ISSN 1002-0837) vol. 5, no. 3 1992 p. 179-185. In Chinese. refs

The paper ascertains the effects of vitamin D3 supplements in diets with normal or high phosphorus content on the chemical composition of the femur, gastrocnemius and kidney, and other indices in rats exposed to tail suspension for 30 d. It is suggested that supplements of high doses of vitamin D to diets with normal or high phosphorus content might be harmful to organisms exposed to weightlessness or simulated weightlessness. P.D.

A93-20027

HEART AND LUNG ALTERATIONS IN NEONATAL RATS EXPOSED TO CO OR HIGH ALTITUDE

DAVID G. PENNEY, ALAN TUCKER, and GREGORY A. BAMBACH (Wayne State Univ., Detroit, MI; Colorado State Univ., Fort Collins) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1713-1719. Research supported by Saint John Hospital and Colorado State Univ refs

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51 LIFE SCIENCES (GENERAL)

Heart and lung alterations in neonatal rats due to exposures to CO or high altitude were investigated in order to determine (1) whether CO hypoxia, like hypoxic hypoxia, induces pulmonary hypertension, (2) whether pulmonary hypertension induced in young animals by either CO or hypoxic hypoxia persists in adulthood, and (3) whether hypoxic hypoxia produces persistent changes in cardiac mass and cellularity similar to those previously observed for CO. It was found that early postnatal exposure to CO was not associated with pulmonary hypertension, in sharp contrast found for neonatal rats exposed to hypoxic hypoxia. It was also found that the development of cardiomegaly in the neonates, whether resulting from CO exposure or from exposure to hypoxic hypoxia, resulted in right-ventricle mass which was above the level expected for untreated rats of the same strain and persisted much longer than the time normally required in adult rats for regression of cardiomegaly. I.S.

A93-20030 **DIFFERENTIAL EFFECTS OF LONG-TERM HYPOXIA ON NOREPINEPHRINE TURNOVER IN BRAIN STEM CELL GROUPS**

V. SOULIER, J. M. COTTET-EMARD, J. PEQUIGNOT, F. HANCHIN, L. PEYRIN, and J. M. PEQUIGNOT (Lyon I, Univ., France) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1810-1814. Research supported by CNRS refs (Contract DRET-88-069)
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The effect of long-term hypoxia on the norepinephrine (NE) turnover in different groups of noradrenergic brain stem cells of rats was investigated by estimating NE turnover changes in A1, A2 (subdivided into anterior and posterior) and A5 and A6 cell groups of animals exposed for 14 days to a 10 percent O₂/90 percent N₂ atmosphere. It was found that NE turnover was decreased in A5 and A6 cell but did not change in A1 cells. The NE turnover also increased in the posterior part of A2 but remained unchanged in the anterior part. The neurochemical responses to hypoxia were abolished by transection of carotid sinus nerves. I.S.

A93-20032 **TIME COURSE OF FUNCTIONAL REPAIR OF THE ALVEOLAR EPITHELIUM AFTER HYPEROXIC INJURY**

REGINA M. PALAZZO, O. D. WANGENSTEEN, and DENNIS E. NIEWOEHNER (Minnesota Univ.; Veterans Affairs Medical Center, Minneapolis) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1881-1887. Research supported by Veterans Affairs Research Service and American Lung Association refs
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Hyperoxic exposure increases epithelial permeability, and during recovery, normal permeability must be regained. To determine the time course for recovery of this function, we exposed hamsters to greater than 95 percent O₂ for 4.5 days and returned them to room air. After recovery periods of 0.5, 1, 3, 7, and 14 days, alveolar epithelial permeability x surface area (PS) values for C-14 sucrose and fluorescein isothiocyanate-Dextran 20 were measured with isolated perfused lung techniques. Eighty-five percent of the exposed animals survived in room air. Control PS values for sucrose and Dextran 20 were 5.76 x 10⁻⁵ and 0.29 x 10⁻⁵ cu cm/s, respectively. After hyperoxia, both values were increased by a factor of five. After half a day of recovery, PS remained elevated, but after one day they were decreased. Normal PS values were achieved after three days for sucrose and seven days for Dextran 20. During both acute injury and recovery, epithelial selectivity was unchanged and no ultrastructural changes in the alveolar epithelium were observed. Author

A93-20033 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ECCENTRIC EXERCISE TRAINING AS A COUNTERMEASURE TO NON-WEIGHT-BEARING SOLEUS MUSCLE ATROPHY
CHRISTOPHER R. KIRBY, MIRELLE J. RYAN, and FRANK W. BOOTH (Texas Univ., Houston) *Journal of Applied Physiology*

(ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1894-1899. refs
(Contract NAG2-239; NAGW-70)
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This investigation tested whether eccentric resistance training could prevent soleus muscle atrophy during non-weight bearing. Adult female rats were randomly assigned to either weight bearing +/- intramuscular electrodes or non-weight bearing +/- intramuscular electrodes groups. Electrically stimulated maximal eccentric contractions were performed on anesthetized animals at 48-h intervals during the 10-day experiment. Non-weight bearing significantly reduced soleus muscle wet weight (28-31 percent) and noncollagenous protein content (30-31 percent) compared with controls. Eccentric exercise training during non-weight bearing attenuated but did not prevent the loss of soleus muscle wet weight and noncollagenous protein by 77 and 44 percent, respectively. The potential of eccentric exercise training as an effective and highly efficient counter-measure to non-weight-bearing atrophy is demonstrated in the 44 percent attenuation of soleus muscle noncollagenous protein loss by eccentric exercise during only 0.035 percent of the total non-weight-bearing time period. Author

A93-20034 **DETERMINANTS OF POSTSTIMULUS POTENTIATION IN HUMANS DURING NREM SLEEP**

M. S. BADR, JAMES B. SKATRUD, and JEROME A. DEMPSEY (William S. Middleton Memorial Veterans Hospital; Wisconsin Univ., Madison) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1958-1971. Research supported by Veterans Affairs Medical Research Service and National Heart, Lung, and Blood Inst refs
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The effect of abrupt termination in healthy humans of active hypoxia-induced hyperventilation during non-rapid-movement (NREM) sleep on the 'afterdischarge' mechanism sleep was investigated in men in whom hypoxia was induced for 15 s, 30 s, 1 min, or 5 min and then abruptly terminated with 100 percent inspiratory O₂. The 1 min and 5 min durations were studied under both isocapnic and hypocapnic conditions. Results of respiratory parameter measurements indicated that poststimulus hyperpnea occurred in NREM sleep as long as hypoxia was brief and arterial P(CO₂) was maintained, suggesting the activation of the afterdischarge mechanism. Transient hypocapnia overrides the potentiating effect of afterdischarge, resulting in hypoventilation, while sustained hypoxia abolishes the potentiating effect of afterdischarge, resulting in central apnea. The results suggest that the inhibitory effects of sustained hypoxia and hypocapnia may interact to cause periodic breathing. I.S.

A93-20036 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EFFECTS OF INSULIN AND EXERCISE ON RAT HINDLIMB MUSCLES AFTER SIMULATED MICROGRAVITY
CRAIG S. STUMP, THOMAS W. BALON, and CHARLES M. TIPTON (Arizona Univ., Tucson; Iowa Univ., Iowa City) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 2044-2053. refs
(Contract NAG2-392; NGT-50493)
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The effect of simulated microgravity on the insulin- and exercise-stimulated glucose uptake and metabolism in the hindlimb muscles of rats was investigated using three groups of rats suspended at 45 head-down tilt (SUS) for 14 days: (1) cage control, (2) exercising (treadmill running) control, and (3) rats subjected to suspension followed by exercise (SUS-E). It was found that the suspension of rats with hindlimbs non-weight bearing led to enhanced muscle responses to insulin and exercise, when these stimuli were applied separately. However, the insulin affect appeared to be impaired after exercise for the SUS-E rats, especially for the soleus muscle. I.S.

A93-20037

INCREASED NORMOXIC VENTILATION INDUCED BY REPETITIVE HYPOXIA IN CONSCIOUS DOGS

KE-YING CAO, CLIFFORD W. ZWILLICH, MICHAEL BERTHON-JONES, and COLIN E. SULLIVAN (Sydney Univ., Australia) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 2083-2088. Research supported by National Health and Medical Research Council, Mutual Providence Society of Australia, and Fogarty Foundation refs
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To determine if a long-lasting increase in normoxic ventilatory drive is induced in conscious animals by repetitive hypoxia, we examined the normoxic ventilatory response following successive episodes of 2-min eucapnic hypoxic challenges in awake tracheotomized dogs. End-tidal CO₂ was maintained at the resting level during and after repetitive hypoxia. To determine if changes in normoxic ventilation occurred between episodes of repetitive hypoxia, data were compared from six periods (epochs) for all experiments. The mean minute ventilation during three normoxic periods between episodes of intermittent hypoxia was 135, 154, and 169 percent of control. Mean minute ventilation during a 30-min recovery period was still higher at 183 and 172 percent of control. Normoxic mean minute ventilation between hypoxic and recovery periods was significantly higher than the corresponding values in sham experiments. Author

A93-20038

MODULATION OF RESPIRATORY RESPONSES TO CAROTID SINUS NERVE STIMULATION BY BRAIN HYPOXIA

J. E. MELTON, Q. P. YU, J. A. NEUBAUER, and N. H. EDELMAN (New Jersey Univ. of Medicine and Dentistry, New Brunswick) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 2166-2171. refs
(Contract NIH-HL-44678; NIH-HL-16022; NIH-HL-07467)
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This study examines the effect of progressive isocapnic CO hypoxemia on respiratory afterdischarge and the phrenic neurogram response to supramaximal carotid sinus nerve (CSN) stimulation. Twelve anesthetized, vagotomized, peripherally chemodenedervated, ventilated cats with blood pressure controlled were studied. During isocapnic hypoxemia, the amplitude of the phrenic neurogram was progressively depressed. In contrast, the increase in peak phrenic amplitude produced by CSN stimulation was unchanged, suggesting that the central respiratory response to CNS stimulation is unaffected by progressive hypoxemia. The time constant of respiratory afterdischarge (tau) was calculated from best-fit plots of phrenic amplitude vs. time after cessation of CSN stimulation. Under control conditions the value of tau was 57.7 s. During progressive isocapnic hypoxemia, tau decreased as a linear function of arterial O₂ content (Ca(O₂)) such that a 40 percent reduction of Ca(O₂) resulted in a 48 percent reduction in tau. This reduction of respiratory after discharge may contribute to the genesis of periodic breathing during hypoxia. Author

A93-20651* National Aeronautics and Space Administration, Washington, DC.

CONFERENCE ON CORRELATIONS OF AGING AND SPACE EFFECTS ON BIOSYSTEMS, OCT. 30-NOV. 1, 1989, PROCEEDINGS

RICHARD L. SPROTT, ED. and CAROL A. COMBS, ED. (NIH, National Inst. on Aging, Bethesda, MD) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 200 p.
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This volume includes papers on correlations between aging effects and space effects on biosystems, with particular attention given to the effects on the cardiovascular system, bone, sleep, cellular systems, immunological system, and genetics. Papers are presented on NASA and NIA plans and opportunities, the age effect on the posture and circulation, the cardiovascular physiology in space flight, and age-related bone changes. Attention is given to research on sleep, circulation rhythms, and aging and its applications to manned spaceflight; sleep and circadian rhythms; altered cell function in microgravity; and the heterogeneity of

changes in lymphoproliferative ability with increasing age. Also included is a review of cellular immunosenescence, a paper on the immune response during space flight, and a paper on *Caenorhabditis elegans* as a model system for space biology studies. (For individual items see A93-20652 to A93-20665) I.S.

A93-20652* National Aeronautics and Space Administration, Washington, DC.

NASA PLANS AND OPPORTUNITIES

FRANK M. SULZMAN (NASA, Washington) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 131-133.
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The NASA plans for the Life Science program of a series of space flight activities throughout the decade of the 1990s are discussed with particular attention given to the NASA life science goals and objectives and to the particular space missions which will carry out these objectives. These space missions and specially designed facilities for experiments in space include Space Station Freedom, Space Biology Initiative, Gravitational Biology Facility, Life Sciences Centrifuge Facility, Controlled Ecological Life Support Systems Test Facility, and Exobiology Facility. I.S.

A93-20660* National Aeronautics and Space Administration, Washington, DC.

ALTERED CELL FUNCTION IN MICROGRAVITY

MILLIE HUGHES-FULFORD (California Univ.; USVA, Medical Center, San Francisco) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 247-256. Research supported by USVA refs
(Contract NAGW-1244)
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The paper overviews published results from investigations of changes in basic biological parameters taking place as a result of spaceflight exposure. These include changes in the rates of the DNA, mRNA, and protein biosyntheses; changes in the growth rate of an organism; and alterations in the cytoskeleton structure, differentiation, hormone accumulation, and collagen matrix secretion. These results, obtained both in complex biological organisms and on cultured cells, suggest that a basic cellular function is influenced and changed by microgravity. Many of the above mentioned changes are also found to take place in aging cells. I.S.

A93-20661 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

THE PITUITARY - AGING AND SPACEFLOWN RATS

W. C. HYMER (Pennsylvania State Univ., University Park) and R. E. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 257-265. refs
(Contract NCC2-370; NAGW-1196; NAS9-17416)
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Decrements in growth hormone (GH) release we observed in two spaceflight experiments and four tail-suspended rat studies mimic age-associated changes in the mammalian pituitary GH system seen by Meites and others. The spaceflight data suggest that formation of high molecular weight bioactive disulfide-linked aggregates of the 20 and 22K monomeric GH forms may be reduced in microgravity, thereby, reducing target tissue activity. Correlative studies to confirm spaceflight as a model for pituitary GH system aging should include: (1) investigation of mechanisms of intracellular hormone packaging, (2) consequences to biological activity of the hormone molecule, and (3) study of intracellular microtubule dynamics. Author

A93-20662

HETEROGENEITY OF CHANGES IN LYMPHOPROLIFERATIVE ABILITY WITH INCREASING AGE

DONNA M. MURASKO, BARBARA J. NELSON, DEBORAH MATOUR, I. M. GOONEWARDENE, and DONALD KAYE (Pennsylvania Medical College, Philadelphia) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p.

51 LIFE SCIENCES (GENERAL)

269-279. refs
(Contract NIH-AG-03934; NIH-AG-07719)
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Although mean mitogen-induced lymphoproliferation decreases with increased age, the response of individual subjects demonstrates great heterogeneity. Results of this study clearly illustrate that individual variation is apparent not only in the level of proliferation, but also in the amount of interleukin-2 (IL-2) detectable after mitogen stimulation. Further, addition of exogenous IL-2 significantly increases proliferation in only about one third of elderly subjects. Data from inbred strains of rats housed under identical environmental conditions indicate that although genetic factors greatly influence both the level of proliferation and the rate of decline with age, variation occurs even within one inbred strain of rat. Author

A93-20663 CELLULAR IMMUNOSENESCENCE - AN OVERVIEW

TAKASHI MAKINODAN, THEODORE J. HAHN, SKYE MCDUGALL, DEAN T. YAMAGUCHI, MEIKA FANG, and AKIKO IIDA-KLEIN (USVA, Medical Center West Los Angeles; California Univ., Los Angeles) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 281-288. Research supported by USVA refs

(Contract NIH-CA-30187; NIH-AR-36834; NIH-HL-40273)
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Recent studies on space flights suggest that certain T cell immunologic activities are vulnerable to microgravitation. It would be desirable to know the extent to which these changes can be prevented or reversed. Since the changes observed are analogous to the effects of aging on immunity, a brief overview is presented of our current knowledge of age-related changes in immune cells and of the various interventional methods which have been used successfully in preventing the decline with age and in elevating the levels of immune functions of old individuals. Author

A93-20665 Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CAENORHABDITIS ELEGANS - A MODEL SYSTEM FOR SPACE BIOLOGY STUDIES

THOMAS E. JOHNSON (Colorado Univ., Boulder) and GREGORY A. NELSON (JPL, Pasadena, CA) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 299-309. Research supported by NASA refs

(Contract NIH-K04-AG-00369; NIH-R01-AG-08322)
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The utility of the nematode *Caenorhabditis elegans* in studies spanning aspects of development, aging, and radiobiology is reviewed. These topics are interrelated via cellular and DNA repair processes especially in the context of oxidative stress and free-radical metabolism. The relevance of these research topics to problems in space biology is discussed and properties of the space environment are outlined. Exposure to the space-flight environment can induce rapid changes in living systems that are similar to changes occurring during aging; manipulation of these environmental parameters may represent an experimental strategy for studies of development and senescence. The current and future opportunities for such space-flight experimentation are presented. Author

A93-20672 BACTERIAL SULFATE REDUCTION ABOVE 100 C IN DEEP-SEA HYDROTHERMAL VENT SEDIMENTS

BO B. JORGENSEN (Max Planck Inst. for Marine Microbiology, Bremen, Germany), MAI F. ISAKSEN (Aarhus Univ., Denmark), and HOLGER W. JANNASCH (Woods Hole Oceanographic Institution, MA) Science (ISSN 0036-8075) vol. 258, no. 5089 Dec. 11, 1992 p. 1756, 1757. Research supported by NSF, U.S. Navy, and SNFO refs

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The currently known upper temperature limit for growth of organisms, shared by a number of archaeobacteria, is 110 C. However, among the sulfate-reducing bacteria, growth temperatures

of greater than 100 C have not been found. A search for high-temperature activity of sulfate-reducing bacteria was done in hot deep-sea sediments at the hydrothermal vents of the Guaymas Basin tectonic spreading center in the Gulf of California. Radiotracer studies revealed that sulfate reduction can occur at temperatures up to 110 C, with an optimum rate at 103 to 106 C. This observation expands the upper temperature limit of this process in deep-ocean sediments by 20 C and indicates the existence of an unknown group of hyperthermophilic bacteria with a potential importance for the biogeochemistry of sulfur above 100 C. Author

A93-20899 EFFECTS OF HEAD DOWN TILT ON HEPATIC CIRCULATION AND METABOLISM IN CONSCIOUS DOGS

NOBUYUKI TERADA, JOUJI HORIUCHI, MITUSHIRO NAGAO, and TORU TAKEUCHI (Yamanashi Medical College, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723) vol. 29, no. 3 Sept. 1992 p. 73-80. In Japanese. refs

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The effects of head down tilt at 20 deg on hepatic circulation and of feeding in a horizontal position with head down tilt on hepatic circulation and metabolism were studied. The head down tilt caused a significant decrease in portal blood flow and an immediate increase in right atrium and portal venous pressures. At the horizontal position, portal venous pressure, hepatic arterial blood flow, and portal blood flow increased significantly after feeding. During head down tilt, portal pressures and hepatic blood arterial blood flow also increased significantly with feeding, but the increase in portal blood flow was inhibited. Plasma triglyceride and glucose in the portal blood increased significantly with feeding, and these postprandial increases were also inhibited during head down tilt. These effects may be induced by changes in the autonomic nervous system, and have implications for hepatic hemodynamics and function as well as digestion and absorption of food in a microgravitational environment. C.D.

N93-15823*# Office of Space Science and Applications, Washington, DC.

STS-40 SPACELAB LIFE SCIENCES 1 (SLS-1): THE FIRST DEDICATED SPACELAB LIFE SCIENCES MISSION

May 1991 54 p Original contains color illustrations (NASA-TM-108034; NAS 1.15:108034; STS-40) Avail: CASI HC A04/MF A01; 20 functional color pages

Successful exploration of space depends on the health and well-being of people who travel and work there. For this reason, the National Aeronautics and Space Administration (NASA) has dedicated several Space Shuttle missions to examine how living and working in space affects the human body. Spacelab Life Sciences 1 (SLS-1) is the first of these missions. The main purpose of the SLS-1 mission is to study the mechanisms, magnitudes, and time courses of certain physiological changes that occur during space flight and to investigate the consequences of the body's adaptation to microgravity and readjustment to gravity upon return to Earth. How does space flight influence the heart and circulatory system, metabolic processes, the muscles and bones, and the cells? If responses to weightlessness are undesirable, how can they be prevented or controlled? Will the human body maintain its physical and chemical equilibrium during months aboard a space station and years-long missions to Mars? When crews return to Earth, what can they expect to experience as their bodies readjust to Earth's gravity? With the SLS-1 experiments, NASA is addressing some of these questions. Various aspects of the SLS-1 are discussed. Author

N93-15965# Armed Forces Radiobiology Research Inst., Bethesda, MD.

AFRRI REPORTS Technical Report, Jul. - Sep. 1992

Oct. 1992 93 p (AD-A257231; AFRRI-SR92-27; AFRRI-SR92-28) Avail: CASI HC A05/MF A01

This volume contains AFRRI Scientific Reports SR92-27 through SR92-38 for July-September 1992. Contents: Peroxide

effects on (3H)L-glutamate release by synaptosomes isolated from the cerebral cortex; Effect of prostaglandins, inositol 1,4,5-trisphosphate, and phorbol esters on radiation-induced decrease in calcium influx in rat brain synaptosomes; Surgical and pharmacological dissociation of cardiovascular and emetic responses to intragastric CuSO₄; Increased resistance to ionizing and ultraviolet radiation in *Escherichia coli* JM83 is associated with a chromosomal rearrangement; Cisplatin-induced conditioned taste aversion--attenuation by dexamethasone but not zacopride or GR38032F; Role of glutathione in repair of free radical damage in hippocampus *in vitro*; Is all radiation-induced emesis ameliorated by 5-HT₃ receptor antagonists?; Emesis in ferrets following exposure to different types of radiation-- a dose-response study; Radioprotection by vitamin E--injectable vitamin E administered alone or with WR-3689 enhances survival of irradiated mice; Application of high-performance liquid chromatography assay for monitoring kinetics of interconversions of stereoisomers of thymidine glycol; Effects of interleukin-1 on the stress-responsive and -nonresponsive subtypes of corticotropin-releasing hormone neurosecretory axons; and The hypothalamo-pituitary-adrenal axis in rodents--corticotropin releasing hormone/vasopressin co-existence and cytokine effects. GRA

N93-16799*# National Aeronautics and Space Administration, Washington, DC.

BIOMEDICAL POLAR RESEARCH WORKSHOP MINUTES

11 Oct. 1990 137 p Workshop held in Washington, DC, 11-12 Oct. 1990 Prepared in cooperation with National Science Foundation, Washington, DC (NASA-TM-108026; NAS 1.15:108026) Avail: CASI HC A07/MF A02

This workshop was conducted to provide a background of NASA and National Science Foundation goals, an overview of previous and current biomedical research, and a discussion about areas of potential future joint activities. The objectives of the joint research were: (1) to develop an understanding of the physiological, psychological, and behavioral alterations and adaptations to extreme environments of the polar regions; (2) to ensure the health, well-being, and performance of humans in these environments; and (3) to promote the application of biomedical research to improve the quality of life in all environments.

N93-16800*# National Aeronautics and Space Administration, Washington, DC.

EPIDEMIOLOGIC RESEARCH IN ANTARCTICA

In its Biomedical Polar Research Workshop Minutes 22 p 11 Oct. 1990 Prepared in cooperation with National Science Foundation, Washington, DC Avail: CASI HC A03/MF A02

A study of epidemiology of respiratory viruses that was begun in the early 1960's is described. Locations selected for the study included a Wisconsin University housing village, a second grade school population, individual volunteers who associated socially, married couples, and the winter-over population at McMurdo Bay and at Scott Base in the Antarctic. It was concluded that most rhinovirus transmission is through aerosolized particles. Air filtration and careful nasal sanitation with virucidal tissues are determined to be effective in blocking rhinovirus transmission and should be useful in both isolated space colonies and in ordinary earth-bound populations. J.P.S.

N93-16802*# National Aeronautics and Space Administration, Washington, DC.

NASA/NSF ANTARCTIC SCIENCE WORKING GROUP

JANIS H. STOKLOSA *In its* Biomedical Polar Research Workshop Minutes 11 p 11 Oct. 1990 Avail: CASI HC A03/MF A02

A collection of viewgraphs on NASA's Life Sciences Biomedical Programs is presented. They show the structure of the Life Sciences Division; the tentative space exploration schedule from the present to 2018; the biomedical programs with their objectives, research elements, and methodological approaches; validation

models; proposed Antarctic research as an analog for space exploration; and the Science Working Group's schedule of events. J.P.S.

N93-16803*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

NASA/NSF WORKSHOP ON ANTARCTIC RESEARCH

MARY M. CONNORS *In* NASA. Headquarters, Biomedical Polar Research Workshop Minutes 8 p 11 Oct. 1990 Avail: CASI HC A02/MF A02

Viewgraphs that accompanied an Ames Research Center presentation address Ames' currently-supported life sciences activities. These include crew factor issues such as human, automation, and telecommunication systems; strategic behavior and workloads; sleep, fatigue, and circadian rhythms; and virtual reality and spatial instrumentation. The need, background, and examples of pertinent research are provided. J.P.S.

N93-16804*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

INFECTIOUS DISEASE

DUANE L. PIERSON *In* NASA. Headquarters, Biomedical Polar Research Workshop Minutes 6 p 11 Oct. 1990 Avail: CASI HC A02/MF A02

This is a collection of viewgraphs on the Johnson Space Center's work on infectious disease. It addresses their major concern over outbreaks of infectious disease that could jeopardize the health, safety and/or performance of crew members engaged in long duration space missions. The Antarctic environment is seen as an analogous location on Earth and a good place to carry out such infectious disease studies and methods for proposed studies as suggested. J.P.S.

N93-16805*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

NUTRITION

HELEN W. LANE *In* NASA. Headquarters, Biomedical Polar Research Workshop Minutes 4 p 11 Oct. 1990 Avail: CASI HC A01/MF A02

This is a collection of viewgraphs on the Johnson Space Center's work on nutrition for long duration space missions. Nutritional requirements are affected by isolation, workloads, and cold as well as the psychological needs, metabolism, and fluid balance of an individual. J.P.S.

N93-16806*# Colorado Univ., Boulder.

IMMUNOLOGY PRESENTATION AT THE 1990 NASA/NSF ANTARCTICA BIOMEDICAL SCIENCE WORKING GROUP

RICHARD T. MEEHAN *In* NASA. Headquarters, Biomedical Polar Research Workshop Minutes 4 p 11 Oct. 1990 Avail: CASI HC A01/MF A02

An overview of methodology used for determining human *in vitro* lymphocyte activation, proliferation and effector cell function was presented and results of previous manned space flight immunology studies from Apollo through Shuttle were reviewed. Until the Shuttle era, lymphocyte assays were not very sensitive and had such large variations among normal subjects that it was difficult to define a consistent effect of space flight. More sensitive assay, however, even with Shuttle missions as brief as 6 days indicate depressed T-cell proliferative responses are routinely observed following space flight. Using a slight modification of the Shuttle assay, five different human stress-immunology models have been studied over the last 6 years in our lab. These have included: academic examinations of medical students having blood drawn during major test periods on three separate groups of first year students and two hypoxia studies (at 25,000 feet in a 6 week chamber ascent to the equivalent of Mount Everest and twice on Pikes Peak at 14,000 feet). These studies are particularly pertinent to Antarctica, since the altitude equivalent of 11,000 feet at the South Pole may affect some of the variables that are being measured in immunology, physiology or cognitive studies. An extravehicular study was performed drawing blood from 35 individuals before and immediately following a chamber exposure

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study. Preliminary results from 30 Shuttle astronauts investigated immunophenotype analysis and the role of a novel monocyte population in modulating the previously observed suppressed in vitro immune function. The results of the Air Force Academy cadet stress study were also presented. Author

N93-16807*# National Aeronautics and Space Administration, Washington, DC.

EXERCISE DURING LONG TERM EXPOSURE TO SPACE: VALUE OF EXERCISE DURING SPACE EXPLORATION

In its Biomedical Polar Research Workshop Minutes 13 p 11 Oct. 1990 Prepared in cooperation with National Science Foundation, Washington, DC
Avail: CASI HC A03/MF A02

There appear to be two general physiological reasons why exercise will be beneficial to space travelers who will experience a weightless and isolated environment for many months or a few years: (1) to alleviate or prevent tissue atrophy (principally bone and muscle), to maintain cardiovascular function, and to prevent deleterious changes in extracellular and cellular fluid volumes and plasma constituents, especially electrolytes; and (2) to maintain whole organism functional physical and physiological status with special reference to neuromuscular coordination (physical skill) and physical fitness (muscle strength and power, flexibility, and aerobic endurance). The latter reason also relates well to the ability of the crew members to resist both general and local fatigue and thus ensure consistent physical performance. Various forms of exercise, performed regularly, could help alleviate boredom and assist the travelers in coping with stress, anxiety, and depression. The type, frequency, duration and intensity of exercise and ways of ensuring that crew members engage in it are discussed.

J.P.S.

N93-17049*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

KINETIC TETRAZOLIUM MICROTITER ASSAY Patent Application

DUANE L. PIERSON, inventor (to NASA), RAYMOND P. STOWE, inventor (to NASA), and DAVID W. KOEING, inventor (to NASA) 31 Jul. 1992 29 p
(NASA-CASE-MSC-21979-1; NAS 1.71:MSC-21979-1; US-PATENT-APPL-SN-931942) Avail: CASI HC A03/MF A01

A method for conducting an in vitro cell assay using a tetrazolium indicator is disclosed. The indicator includes a nonionic detergent which solubilizes a tetrazolium reduction product in vitro and has low toxicity for the cells. The incubation of test cells in the presence of zolium bromide and octoxynol (TRITON X-100) permits kinetics of the cell metabolism to be determined. NASA

N93-17189# Argonne National Lab., IL. PRIMARY CHARGE SEPARATION IN ISOLATED PHOTOSYSTEM 2 REACTION CENTERS

M. SEIBERT, S. TOON (Midwest Research Inst., Golden, CO.), GOVINDJEE (Illinois Univ., Urbana.), M. P. ONEIL, and M. R. WASIELEWSKI 24 Aug. 1992 5 p Presented at the 9th International Congress on Photosynthesis, Nagoya (Japan), 30 Aug. - 5 Sep. 1992

(Contract W-31-109-ENG-38; DE-AC02-83CH-10093) (DE92-041128; ANL/CP-76567; CONF-9208155-2) Avail: CASI HC A01/MF A01

Primary charge-separation in isolated bacterial reaction center (RC) complex occurs in 2.8 ps at room temperature and 0.7-1.2 ps at 10 K. Because of similarities between the bacterial and photosystem 2 (PS2) RC's, it has been of considerable interest to obtain analogous charge-separation rates in the higher plant system. Our previous femtosecond transient absorption studies used PS2 RC material stabilized with PEG or by exchanging dodecyl maltoside (DM) for Triton in the isolation procedure. These materials gave charge-separation 1/e times of 3.0 +/- 0.6 ps at 4 C and 1.4 +/- 0.2 ps at 15 K based on the risetime of transient absorption kinetics at 820 nm. These values were thought to represent the time required for formation of the P680(+)-Pheo(-) state. Recent results of Hastings et al. obtained at high data acquisition rates

and low flash intensities, suggest that the Pheo(sup (-) state may form more slowly. In light of this work, we have carried out additional time domain studies of both electron transport and energy transfer phenomena in stabilized DM PS2 RC's at room temperature. We used a 1-kHz repetition rate femtosecond transient absorption spectrometer with a 200 fs instrumental time resolution and compared the results with those obtained by others using frequency domain hole-burning techniques. DOE

N93-17214# Rome Univ. (Italy). Dipt. di Fisica. EFFECTIVE NEURONS AND ATTRACTOR NEURAL NETWORKS IN CORTICAL ENVIRONMENT

DANIEL J. AMIT (Hebrew Univ., Jerusalem, Israel) and M. V. TSODYKS (Hebrew Univ., Jerusalem, Israel) 9 Oct. 1991 18 p Submitted for publication
(PREPRINT-829; ETN-93-92932) Avail: CASI HC A03/MF A01

Single neuron spike dynamics is discussed. In the case considered, the neural afferent spike input, originating from nonspecific spontaneous activity, is very large compared with the input produced by specific operation of a critical module. The situation prevailing in associative context is analyzed. It is shown that the Frolov-Cowan 'point approximation' can be derived systematically in this case, even in the presence of shunting inhibition. The same type of logic is applied to the cable theory equation for the neuron. Under low ratio of signal to spontaneous activity in the input, the dynamics linearizes, leading to an integrate and fire behavior for the effective neuron. The only remnant of the geometric structure of the dendritic tree, is a weakening of the post synaptic potential due to the spatial decay of the spike influence and a time delay for the arrival of the peak of the spike influence. This description can be reexpressed in terms of rates. The role of the low rates of the selectivity spiking neurons is found to be essential in the argument. ESA

N93-17303*# Alabama Univ., Huntsville. Dept. of Biological Sciences.

GROUND TESTING OF BIOCONVECTIVE VARIABLES SUCH AS MORPHOLOGICAL CHARACTERIZATIONS AND MECHANISMS WHICH REGULATE MACROSCOPIC PATTERNS

ADRIEL D. JOHNSON *In* Alabama Univ., 1992 NASA/ASEE Summer Faculty Fellowship Program 3 p Dec. 1992
Avail: CASI HC A01/MF A03

Conditions simulating low- and high-gravity, reveal changes in macroscopic pattern formation in selected microorganisms, but whether these structures are gravity dependent is not clear. Two theories have been identified in the fluid dynamics community which support macroscopic pattern formation. The first one is gravity dependent (fluid density models) where small concentrated regions of organisms sink unstably, and the second is gravity independent (wave reinforcement theory) where organisms align their movements in concert, such that either their swimming strokes beat in phase or their vortices entrain neighbors to follow parallel paths. Studies have shown that macroscopic pattern formation is consistent with the fluid density models for protozoa and algae and wave reinforcement hypothesis for caprine spermatozoa.

Author

N93-17359# California Univ., Berkeley. Lawrence Berkeley Lab.

MATHEMATICS AND BIOLOGY: THE INTERFACE, CHALLENGES AND OPPORTUNITIES

S. A. LEVIN, ed. Jun. 1992 96 p Presented at the National Science Foundation Workshop on Mathematics and Biology, Washington, DC, 28 Apr. - 3 May 1990

(Contract DE-AC03-76SF-00098) (DE92-041207; LBL-PUB-701; CONF-9004365-SUMM) Avail: CASI HC A05/MF A01

The interface between mathematics and biology has long been a rich area of research, with mutual benefit to each supporting discipline. Traditional areas of investigation, such as population genetics, ecology, neurobiology, and 3-D reconstructions, have flourished, despite a rather meager environment for the funding of such work. In the past twenty years, the kind and scope of such

interactions between mathematicians and biologists have changed dramatically, reaching out to encompass areas of both biology and mathematics that previously had not benefited. At the same time, with the closer integration of theory and experiment, and the increased reliance on high-speed computation, the costs of such research grew, though not the opportunities for funding. The perception became reinforced, both within the research community and at funding agencies, that although these interactions were expanding, they were not doing so at the rate necessary to meet the opportunities and needs. A workshop was held in Washington, DC, between 28 Apr. and 3 May 1990 which drew together a broadly based group of researchers to synthesize conclusions from a group of working papers and extended discussions. The result is the report presented here, which we hope will provide a guide and stimulus to research in mathematical and computational biology for at least the next decade. The report identifies a number of grand challenges, representing a broad consensus among the participants. DOE

N93-17458* American Inst. of Biological Sciences, Washington, DC.

POSSIBLE BIOMEDICAL APPLICATIONS AND LIMITATIONS OF A VARIABLE-FORCE CENTRIFUGE ON THE LUNAR SURFACE: A RESEARCH TOOL AND AN ENABLING RESOURCE

KEITH L. COWING *In* NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 353-357 Sep. 1992
Avail: CASI HC A01/MF A03

Centrifuges will continue to serve as a valuable research tool in gaining an understanding of the biological significance of the inertial acceleration due to gravity. Space- and possibly lunar-based centrifuges will play a significant and enabling role with regard to the human component of future lunar and martian exploration, both as a means of accessing potential health and performance risks and as a means of alleviating these risks. Lunar-based centrifuges could be particularly useful as part of a program of physiologic countermeasures designed to alleviate the physical deconditioning that may result from prolonged exposure to a 1/6-g environment. Centrifuges on the lunar surface could also be used as part of a high-fidelity simulation of a trip to Mars. Other uses could include crew readaptation to 1 g, waste separation, materials processing, optical mirror production in situ on the Moon, and laboratory specimen separation. Author

N93-17780* Colorado Univ., Boulder. Aerospace Engineering Sciences.

AUTONOMOUS SUPPORT FOR MICROORGANISM RESEARCH IN SPACE

MARY L. FLEET, MARK S. MILLER, DEREK SHIPLEY, E., and JEFF D. SMITH 1992 107 p
(Contract NASW-4435)
(NASA-CR-192062; NAS 1.26:192062) Avail: CASI HC A06/MF A02

A preliminary design for performing on orbit, autonomous research on microorganisms and cultured cells/tissues is presented. An understanding of gravity and its effects on cells is crucial for space exploration as well as for terrestrial applications. The payload is designed to be compatible with the Commercial Experiment Transporter (COMET) launch vehicle, an orbiter middeck locker interface, and with Space Station Freedom. Uplink/downlink capabilities and sample return through controlled reentry are available for all carriers. Autonomous testing activities are preprogrammed with in-flight reprogrammability. Sensors for monitoring temperature, pH, light, gravity levels, vibrations, and radiation are provided for environmental regulation and experimental data collection. Additional experimental data acquisition includes optical density measurement, microscopy, video, and film photography. On-board full data storage capabilities are provided. A fluid transfer mechanism is utilized for inoculation, sampling, and nutrient replenishment of experiment cultures. In addition to payload design, representative experiments were developed to ensure scientific objectives remained compatible with

hardware capabilities. The project is defined to provide biological data pertinent to extended duration crewed space flight including crew health issues and development of a Controlled Ecological Life Support System (CELSS). In addition, opportunities are opened for investigations leading to commercial applications of space, such as pharmaceutical development, modeling of terrestrial diseases, and material processing. Author

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A93-17527

FRONTIER SYMPOSIUM ON CLINICAL PHARMACOLOGY IN SPACE, 10TH, HOUSTON, TX, MAY 10, 11, 1990, PROCEEDINGS

Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 171 p.

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Papers included in this volume are on the development of lower body negative pressure as a countermeasure for orthostatic intolerance, human vestibular function and weightlessness, cerebral blood flow during +Gz acceleration as measured by transcranial Doppler, and metabolic changes observed in astronauts. Attention is also given to pharmacologic considerations for Shuttle astronauts; new pharmacologic approaches to the prevention of space motion sickness; intraocular pressure in microgravity; human autonomic responses to actual and simulated weightlessness; and effects of gravity on gastric emptying, intestinal transit, and drug absorption. Other papers discuss acute hemodynamic responses to weightlessness during parabolic flight, changes in total body water during spaceflight, alterations of proprioceptive function in the weightless environment, cardiovascular adaptation to spaceflight, and echocardiographic evaluation of the cardiovascular effects of short-duration spaceflight. (For individual items see A93-17528 to A93-17553) I.S.

A93-17528* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

BLOOD AND URINE RESPONSES TO INGESTING FLUIDS OF VARIOUS SALT AND GLUCOSE CONCENTRATIONS

MARY A. FREY (Universities Space Research Association; Wright State Univ., Dayton, OH; Lockheed Engineering and Sciences Co., Washington), JEANNE RIDDLE (Krug International Corp., Houston, TX), JOHN B. CHARLES, and MICHAEL W. BUNGO (NASA, Johnson Space Center, Houston, TX) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 880-887. refs

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To compensate for the reduced blood and fluid volumes that develop during weightlessness, the Space Shuttle crewmembers consume salt tablets and water equivalent to 1 l of normal saline, about 2 hrs before landing. This paper compares the effects on blood, urine, and cardiovascular variables of the ingestion of 1 l of normal (0.9 percent) saline with the effects of distilled water, 1 percent glucose, 0.74 percent saline with 1 percent glucose, 0.9 percent saline with 1 percent glucose, and 1.07 percent saline. It was found that the expansion of plasma volume and the concentration of urine were greater 4 hrs after ingestion of 1.07 percent saline solution than after ingestion of normal saline and that the solutions containing glucose did not enhance any variables as compared with normal saline. I.S.

A93-17529* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

DEVELOPMENT OF LOWER BODY NEGATIVE PRESSURE AS A COUNTERMEASURE FOR ORTHOSTATIC INTOLERANCE

SUZANNE M. FORTNEY (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 888-892. refs
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Exposure to prolonged (1-4 hr) lower body negative pressure (LBNP) is a countermeasure against postflight orthostatic intolerance which is used in the Soviet space program and planned for use in the American space program. LBNP in combination with fluid-loading is believed to act by promoting a transient positive fluid balance resulting in an increase in vascular, as well as extravascular fluid. Inflight LBNP also may provide beneficial orthostatic effects by restoring baroreceptor reflex functions and/or lower body venous compliance. Current research efforts at the Johnson Space Center are directed toward increasing the effectiveness and efficiency of the LBNP and saline countermeasure. A promising avenue may involve combining pharmacologic agents, such as inhaled anti-diuretic hormone, or mineralocorticoids, with mechanical stimuli such as LBNP.

Author

A93-17530* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

ORTHOSTATIC FUNCTION DURING A STAND TEST BEFORE AND AFTER HEAD-UP OR HEAD-DOWN BEDREST

CLAIRE M. LATHERS (Universities Space Research Association; NASA, Johnson Space Center, Houston, TX; Food and Drug Administration, Rockville, MD), PETER H. DIAMANDIS (MIT, Cambridge, MA), JEANNE M. RIDDLE (Krug International Corp., Houston, TX), CHIAKI MUKAI (NASDA; NASA, Johnson Space Center, Houston, TX), KAY F. ELTON (Krug International Corp., Houston, TX), MICHAEL W. BUNGO, and JOHN B. CHARLES (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 893-903. refs

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The effects of head-down or head-up bedrest at -5, +10, +20, or +42 deg (simulating 0, 1/6, 1/3, and 2/3 g, respectively) for 6 hrs on four different days on the orthostatic tolerance were investigated by measuring relevant physiological reactions to orthostatic test taken before and after bedrest sessions. The multivariate analysis of variance statistical analysis indicates that there was no angle effect on any of the cardiovascular parameters monitored during the last 3 min of the stand test, suggesting that partial gravity loads would have no effect on the cardiovascular deconditioning exhibited postflight. There was, however, a significant elevation in the heart rate post-bedrest, and the heart rate increased on standing. Results from the stand test pre- and post-bedrest at -5 deg (but not at +10, +20, and +42 deg) were similar to those observed after space flight. I.S.

A93-17531* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

HUMAN VESTIBULAR FUNCTION AND WEIGHTLESSNESS

DONALD E. PARKER (Miami Univ., Oxford, OH) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 904-910. refs

(Contract NAS9-17413)

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This article presents the concept of a spatial orientation/motion perceptual system and discusses the contributions of the vestibular receptors to this system. The apparatus and training procedures and observations to allow astronauts to preadapt to weightlessness are described. The author also discusses perceptual reactions to prolonged weightlessness. Author

A93-17532

CEREBRAL BLOOD FLOW DURING +GZ ACCELERATION AS MEASURED BY TRANSCRANIAL DOPPLER

LLOYD D. TRIPP, JR. (Systems Research Labs., Inc., Dayton, OH) and TAMARA L. CHELETTE (USAF, Armstrong Aerospace Medical Research Lab., Wright-Patterson AFB, OH) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct.

1991 p. 911-914. refs

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The feasibility of using transcranial Doppler measurements as a noninvasive method for monitoring cerebral circulation during sustained +Gz acceleration was investigated in four human subjects instrumented with a three-lead EKG, while seated and secured inside a human centrifuge gondola in a seat with a 30-deg seat-back angle. The subjects were equipped with a 2.0 MHz transducer secured on top of the middle cerebral artery. Measurements of blood flow relative to the baseline showed that the mean cerebral blood flow in subjects at 10 to 20 sec exposures to increasing G levels showed an initial decrease to about 80 percent of the prebaseline condition and then leveled off during 5.5 G to 6.0 G exposures. Decreases were observed again at 6.5 Gz, when the blood flow dropped to about 75 percent of the prebaseline condition. I.S.

A93-17533

CEREBRAL BLOOD FLOW VELOCITIES BY TRANSCRANIAL DOPPLER DURING PARABOLIC FLIGHT

ROBERTA L. BONDAR (Canadian Space Agency, Ottawa, Canada), FLO STEIN, MIKE S. KASSAM, PAUL T. DUNPHY (Ryerson Polytechnical Inst., Toronto, Canada), BARBARA S. BENNETT (Krug Life Sciences, Inc., Houston, TX), and K. W. JOHNSTON (Toronto Univ., Canada) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 915-919. Research supported by Canadian Space Agency refs
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Microgravity is produced for 20 to 30 seconds in NASA's KC-135 aircraft at the end of a 2 G pullup for each of 40 parabolas per flight. Continuous transcranial Doppler ultrasound, arterial blood pressure, and acceleration levels were recorded for 12 male and 8 female healthy subjects without known cardiovascular or cerebrovascular disease. Recordings were made throughout 10 parabolas per subject in each of the supine, sitting, and standing postures. The data were digitized for off-line analysis using Fast Fourier Transform and other signal processing methods. A phase lag in changes to transcranial Doppler waveforms from the onset of acceleration was more pronounced in the standing position than in the sitting position. There was less of a phase lag in the supine position. These ultrasound changes preceded the more delayed variations in arterial blood pressure. The KC-135 provides a unique short-term environment that allows measurement of the human response to variations in acceleration but limits physiological monitoring of responses to a steady state of microgravity.

Author

A93-17534* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

FIRST INTRAMUSCULAR ADMINISTRATION IN THE U.S. SPACE PROGRAM

JAMES P. BAGIAN (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 920.

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In the past, the only kind of medicines used for symptomatic treatment of space motion sickness (SMS) in space had been oral, transdermal, or suppositories. This paper describes the effect of the first intramuscular (IM) administration of Phenergan (50-mg in single dose) on SMS in one subject who exhibited grade-3 symptoms and signs which persisted unabated throughout the first and the second flight days aboard the Space Shuttle. Thirty minutes after the injection, the subject had completely recovered. His symptoms were gone, his appetite was back, and he had no recurrences for the remainder of the flight. Since that experiment, intramuscular injections have been given nine more times on subsequent flights, with similar results. I.S.

A93-17535* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

METABOLIC CHANGES OBSERVED IN ASTRONAUTS

CAROLYN S. LEACH, N. M. CINTRON (NASA, Johnson Space Center, Houston, TX), and J. M. KRAUHS (Krug Life Sciences,

Inc., Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 921-927. refs
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Results of medical experiments with astronauts reveal rapid loss of volume (2 l) from the legs and a transient early increase in left ventricular volume index. These findings indicate that, during space flight, fluid is redistributed from the legs toward the head. In about 2 days, total body water decreases 2 to 3 percent. Increased levels of plasma renin activity and antidiuretic hormone while blood sodium and plasma volume are reduced suggest that space flight-associated factors are influencing the regulatory systems. In addition to fluid and electrolyte loss, Skylab astronauts lost an estimated 0.3 kg of protein. Endocrine factors, including increased cortisol and thyroxine and decreased insulin, are favorable for protein catabolism. The body appears to adapt to weightlessness at some physiologic cost. Readaptation to earth's gravity at landing becomes another physiologic challenge.

Author

A93-17537* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

PHARMACOLOGIC CONSIDERATIONS FOR SHUTTLE ASTRONAUTS

PATRICIA A. SANTY (NASA, Johnson Space Center, Houston; Texas Univ., Galveston) and MICHAEL W. BUNGO (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 931-933. refs

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Medication usage by crewmembers in the preflight and inflight mission periods is common in the Shuttle Program. The most common medical reports for which medication is used are: space motion sickness (SMS), sleeplessness, headache, and backache. A number of medications are available in the Shuttle Medical Kit to treat these problems. Currently, astronauts test all frequently used medications before mission assignment to identify potential side-effects, problems related to performance, personal likes/dislikes, and individual therapeutic effect. However, microgravity-induced changes in drug pharmacokinetics, in combination with multiple operational factors, may significantly alter crewmember responses in flight. This article discusses those factors that may impact pharmacologic efficacy during Shuttle missions.

Author

A93-17538 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

NEW PHARMACOLOGIC APPROACHES TO THE PREVENTION OF SPACE/MOTION SICKNESS

RANDALL L. KOHL (Universities Space Research Association; NASA, Johnson Space Center, Houston; Texas Univ., Galveston) and SCOTT MACDONALD (Universities Space Research Association; NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 934-946. refs

(Contract NAS9-18128; RTOP 199-16-11-08)

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Three fundamental approaches used in the selection of new agents for the evaluation in the prevention of space-motion sickness (SMS) are reviewed, with emphasis on drugs under investigation at the Johnson Space Center. These approaches are: (1) the selection of agents from drug classes that possess pharmacologic properties of established antimotion sickness agents, (2) the selection of drugs that are used to prevent emesis caused by means other than the exposure to motion, and (3) basic research that characterizes individual differences in susceptibility to SMS. In the latter type of studies, it was found that subjects who were more resistant to SMS had higher plasma AVP after severe nausea than subjects with lower resistance. The review details the experimental data collected on AVP and adrenocorticotropin. It is noted that data support interrelated roles for AVP and opioid peptides in SMS. I.S.

A93-17539

INTRAOCULAR PRESSURE IN MICROGRAVITY

THOMAS H. MADER (U.S. Army, Madigan Army Medical Center, Tacoma, WA) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 947-950. refs
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Data from the orbital-flight, KC-135-aircraft, and bedrest studies are presented, which indicate that intraocular pressure (IOP) may be significantly (up to 30 percent compared to the sitting value) elevated in some space travelers. This rise in IOP may result from increased choroidal volume caused by cephalad fluid shifts. It is noted that chronic exposure to such elevated IOPs could cause glaucomatous optic nerve damage. It is suggested that topical pressure-lowering medications could control this type of IOP elevation. I.S.

A93-17540

HUMAN AUTONOMIC RESPONSES TO ACTUAL AND SIMULATED WEIGHTLESSNESS

DWAIN L. ECKBERG (Hunter Holmes McGuire Dept. of Veterans Affairs, Medical Center, Richmond, VA) and JANICE M. FRITSCH (Hunter Holmes McGuire Dept. of Veterans Affairs, Medical Center; Virginia Medical College, Richmond) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 951-955. refs

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The authors developed a device for stimulating carotid baroreceptors to test the hypothesis that exposure to microgravity leads to impairment of arterial baroreflex mechanisms. Data obtained before and after two head-down bedrest studies and before and after brief Space Shuttle missions indicate that baroreceptor-cardiac reflex control is impaired by simulated or actual weightlessness. The authors speculate that arterial baroreflex derangements combine with blood volume reductions and increased venous compliance to provoke orthostatic hypotension after microgravity exposure. Altered baroreflex function after missions may result from autonomic neuronal plasticity that develops during missions secondary to changes of cardiopulmonary and arterial dimensions and consequent changes of autonomic sensory input profiles. Author

A93-17542* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

OPTIMAL SAMPLING THEORY AND POPULATION MODELLING - APPLICATION TO DETERMINATION OF THE INFLUENCE OF THE MICROGRAVITY ENVIRONMENT ON DRUG DISTRIBUTION AND ELIMINATION

GEORGE L. DRUSANO (Maryland Univ., Baltimore) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 962-967. refs

(Contract NAG9-249)

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The optimal sampling theory is evaluated in applications to studies related to the distribution and elimination of several drugs (including ceftazidime, piperacillin, and ciprofloxacin), using the SAMPLE module of the ADAPT II package of programs developed by D'Argenio and Schumitzky (1979, 1988) and comparing the pharmacokinetic parameter values with results obtained by traditional ten-sample design. The impact of the use of optimal sampling was demonstrated in conjunction with NONMEM (Sheiner et al., 1977) approach, in which the population is taken as the unit of analysis, allowing even fragmentary patient data sets to contribute to population parameter estimates. It is shown that this technique is applicable in both the single-dose and the multiple-dose environments. The ability to study real patients made it possible to show that there was a bimodal distribution in ciprofloxacin nonrenal clearance. I.S.

A93-17543

EFFECTS OF GRAVITY ON GASTRIC EMPTYING, INTESTINAL TRANSIT, AND DRUG ABSORPTION

GORDON L. AMIDON, GARY A. DEBRINCAT, and NAJI NAJIB (Michigan Univ., Ann Arbor) *Journal of Clinical Pharmacology*

(ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 968-973. refs

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The space motion sickness (SMS) symptoms exhibited by astronauts of many of the Space Shuttle missions to date are characterized by nausea and vomiting. The erratic nature of and the individual differences in the inflight salivary concentration vs. time curves of scopolamine/detroamphetamine tablets used to alleviate these symptoms suggest the possibility of a microgravity-related irregularities in gastric emptying and of a variability in intestinal transit and drug absorption. This paper addresses each of these possibilities by discussing the forces acting upon a particle traveling along the GI tract and the factors that can influence the movement of a particle. The most significant factor influencing the particle motion is the ratio of the gravitational force to the viscous force on the particle. I.S.

A93-17544* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DRUG EFFECTS ON ORTHOSTATIC INTOLERANCE INDUCED BY BEDREST

J. VERNIKOS (NASA, Ames Research Center, Moffett Field, CA), M. F. DALLMAN (California Univ., San Francisco), G. VAN LOON (Billings Clinic, MN), and L. C. KEIL (NASA, Ames Research Center, Moffett Field, CA) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 974-984. refs
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Effective and practical preventive procedures for postflight orthostatic intolerance are highly desirable. The current practice of attempts to expand plasma volume by ingestion of salt and fluids before reentry has proven benefits. This study evaluated alternative options using fludrocortisone (F) to expand plasma volume (PV), dextroamphetamine (Dex) to enhance norepinephrine (NE) release, and atropine (A) to reduce the effects of vagal stimulation. Seven subjects with proven post-bedrest orthostatic intolerance returned for a 7-day 6-deg head-down bedrest study. F (0.2 mg) was given at 8:00 AM and 8:00 PM the day before and 8:00 AM the day the subjects got out of bed (2 hours before standing). PV was measured before and 1 hour after the last dose of F. Dex (5 mg) and A (0.8 mg) were then taken orally 1 hour before the stand test. F expanded PV by 16 percent and caused sodium retention. Four of the 7 subjects stood for 1 hour post-bedrest and heart rate, plasma NE and plasma renin responses to standing were greatly enhanced and sustained. Although there was a narrowing of pulse pressure, the ability to overcome orthostatic intolerance with these countermeasures was largely due to vasoconstriction and sustained high heart rate.

Author

A93-17547* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

ACUTE HEMODYNAMIC RESPONSE TO WEIGHTLESSNESS DURING PARABOLIC FLIGHT

CHIAKI N. MUKAI (NASA, Johnson Space Center, Houston, TX), CLAIRE M. LATHERS (NASA, Johnson Space Center, Houston, TX; Food and Drug Administration, Rockville, MD), JOHN B. CHARLES (NASA, Johnson Space Center, Houston, TX), BARBARA S. BENNETT (Krug Life Sciences, Inc., Houston, TX), MAKOTO IGARASHI, and SAUMIL PATEL (Baylor College of Medicine, Houston, TX) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 993-1000. refs
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The effect of a short exposure to weightlessness on hemodynamic parameters of humans was investigated in seven subjects flown aboard the KC-135 aircraft. Particular attention is given to the relationships among various hemodynamic responses to hypergravic and hypogravic states, observed for four different postures: semisupine, supine, standing, and sitting. Results are presented on changes in the thoracic fluid index, heart rate, cardiac index, and the coefficient of variation of the R-R intervals. High values of the coefficient of variation were found at the onset of 0-G, suggesting that vagal cardiac neural activity increases in all

positions except supine (where a small decrease was registered). I.S.

A93-17548* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CHANGES IN TOTAL BODY WATER DURING SPACEFLIGHT

CAROLYN S. LEACH (NASA, Johnson Space Center, Houston, TX), L. D. INNERS (Krug Life Sciences, Inc., Houston, TX), and JOHN B. CHARLES (NASA, Johnson Space Center, Houston, TX) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1001-1006. refs
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Total body water (TBW) changes occurring in humans as a consequence of prolonged exposure to microgravity were measured in five male crewmembers of Space Shuttle missions STS-61C and STS-26. It was found that the inflight mean TBW values were significantly different from the preflight and postflight values, while the preflight TBW values were not significantly different from the postflight values. It was also found that individuals may differ in the rate at which they respond to weightlessness. Of the three crewmen who reported experiencing no symptoms of space motion sickness (SMS), two had not exhibited a decrease of TBW at the time of measurements (24 hrs after launch), while the two crewmen who reported SMS of intermediate severity showed a decrease of several kg by 24 hrs, suggesting that dehydration might be an important factor affecting the rate of TBW decrease. I.S.

A93-17549

ALTERATIONS OF PROPRIOCEPTIVE FUNCTION IN THE WEIGHTLESS ENVIRONMENT

KENNETH E. MONEY (Canadian Space Agency, Ottawa, Canada) and B. S. K. CHEUNG (Defence and Civil Inst. of Environmental Medicine, Downsview, Canada) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1007-1009. Research supported by Universities Space Research Association refs

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The effect of weightless environment on the proprioceptive function (i.e., the function of sensory systems that have their sensory receptors in muscles, tendons, and joints) is discussed. It is suggested that the sensory cells that are activated by a sudden onset of ion flow (as in the eye or ear) are not influenced by weightlessness. On the other hand, results obtained on the accuracy of pointing toward a target by subjects 13 weeks before, 11 hours into, and 2.2 hours after a spaceflight show that the exposure to weightlessness significantly affected their performance, indicating an effect on the proprioceptive function. I.S.

A93-17550* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CARDIOVASCULAR ADAPTATION TO SPACEFLIGHT

JOHN B. CHARLES (NASA, Johnson Space Center, Houston, TX) and CLAIRE M. LATHERS (NASA, Johnson Space Center, Houston, TX; Food and Drug Administration, Rockville, MD) Journal of Clinical Pharmacology (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1010-1023. Research supported by Universities Space Research Association refs
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Data are presented on the rate of adaptation of the human cardiovascular system to conditions of spaceflight, with particular attention given to data obtained during spaceflight in the U.S. Space Shuttle Program. It is pointed out that many of the cardiovascular changes that occurred during spaceflights that lasted from 2 to 11 days can be traced directly to changes in the body fluid volume. The beneficial effects of a fluid loading countermeasure (oral rehydration) and of the supine body position on the heart rate during the spaceflight are demonstrated. It is noted that, after hours or a few days of spaceflight, a state of adaptation is reached, in which the subject is well adapted and appropriately hydrated for the weightless environment. However, the return to the normal gravity of the earth leaves the individual especially sensitive to orthostatic stress. I.S.

A93-17551* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

ECHOCARDIOGRAPHIC EVALUATION OF THE CARDIOVASCULAR EFFECTS OF SHORT-DURATION SPACEFLIGHT

SHARON L. MULVAGH (Universities Space Research Association, Houston, TX), JOHN B. CHARLES (NASA, Johnson Space Center, Houston, TX), JEANNE M. RIDDLE, TRACY L. REHBEIN (Krug International Corp., Houston, TX), and MICHAEL W. BUNGO (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1024-1026. refs
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Results are presented of echocardiographic investigations and hemodynamic measurements performed on 24 astronauts before and after short-duration (4-5 days) spaceflight, including data on the heart rate, blood pressure, and cardiac volumes. Cardiovascular changes which were found to occur after 4-5 day long spaceflight included decreased the left ventricular end-diastolic volume and the stroke volume indices, with a compensatory increased heart rate and the cardiac output being maintained; in addition, altered total peripheral vascular resistance was found to occur, with an apparent reduction in the ability to augment the peripheral vascular tone upon assuming the standing position. These cardiovascular characteristics normalized within 48 hrs of landing. I.S.

A93-17552* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

SPACE MEDICINE - ANSWERING THE CHALLENGE

CHARLES W. LLOYD (NASA, Johnson Space Center, Houston, TX) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1027-1035. refs
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The development of Space Station Freedom (SSF) Health Maintenance Facility (HMF) is discussed. Attention is given to HMF subsystems; the diagnostic radiological imaging system; the physician instruments; the pharmacy and central supply; the Fluid Therapy Subsystem; the restraints to be used for medical procedures; and the Safe Haven mode, which is a mode of station operation in which it is assumed that the HMF has been lost and the medical needs must be provided by the emergency medical equipment and supplies located in the Portable Emergency Provisions. Special attention is given to the pharmaceutical issues involved, including such as the product selection, oral medications, injectable medications, the effect of exposing medications to high vacuum, and the product shelf life. I.S.

A93-17553* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CEREBRAL BLOOD FLOW - COMPARISON OF GROUND-BASED AND SPACEFLIGHT DATA AND CORRELATION WITH SPACE ADAPTATION SYNDROME

JAMES P. BAGIAN (NASA, Johnson Space Center, Houston, TX) and PETER HACKETT (Alaska Univ., Anchorage) *Journal of Clinical Pharmacology* (ISSN 0091-2700) vol. 31, no. 10 Oct. 1991 p. 1036-1040. refs
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The relationship between the cerebral blood flow velocity and the space adaptation syndrome (SAS), which includes symptoms of motion sickness, stuffy head, and/or headaches, was investigated by measuring (using a transcranial Doppler device) differences between the preflight and the inflight cerebral blood flow velocity in crew members who were motion sick and in those who were not sick during a flight aboard KC-135. It was found that the cerebral artery bloodflow inflight did not differ significantly from that recorded preflight, nor did the severity of SAS symptoms correlate directly with the cerebral blood flow. I.S.

A93-17897

HYPOKINESIA AND WEIGHTLESSNESS: CLINICAL AND PHYSIOLOGIC ASPECTS

OLEG IU. ATKOV (All-Union Cardiology Research Center, Moscow,

Russia) and VIKTOR S. BEDNENKO Madison, CT International Universities Press, Inc. 1992 579 p. Translation. refs (ISBN 0-8236-2415-3) Copyright

The monograph summarizes research on human adaptation to hypokinesia and weightlessness carried out by the authors for more than 10 years as well as numerous works on space biology and medicine published in the U.S.S.R. Original results obtained from cardiovascular studies of cosmonauts during and after exposure to weightlessness on long-term orbital flights lasting from 49 to 237 days on Salyut and Mir are presented. A theoretical interpretation of the adaptive mechanisms to space flight and their clinical implications for long-duration missions is given. O.G.

A93-17975* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

INTERPLANETARY CREW EXPOSURE ESTIMATES FOR GALACTIC COSMIC RAYS

LAWRENCE W. TOWNSEND, FRANCIS A. CUCINOTTA, and JOHN W. WILSON (NASA, Langley Research Center, Hampton, VA) *Radiation Research* (ISSN 0033-7587) vol. 129 1992 p. 48-52. refs
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Using the Langley Research Center galactic cosmic-ray transport computer code and the Computerized Anatomical Man model, initial estimates of interplanetary exposure of astronauts to galactic cosmic rays, during periods of solar minimum activity, are made for a realistic human geometry shielded by various thicknesses of spacecraft aluminum shielding. Conventional dose assessment in terms of total absorbed dose and dose equivalent is made for the skin, ocular lens, and bone marrow. Included in the analyses are separate evaluations of the contributions from the incident primary ions, from subsequent-generation fragmentation products, and from target fragments. In all cases considered, the equivalent sphere approximation yielded conservative overestimates for the actual organ exposures.

Author

A93-18033

THE PIGMENTARY DISPERSION DISORDER IN USAF AVIATORS

DANIEL R. PETERS and ROBERT P. GREEN, JR. (USAF, Armstrong Lab., Brooks AFB, TX) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1049-1053. refs
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The pigmentary dispersion syndrome (PDS) can have serious ocular consequences. Visual changes due to glaucoma and the treatment required can threaten the high level of visual function necessary in military aviation. We reviewed the records of 50 aviators with PDS who were evaluated at the Aeromedical Consultation Service over the past 10 years. At last evaluation, 48 were still qualified to fly. Only two aviators were permanently removed from flying duties due to glaucoma. Initial intraocular pressures, cup-to-disk ratios, and refractions were not statistically correlated with progression to glaucoma, but sample sizes were small. At final evaluation, 20 of the 34 aviators with follow-up had glaucoma and required medication. Thirteen eyes underwent laser trabeculoplasty. With appropriate management, the majority of aviators with PDS were able to safely continue their flying careers. Author

A93-18034

THE EFFECTS OF PYRIDOSTIGMINE BROMIDE ON VISUAL PERFORMANCE

ROGER W. WILEY, JOHN C. KOTULAK, and ISAAC BEHAR (U.S. Army, Aeromedical Research Lab., Fort Rucker, AL) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1054-1059. refs
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The effects of pyridostigmine bromide (PB) on selected visual functions were measured on four healthy aviator candidates. Following a pretreatment day during which baseline measurements were completed, subjects were administered currently

recommended doses (30 mg, t.i.d.) of PB for 3 d during which their visual functions were assessed using a repeated measures design. Spatial resolution ability was evaluated with high and low contrast visual acuity charts and contrast sensitivity charts at three luminance levels. Dark adaptation was evaluated by measuring visual thresholds for 40 min after a standardized retinal photopigment bleach. Also, refractive error and several oculomotor functions (lateral phoria, fusional vergence, accommodative amplitude, and pupil size) were measured. On days that the subjects ingested PB, only refractive error and pupil diameter were significantly different, and these only minimally. We conclude that the use of PB at doctrinal doses will not significantly compromise an aviator's visual ability. Author

A93-18035
VISUAL SCENE EFFECTS ON THE SOMATOGRATIC ILLUSION

FRED H. PREVIC (USAF, Armstrong Lab., Brooks AFB, TX), DENISE C. VARNER (Southwest Research Inst., San Antonio, TX), and KENT K. GILLINGHAM (USAF, Armstrong Lab., Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1060-1064. Research supported by USAF refs
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This study attempted to determine which visual scene cues are most effective in overcoming the somatogravic illusion (SGI), a form of spatial disorientation that occurs when a shift in the resultant gravito-inertial force vector created by a sustained linear acceleration is misinterpreted as a change in pitch or bank attitude. Nine subjects were exposed to a gravito-inertial force shift of -30 deg in the pitch plane, both with their eyes closed and while viewing computer-generated visual scenes through a wide field-of-view head-mounted display. The scenes depicted acceleration over a shoreline by means of horizon, texture, perspective, and color cues that were presented both in isolation and in various combinations. None of the scenes significantly reduced the magnitude of the SGI relative to the eyes-closed (baseline) pitch illusion, even though the textured scenes produced some linearvection. It remains to be established whether low-cost head-mounted visual displays can reliably reduce the magnitude of the SGI and other spatially disorienting illusions. Author

A93-18036
LIMITED HEAT TRANSFER BETWEEN THERMAL COMPARTMENTS DURING REWARMING IN VASOCONSTRICTED PATIENTS

MARK H. ERETH, ROBERT L. LENNON (Mayo Medical School, Rochester, MN), and DANIEL I. SESSLER (California Univ., San Francisco) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1065-1069. Research supported by Augustine Medical, Inc. refs
 (Contract NIH-R29-GM-39723)
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Thermoregulatory vasoconstriction may serve to separate and limit heat transfer between peripheral and central thermal compartments, in effect providing a thermal buffer for central temperature. We hypothesized that thermoregulatory vasoconstriction would limit heat transfer to the central compartment in patients warmed cutaneously. Hypothermic patients recovering from surgery were randomly assigned to receive forced-air warming ($n = 6$) or warmed cotton blankets ($n = 6$). The forced-air warmer delivers about 50 W of heat, compared to a heat loss of about 50 W with warmed cotton blankets. Despite a significantly greater increase in mean skin-surface temperature with forced-air warming, central temperature in the two groups did not significantly differ. All patients vasoconstricted and there was no difference in oxygen consumption between groups. These data confirm that thermoregulatory vasoconstriction limits heat transfer from peripheral to central thermal compartments and impedes skin surface warming of the body core. Author

A93-18037
COMPARISON OF FOUR NONINVASIVE REWARMING METHODS FOR MILD HYPOTHERMIA

H. A. M. DAANEN and F. J. G. VAN DE LINDE (TNO, Soesterberg, Netherlands) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1070-1076. Research sponsored by Royal Netherlands Navy refs
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Four noninvasive rewarming techniques for mildly hypothermic subjects were compared. Seven subjects were cooled in a water bath of 15 C for 2 h to an average esophageal temperature (Tes) of 36 C. Thereafter, the subjects were rewarmed by immersion of the body in a water bath of 42 C (Method 1), the body but not the extremities in water of 42 C (Method 2), only the extremities in water of 42 C (Method 3), or spontaneous rewarming in blankets (Method 4). Method 1 showed the highest rewarming rate in Tes (10.1 C/h) and an afterdrop in Tes of 0.18 C. Method 2 showed the same afterdrop, but a lower rewarming rate (7.5 C/h). In Method 3, the heat uptake of the extremities was too low to rewarm the subjects effectively. The afterdrop and rewarming rate were 0.38 C and 0.8 C/h, respectively. Method 4 had the lowest rewarming rate (0.2 C/h), and an afterdrop (0.14 C) which was not significantly lower than that of Method 1 or 2. Therefore, Method 1 is recommended for rewarming mild hypothermic subjects because of its high rewarming rate and small afterdrop. Author

A93-18038
DECREMENT IN MANUAL ARM PERFORMANCE DURING WHOLE BODY COOLING

GORDON G. GIESBRECHT and G. K. BRISTOW (Manitoba Univ., Winnipeg, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1077-1081. Research supported by Manitoba Medical College Foundation, Manitoba Health Research Council, and Univ. of Manitoba refs
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Six subjects performed three manual arm tasks: prior to immersion in 8 C water; soon after immersion to the neck, but prior to any decrease in core temperature; and every 15 min until core temperatures decreased 2-4.5 C. The tasks were speed of flexion and extension of the fingers, handgrip strength and manual dexterity. There was no immediate effect of cold immersion; however, all scores decreased significantly after core temperature decreased 0.5 C. Further decrease in core temperature was associated with a progressive impairment of performance, although at a slower rate than during the first 0.5 C decrease. Flexion and extension of the fingers was affected relatively more than handgrip strength or manual dexterity. Decrement in performance is a result of peripheral cooling on sensorimotor function with a probable additional effect of central cooling on cerebral function. Author

A93-18040
HEAT STRESS IN PROTECTIVE CLOTHING - VALIDATION OF A COMPUTER MODEL AND THE HEAT-HUMIDITY INDEX (HHI)

MELCHOR J. ANTUNANO and SARAH A. NUNNELEY (USAF, Armstrong Lab., Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1087-1092. Research supported by National Research Council refs
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The validity of the Texas Model of Thermoregulation and the HHI to predict body heat storage is assessed. Nine men wearing chemical defense (CD) clothing were studied under eight conditions over the range of $T_{db} = 20-40$ C, $T_{bg} = T_{db} + 5$ C, relative humidity = 9-75 percent, and oxygen uptake = 14-27 ml/kg/min. Results indicate that the Texas model successfully predicted heat storage rate for high-stress conditions produced by widely varied working conditions. Under milder conditions the model predicted too little heat storage, probably due to an overestimation of heat transfer from the body to the environment. The HHI successfully predicted the physiological impact of environmental heat load among male subjects wearing CD clothing. O.G.

A93-18041

THE EFFECTS OF CHRONIC HYPOXIA ON HUMAN AUDITORY SYSTEM SENSITIVITY

SIMON CARLILE and DAVID J. PATERSON (Oxford Univ., United Kingdom) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1093-1097. Research supported by Wellcome Trust refs
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We have examined the effects of prolonged periods of hypoxia produced at high altitudes on the latency of the auditory brain-stem evoked response (ABER) in 9 subjects at around sea level, 3500 m, and 4370 m. Following an ascent from 1300 m to 3500 m over 24 h, the mean blood O₂ saturation fell to 86.5 +/- 1.2 percent (+/- S.E.M.) and was associated with a mean prolongation of latency of wave V of the ABER of 0.34 +/- 0.10 ms. Using the stimulus-level/response latency relation determined at around sea-level for each subject, this prolongation of wave V corresponded to a mean reduction in sensitivity of 9.1 dB +/- 1.6 dB. Over a period of 72 h, blood O₂ saturation improved slightly and mean wave V latency returned to control values. A second rapid ascent to 4370 m reduced blood O₂ to below prerecovery levels, but in this case there were no significant changes in auditory sensitivity. These data show that mild hypoxia results in an initial decrease in auditory sensitivity. However, the recovery of sensitivity with more prolonged exposure suggests that the auditory system can compensate for chronic mild hypoxia. Author

A93-18042

THE CANADIAN FORCES AIRSICKNESS REHABILITATION PROGRAM, 1981-1991

ROBERT D. BANKS, DAVID A. SALISBURY, and P. J. CERESIA (Canadian Forces Base Hospital, Bushell Park, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1098-1101. refs
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Airsickness is a significant obstacle in the training of some student pilots. When conventional therapy fails, desensitization therapy may be indicated. Using experience gained by the RAF and USAF, the Canadian Forces began such a program in 1981. This paper reports program results from 1981-1991. Following subject identification, treatment consists of three phases: biofeedback relaxation therapy, ground-based desensitization training and in-flight desensitization therapy with a pilot-flight surgeon. Employing a definition of cure used by the RAF, success was compared with that of the RAF and USAF programs. A total of 22 student pilots have undergone rehabilitation, 17 of whom have been successfully treated for a success rate of 77 percent. This is comparable to success rates of other programs. It is reaffirmed that desensitization is a valid clinical tool in treatment of airsickness. Author

A93-18043

THE ROLE OF GROUND LEVEL OXYGEN IN THE TREATMENT OF ALTITUDE CHAMBER DECOMPRESSION SICKNESS

FREDERICK W. RUDGE (USAF, Jefferson C. Davis Hyperbaric Lab., Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1102-1105. refs
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This study reports the U.S. Air Force experience in the treatment of Type 1 altitude chamber decompression sickness (DCS) with ground level oxygenation (GLO₂) during the period 1 January 1989 to 31 December 1991. Data collected included age, sex, time of symptom development, type of initial treatment, and response to GLO₂ administration. There were 221 cases of Type 1 DCS, of which 46 were treated with compression therapy without initial use of GLO₂. Of the 175 cases treated with GLO₂, 40 failed to resolve and were treated with compression therapy. The remaining 135 cases all resolved with GLO₂, obviating the need for HBO therapy. Only 8 patients had a recurrence of symptoms after

resolution with GLO₂, all of which subsequently resolved with compression therapy. Factors associated with a favorable response to GLO₂ are discussed. Author

A93-18044

MYOCARDIAL INFARCTION OCCURRING AT THE CONCLUSION OF CENTRIFUGE TRAINING IN A 37-YEAR-OLD AVIATOR

WALTER R. CAYCE and ROBERT G. ZERULL (USAF, Aerospace Medicine Dept., Luke AFB, AZ) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1106-1108. refs
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In September 1988, the U.S. Air Force instituted routine centrifuge training for aircrew involved in high performance, high G aircraft. As of June 1991, 6078 aircrew members have been trained. This report documents an anterolateral myocardial infarction that occurred in a 37-year-old pilot immediately after his centrifuge training profile. The individual had a history of elevated lipids and smoking, and was on a waiver from the USAF for Flying Class II duties for hyperlipidemia treated with cholestyramine. Author

A93-18045

ETHICAL CONCERNS IN THE PRACTICE OF MILITARY AVIATION MEDICINE

BRIAN F. MCCRARY (Occupational Health Services, 5th Preventive Medicine Unit, Seoul, Republic of Korea) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1109-1111. refs
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Military aviation physicians are frequently placed in conflicting ethical situations regarding the areas of patient loyalty, confidentiality, and reporting of findings or hazards. The American College of Occupational and Environmental medicine has developed a set of guidelines for ethical conduct to assist physicians providing occupational health services. This paper attempts to show that these guidelines can be applied similarly by physicians providing aeromedical services. These guidelines can be helpful in resolving ethical dilemmas that can occur in the daily practice of aviation medicine. Author

A93-18288

CONTROL OF BREATHING UNDER CONDITIONS OF ALTERED ATMOSPHERIC DENSITY DURING MUSCULAR WORK [REGULIATSIIA DYKHANIIA V USLOVIAKH IZMENENNOI PLOTNOSTI GAZOVOI SREDY PRI MYSHECHNOI RABOTE]

M. O. SEGIZBAEVA and G. G. ISAEV (RAN, Inst. Fiziologii, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 14-25. In Russian. refs
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The effect of atmospheric gas density on the ventilatory and biomechanical parameters of the respiratory system was investigated in human subjects who were performing moderate muscular work in normoxic atmospheres of air, the He-O₂, and SF₆-O₂, in which the density of He-O₂ mixture was 2.94 times lower than that of air, and that of the SF₆-O₂ mixture was 4.21 times higher. Results indicated that, at rest and especially during muscular activity, the substitution of the less dense He-O₂ mixture for air caused decreases of the inspiration drive, the respiratory work, and the electrical activity of inspiration-controlling muscles. Inhalation of the SF₆-O₂ mixture led to opposite effects. I.S.

A93-18291

SLEEP AS A RESTORATIVE PROCESS UNDER EXTREME CONDITIONS [SON KAK VOSSTANOVITEL'NYI PROTSESS V USLOVIAKH EKSTREMAL'NYKH VOZDEISTVII]

I. STOILOVA (Bulgarian Academy of Sciences, Inst. of Brain Research, Sofia, Bulgaria) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 40-45. In Russian. refs
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It was found that a prolonged stay in a pressure chamber filled with an oxygen-helium-nitrogen atmosphere under elevated pressure (11 to 46 kgs/sq cm) did not affect the average duration of sleep in human subjects. However, the phases of the slow-wave sleep (mostly its 3rd and 4th stages) and the paradoxical sleep were significantly decreased, while the ratio of light sleep to deep sleep increased. The cyclic structure of sleep became altered. With the increase of the exposure to high pressure, the periods of relative decreases of the slow-wave sleep and the REM-phase were alternating with periods of relative increases of these sleep phases. Normal sleep cycles terminating in the REM phase were not restored until after a few days following the decompression.

I.S.

A93-18292**ELECTROMYOGRAPHIC INVESTIGATIONS OF TREMOR IN AQUANAUTS IN SIMULATED IMMERSIONS****[ELEKTROMIOGRAFICHESKIE ISSLEDOVANIYA TREMORA U AKVANAVTOV PRI IMITIROVANNYKH POGRUZHENIYAKH]**

D. T. FILIPOVA (Bulgarian Academy of Sciences, Inst. of Brain Research, Sofia, Bulgaria) *Fiziologicheskii Zhurnal* (ISSN 0015-329X) vol. 78, no. 3 March 1992 p. 46-49. In Russian. refs

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The occurrence of tremor in aquanauts subjected to simulated immersion, during various stages of compression, elevated pressure, decompression, and postdecompression was investigated by carrying out electromyographic measurements in several groups of muscles of subjects placed into a pressure chamber filled with a He-N₂-O₂ mixture. It was found that the characteristics of tremor observed during elevated pressure phases were similar to those of Parkinson tremor.

I.S.

A93-18406

K.E. TSIOLKOVSKY AND BIOMEDICAL PROBLEMS CONNECTED WITH SPACE EXPLORATION; LECTURES DEVOTED TO K.E. TSIOLKOVSKY'S IDEAS, 25TH, KALUGA, RUSSIA, SEPT. 11-14, 1990, TRANSACTIONS [K.E. TSIOLKOVSKII I BIOMEDITSINSKIE PROBLEMY OSVOENIYA KOSMICHESKOGO PROSTRANSTVA; CHTENIYA, POSVIASHCHENNYE IDEIAM K.E. TSIOLKOVSKOGO, 25TH, KALUGA, RUSSIA, SEPT. 11-14, 1990, TRUDY]

V. B. MALKIN, ED., F. P. KOSMOLINSKII, ED., and E. I. KUZNETS, ED. Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 90 p. In Russian.

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The volume contains papers on Tsiolkovsky's ideas on the problem of human survival in extreme environmental conditions on earth and in space, the interaction of terrestrial and space environments with human life, and the role of human factors in securing safety during spaceflights. Attention is also given to the problem of decompression safety of cosmonauts on a mission to Mars, problems of medical support of EVA during a manned mission to Mars, the factor of physical fitness as a criterion of readiness for spaceflights, and the results from a general model of external information perception. Particular consideration is given to the efficiency of a rehabilitation and prophylactic treatment of civil aviation flight crews, preclinical cardiovascular and neurological occupation-related pathological symptoms in helicopter pilots, psychophysiological studies of acute hypoxia, and the effects of possible atmospheric pollution sources on the growth of selected microorganisms. (For individual items see A93-18407 to A93-18419)

I.S.

A93-18408

DEVELOPMENT OF K.E. TSIOLKOVSKY'S IDEAS ON THE INTERACTION BETWEEN SPACE, NATURE, AND MAN [RAZVITIE IDEI K.E. TSIOLKOVSKOGO O VZAIMODEISTVII KOSMOSA, PRIRODY I CHELOVEKA]

G. I. LOKTIN *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990,

Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 13-19. In Russian. refs

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The proposal of Tsiolkovsky that natural phenomena on earth and human life are strongly influenced by electromagnetic forces of cosmic origin is developed and illustrated with citations from recently reported theoretical and experimental work in the fields of physics and biology. It has been found that the energy density and the power flow of the electromagnetic field (EMF) during geomagnetic disturbances may exceed, by 2 to 5 orders of magnitude, the sensitivity threshold of human-cell biological receptors, leading to changes in structural orientation of cellular components and thus to physiological changes in the human body. Results of statistical analysis showed close correlations between the instances of solar-radiation and EMF changes and the occurrence of epidemics and industry- and driving-related accidents.

I.S.

A93-18410

APPROACHES TO SOLVING THE PROBLEM OF DECOMPRESSION SAFETY OF COSMONAUTS ON THEIR FLIGHTS TO MARS [PODKHODY K RESHENIIU PROBLEMY DEKOMPRESSIONNOI BEZOPASNOSTI KOSMONAVTOV PRI POLETE NA MARS]

L. R. ISEEV, E. I. KUZNETS, V. P. KATUNTS, and I. I. MALKIMAN *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 24-28. In Russian. refs

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The prospect of long-term (from 640 to 1160 day long) spaceflights, in particular flights to Mars, calls for the necessity of a special medical support program. Attention is given to methods for conserving in man the original gravity-regulated physiological mechanisms, in order to prepare him for the Martian gravity and for the return to earth, by means of creating artificial gravity in spacecraft. Other problems that must be attended to include the design of special regimens of physical activity under conditions of hypokinesia and hypogravity during spaceflight and of protection against decompression during planetary explorations. A detailed program is proposed which is designed to protect cosmonauts from decompression during spaceflights and during Mars orbit and landing.

I.S.

A93-18411

PROBLEMS OF MEDICAL SUPPORT DURING EXTRAVEHICULAR ACTIVITY DURING FLIGHTS TO MARS [MEDITSINSKIE PROBLEMY OBESPECHENIYA VNEKORABEL'NOI DEIATEL'NOSTI PRI POLETAKH NA MARS]

A. S. BARER, N. K. GNOEVAIA, G. A. RYKOV, E. A. SOKOL, and S. N. FILIPENKOV *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 29-36. In Russian. refs

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The technical and medical support needed during extravehicular activity (EVA) of cosmonauts on their flights to Mars is discussed, with particular attention given to the physiological factors involved in EVA activity. It is emphasized that long-term (1.5-2 years) manned flights to Mars require methods based on preliminary studies of medical and biological effects of such flights, conducted under conditions close to those of the Mars, such as during EVA in space or staying for various periods of time in space vehicles orbiting Mars, as well as on studies conducted on earth under conditions simulating Martian gravity and atmosphere. Particular attention is given to the concept of a special spacesuit provided with an autonomous life-support system, which could be used to walking and working on Mars.

I.S.

A93-18415

THE EFFICIENCY OF A PROPHYLACTIC-REHABILITATIONAL TREATMENT OF CIVIL-AVIATION FLIGHT CREWS [OB EFEKTYVOSTI REABILITATSIONNO-PROFILAKTICHESKOGO LECHENIIA LETNOGO SOSTAVA GRAZHDANSKOI AVIATSII]

M. L. KOLOMIEVSKII *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 63-68. In Russian. refs
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The efficiency of a prophylactic-rehabilitational treatment (PRT) described by Kolomievski (1987) on the work capacity of civil-aviation flight personnel was investigated by examining data from 1981 to 1989 on flight crews of different age groups with regard to the effect of treatment on the work capacity of the pilot, the length of the positive effect, and the effect of treatment in the case of various cardiovascular disorders. It is shown that the treatment was effective in 75-96 percent of treated pilots, in particular of pilots with extrasystole and those with lowered tolerance to hypoxia. Eighty five percent of the pilots who underwent PRT followed by regular medical examinations remained active from five to three years. I.S.

A93-18416

PRECLINICAL CARDIOVASCULAR AND NEUROLOGICAL OCCUPATION-RELATED PATHOLOGICAL SYMPTOMS IN HELICOPTER PILOTS [DONOZOLOGICHESKIE SERDECHNO-SOSUDISTYE I NEVROLOGICHESKIE PROIAVLENIIA PROFESSIONAL'NOI PATOLOGII U LETCHKOV VERTOLETNOI AVIATSII]

S. N. AKIMOV, M. M. ODINAK, A. IU. EMEL'IANOV, A. A. BLAGININ, and A. A. GEORGINOV *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 69-73. In Russian. refs
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The effect of vibration and noise on the cardiovascular and neural systems of helicopter pilots was investigated in 334 students of a helicopter-aviation school and 79 pilots with various lengths of flight time. Results showed that students without flight experience were free of cardiovascular or neural symptoms, whereas pilots with 500 or more hours of flight time exhibited an increased number of symptoms (e.g., 82.1 percent of pilots with more than 1500 hours of flight complained of asthenia) and significant ECG alterations. Vertebral changes were found in 87 percent of pilots with over 1500 hours of flight time. I.S.

A93-18417

PSYCHOPHYSIOLOGICAL STUDIES OF ACUTE HYPOXIC HYPOXIA [PSIKHOFIZIOLOGICHESKIE ISSLEDOVANIIA PRI OSTROI GIPOKSICHESKOI GIPOKSII]

N. A. ROSHCINA, M. IU. BULYGINA, V. M. NAZAROV, and M. A. IL'NITSKAIA *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 74-79. In Russian. refs
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The psychophysiological characteristics of the functional state and the psychophysiological response reactions in humans subjected to a rapid decrease in oxygen supply were investigated in subjects exposed for 190 min to simulated altitudes of 5400 or 6100 m above sea level. Results revealed two types of reactions: general reactions and individually specific reactions. General reactions included changes of the psychophysiological indices characterizing the level of the adaptive and compensatory processes in response to hypoxia, while the individual type of reaction was expressed by variations of the characteristics of reactions of the cardiovascular system, reflecting the level of work capacity. Results obtained on the dynamics of psychological

characteristics (determined by the self-assessed levels of good mood, well-being, and activity) upon a transfer to a simulated altitude of 6100 m were used to divide all subjects into types of low and high levels of anxiety. I.S.

A93-19991

COMPARISON BETWEEN VDV AND A(RMS) USING SIMULATED IMPULSIVE VIBRATION

YING-ZHONG LI (Inst. of Space Medico-Engineering, Beijing, China) and PER RASMUSSEN (Bruel & Kjaer, Naerum, Denmark) Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 157-162. refs

Examples of impulsive vibration are used to compare the vibration dose value (VDV) and a(rms). The weighting curve of ISO 2631/1 (whole-body vibration in z-axis) is added, and simulated impulsive vibrations are employed in the experiment. The vibration signals in different pulse durations, cycle times, and levels are weighted with the curve. It is shown that VDV is more sensitive to impulsive vibration, especially to those whose crest factors are more than 6 and possess a larger changing range. P.D.

A93-19992

WINDBLAST TOLERANCE OF HUMAN THORAX AND ABDOMEN

YU-YING TENG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 163-171. In Chinese. refs

The tolerance of the human thorax and abdomen to a windblast is determined in order to provide human engineering a basis for determining the maximum speed under which open seat ejection can be performed. This study is based on results obtained from a series of animal windblast and mechanical experiments and an investigation of the literature on a rocket sled test, thoracic blunt impact, and injuries from a high-velocity impact on water. Thoracic-abdominal tolerances to a windblast and the thoracic tolerance to a blunt impact are inferred from these results for human beings, pigs, dogs and monkeys. The relationship between thorax tolerance to a blunt impact and tolerance of the thorax and abdomen to a windblast is obtained, and the conversion method between the two kinds of tolerance is established. The index of impact severity of VC/(1-C) (where V and C are the impact velocity and the normalized chest compression, respectively) suggested by Viano (1983) and the dynamic pressure, qc, of the air flow are found to be two correlated quantities. P.D.

A93-19993

DYNAMIC CHARACTERISTIC OF CHANGES OF OXYGEN SATURATION OF BLOOD HEMOGLOBIN UNDER CONDITIONS OF ACUTE HYPOXIA IN HUMAN BODY

TIAN-DE YANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 172-178. In Chinese. refs

The dynamic change of S HbO during processes from one state of hypoxia to another is investigated in order to facilitate prediction of the hypoxic severity and tolerance to hypoxia of subjects in a hypoxic environment. The experiment was carried out in a decompression chamber simulating altitudes of 0 to 7000 m. The curves of S HbO changes in eight subjects were recorded with an oxymeter. The curves of change of S HbO from hypoxic states to 100 percent O₂ were found to be similar to each other in the eight subjects, and so were the curves of changes of S HbO from a 100 percent O₂ state to hypoxic states. Statistical analysis demonstrated that S HbO changes exponentially with time. P.D.

A93-19995

METHOD OF SELECTION OF ASTRONAUTS CARDIOVASCULAR REGULATIVE FUNCTION UNDER SIMULATED WEIGHTLESSNESS

QIU-LU XIANG (Inst. of Space Medico-Engineering, Beijing, China)

52 AEROSPACE MEDICINE

et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 186-192. In Chinese. refs

A method involving -15-deg head-down tilt in bed for 4 hr instead of -2 to -6 deg head down for 1-2 wk, as is commonly applied in other studies, is used for the selection of cardiovascular regulative functions under simulated weightlessness. The cardiovascular regulative function and its adaptation to the effects of body fluid redistribution are observed, and individual differences among the subjects are also analyzed. Reactions resembling the space-adaptation syndrome were found in 13 of the 38 subjects within 30-60 min of bed rest when marked changes of the heart rate, blood pressure, arterial compliance, and rheoencephalogram occurred. It is suggested that blood redistribution during head-down tilt not only caused changes in cardiovascular functions but also induced functional or even structural changes in the brain, and those who were adapted to these kinds of reactions would be more susceptible to the space-adaptive syndrome. It is shown that the method of -15-deg head-down tilt in bed for 1 h could be used in the selection of the human body's adaptability to microgravity. P.D.

A93-19996

EEG CHANGES IN MAN DURING MOTION SICKNESS INDUCED BY PARALLEL SWING

JIAN-PING WU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 200-205. In Chinese. refs

Motion sickness was induced by parallel swing with 6-m-long arms and about 0.2-Hz swing frequency in order to examine EEG changes in humans during motion sickness induced by parallel swing. Unlike previous studies with a rotating chair experiment in which only the increase of theta band spectra of EEG was reported, two types of EEG changes were observed. In eight of the 11 subjects observed, the main changes were an increase of power in the theta band (4.0 to 7.75 Hz) in the frontal and center area, without an increase of power in the alpha band, and five of those eight subjects had theta rhythmic discharges. It is suggested that the EEG could serve as an indicator of MS to some degree. The decrease of the alpha band in the remaining three subjects, the increase of theta activities, and the autonomic nervous dysfunctions of the subjects indicated a reduction of reticular and cerebral cortical activities of the brain during MS. P.D.

A93-19997

EFFECTS OF +GY STRESS ON HUMAN BODY

BAO-SHENG XIE (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 206-211. In Chinese. refs

Results of an experimental study tracing the effects of +Gy stress on the human body are reported. Five male subjects aged from 18 to 23 were exposed to +Gy stress on a human centrifuge of 12-m radius. A conventional ejection seat (back angle = 15 deg) was mounted in the gondola. A specially designed sidearm controller was mounted on the right side of the arm rest with which the subject could correct the random disturbance through certain simulated functions and control the light spot to the center of the screen. The G stress was +Gy of the trapezoidal profile having plateau levels of +1 Gy, +2 Gy, and +3 Gy with a duration of 120 s. Changes of some physiological parameters such as heart rate, respiratory rate, and EEG, and changes of some physical parameters such as tracking errors and tracking dynamic parameters were observed. Results showed that the influence of +Gy stress on human physiological functions and working performance was significant. P.D.

A93-20026

T WAVE CHANGES IN HUMANS AND DOGS DURING EXPERIMENTAL DIVES

F. JOULIA, P. BARTHELEMY, F. GUERRERO, and Y. JAMMES (Aix-Marseille II, Univ., Marseille, France) Journal of Applied

Physiology (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1708-1712. Research supported by IFREMER refs (Contract DRET-89-176)

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Electrocardiogram (ECG) analysis was performed in three human divers studied at 21 and 23.5 ata while they breathed various gas mixtures containing H₂ and/or He (COMEX HYDRA IX experiment) and in five dogs exposed to 91 ata of He-O₂ or He-N₂-O₂. In all cases, the O₂ partial pressure was slightly higher than its physiological value. These human and animal studies reveal that elevated pressure of different inert gases did not change the resting heart rate or its respiratory fluctuation. However, the T wave amplitude increased in proportion to the gas density in the three divers; this was also found in four of the five dogs studied. Changes in peak T wave configuration were also observed in the dog experiments. Positional changes in QRS or T vectors cannot explain these T wave changes. Author

A93-20028

EFFECTS OF A 1-YR STAY AT ALTITUDE ON VENTILATION, METABOLISM, AND WORK CAPACITY

TAT'IANA V. SEREBROVSKAIA and ALEKSANDRA A. IVASHKEVICH (Ukrainian Academy of Sciences, Inst. of Physiology, Kiev, Ukraine) Journal of Applied Physiology (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1749-1755. refs

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Individual ventilatory responses to hypoxic and hypercapnic stimuli were studied in humans with a range of individual endurance levels, under conditions of the 1-yr-long stay at altitudes 1680 m or 3650 m, and the responses were related to the individuals' characteristics of metabolism and physical work capacity. Results indicated the existence of two extreme types of adaptation strategy: active, with marked reactions of 'struggle for oxygen', and passive, with reduced O₂ metabolism. Several intermediate types were also identified. It is noted that, while an active adaptation strategy permits a higher performance at altitude, it puts an organism in complete dependence on the aerobic metabolism, reducing its capacity to utilize the anaerobic glycolysis to bear an ultimate hypoxia. I.S.

A93-20029

MODIFICATION OF WATER AND ELECTROLYTE METABOLISM DURING HEAD-DOWN TILTING BY HYPOLYCEMIA IN MEN

YOSHITAKA HAYASHI, YOSHIHARU MURATA, HISAO SEO, NORIHIRO MIYAMOTO, FUKUSHI KAMBE, SACHIKO OHMORI, CHIKASHI YAMAMOTO, SAYOKO HAYAMIZU, YOSHIHIRO TAMURA, and NOBUO MATSUI (Nagoya Univ., Japan) Journal of Applied Physiology (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1785-1790. Research supported by Special Coordination Fund for Science and Technology refs

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The effect of hypoglycemic stress on the responses of hormones regulating water and electrolyte metabolism during head-down tilt (HDT) was investigated in humans subjected to postural changes which included 30 min standing followed by 2 hours HDT and finally by 1 hour standing, with or without intravenous administration of insulin at the beginning of HDT. It was found that insulin-induced hypoglycemia strongly altered the responses of hormones regulating both water and electrolyte metabolism during HDT, resulting in the abolishment of Gauer's (Gauer et al., 1970, 1976) reflex. I.S.

A93-20031

ENERGY EXPENDITURE CLIMBING MT. EVEREST

KLAAS R. WESTERTERP, BENGT KAYSER, FRED BROUNS, JEAN P. HERRY, and WIM H. M. SARIS (Limburg Univ., Maastricht, Netherlands; Geneva Univ., Medical Center, Switzerland; Ecole Nationale de Ski et Alpinisme, Chamonix, France) Journal of Applied Physiology (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 1815-1819. Research supported by Sandoz Nutrition and Federation Francaise pour la Montagne et l'Escalade refs

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Energy metabolism was studied in climbers at high altitude by measuring simultaneously the energy intake, the energy expenditure, and changes in body composition. The energy intake was estimated using the dietary record and daily measurements of the average metabolic rate and resting metabolic rate. The results illustrate the problem of maintaining energy balance while climbing at high altitude. The energy intake is low, whereas the energy expenditure reaches values comparable to those of highly trained endurance athletes at sea level. I.S.

A93-20035**EFFECTS OF ACUTE HYPOXIA ON RENAL AND ENDOCRINE FUNCTION AT REST AND DURING GRADED EXERCISE IN HYDRATED SUBJECTS**

NIELS V. OLSEN, INGE-LIS KANSTRUP, JEAN-PAUL RICHALET, JESPER M. HANSEN, GENEVIEVE PLAZEN, and FRANCOIS-XAVIER GALEN (Herlev Hospital, Denmark; Association pour la Recherche en Physiologie de l'Environnement, Bobigny; Sandoz Labs.; Inst. National de la Sante et de la Recherche Medicale, Paris, France) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 2036-2043. Research supported by Labs. Sandoz, Danish Medical Research Council, Danish Sport Federation, et al refs
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The effect of acute hypoxia on renal and hormonal functions at rest and during exercise was investigated in human subjects during the initial rest period, a period of graded exercise at sea level, and 48 hours after a rapid ascent to 4350 m (high altitude, HA). It was found that the HA exposure did not change the resting values of the effective renal plasma flow (ERPF), glomerular filtration rate (GFR), sodium clearance, urine flow, or lithium clearance (which was used as an index of proximal tubular outflow). At rest, HA exposure increased the plasma concentration of norepinephrine and decreased the plasma concentrations of renin and aldosterone. Exercise led to decreases of ERPF in both environments. The CFR decreased progressively after normoxic exercise, but at HA, CFR decreased only during heavy exercise. I.S.

A93-20039* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

REGIONAL CHANGES IN MUSCLE MASS FOLLOWING 17 WEEKS OF BED REST

ADRIAN D. LEBLANC, VICTOR S. SCHNEIDER, HARLAN J. EVANS, COLETTE PIENOK, ROGER ROWE, and ELISABETH SPECTOR (Baylor College of Medicine; NASA, Johnson Space Center; Krug Life Sciences, Houston, TX) *Journal of Applied Physiology* (ISSN 8750-7587) vol. 73, no. 5 Nov. 1992 p. 2172-2178. refs
(Contract NAG9-130; NIH-RR-00350; NIH-RR-02558)
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This work reports on the muscle loss and recovery after 17 wk of continuous bed rest and 8 wk of reambulation in eight normal male volunteers. Muscle changes were assessed by urinary levels of 3-methylhistidine (3-MeH), nitrogen balance, dual-photon absorptiometry (DPA), magnetic resonance imaging (MRI), and isokinetic muscle performance. The total body lean tissue loss during bed rest calculated from nitrogen balance was 3.9 +/- 2.1 kg. Although the total loss is minimal, DPA scans showed that nearly all of the lean tissue loss occurred in the lower limbs. Similarly, MRI muscle volume measurements showed greater percent loss in the limbs relative to the back muscles. MRI, DPA, and nitrogen balance suggest that muscle atrophy continued throughout bed rest with rapid recovery after reambulation. Isokinetic muscle strength decreased significantly in the thigh and calf with no loss in the arms and with rapid recovery during reambulation. Author

A93-20653**POSTURE AND THE CIRCULATION - THE AGE EFFECT**

JAMES J. SMITH (Wisconsin Univ., Milwaukee) and CAROL J. M. PORTH (USVA, Medical Center, Milwaukee, WI) *Experimental*

Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 141-162. refs

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The general features of the circulation system are discussed with particular attention given the postural adaptation and the circulatory aspects of change to the upright posture, and the use of circulatory changes to the upright posture as a circulatory function test. Consideration is also given to a comparison between the effects of a postural change and the lower body negative pressure, the effect of age on the orthostatic response, the mechanism of aging responses in orthostasis, the neurohormonal responses to the headup posture, and the postural hypotension in the elderly. The tests which are currently used to assess circulatory tolerance are analyzed and compared. I.S.

A93-20654* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CARDIOVASCULAR PHYSIOLOGY IN SPACE FLIGHT

JOHN B. CHARLES and MICHAEL W. BUNGO (NASA, Johnson Space Center, Houston, TX) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 163-168. refs
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The effects of space flight on the cardiovascular system have been studied since the first manned flights. In several instances, the results from these investigations have directly contradicted the predictions based on established models. Results suggest associations between space flight's effects on other organ systems and those on the cardiovascular system. Such findings provide new insights into normal human physiology. They must also be considered when planning for the safety and efficiency of space flight crewmembers. Author

A93-20655**AGE-RELATED BONE CHANGES**

GARY M. KIEBZAK (Science Applications International Corp., Joppa, MD) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 171-187. refs
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The various age-related bone changes which occur as a result of a net loss of bone protein matrix and mineral and bone strength are discussed together with the mechanisms responsible for these changes. It is emphasized that the loss of bone strength with age is not the result of a single perturbation, but is a combined function of a decreased mineral content (which itself may be a consequence of age-related negative calcium balance due to decreased 1,25-dihydroxy cholecalciferol and/or elevated PTH), age-related changes in collagen and perhaps other bone matrix proteins; and such ultrastructural changes as the accumulation of microfractures and porosities. I.S.

A93-20656* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CAN THE ADULT SKELETON RECOVER LOST BONE?

ADRIAN LEBLANC (Baylor College of Medicine, Houston, TX) and VICTOR SCHNEIDER (NASA, Johnson Space Center, Houston, TX) *Experimental Gerontology* (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 189-201. refs
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The loss of bone mineral with aging and subsequent development of osteoporosis is a common problem in elderly women, and as life expectancy increases, in elderly men as well. Space flight also causes bone loss and could be a limiting factor for long duration missions, such as, a Mars expedition or extended occupation of a Space Station. Before effective countermeasures can be devised, a thorough knowledge of the extent, location, and rate of bone loss during weightlessness is needed from actual space flight data or ground-based disuse models. In addition, the rate and extent that these losses are reversed after return from space flight are of primary importance. Although the mechanisms are not likely to be the same in aging and space flight, there are common elements. For example, strategies developed to prevent disuse bone loss or to enhance the rate of recovery following space flight might have direct applicability to clinical medicine.

For various reasons, little attention has been given to recovery of bone mass following space flight. As a prelude to the design of strategies to enhance recovery of bone, this paper reviews published literature related to bone recovery in the adult. We conclude that recovery can be expected, but the rate and extent will be individual and bone site dependent. The development of strategies to encourage or enhance bone formation following space flight may be as important as implementing countermeasures during flight. Author

A93-20657
THE MECHANICAL CONTROL SYSTEM OF BONE IN WEIGHTLESS SPACEFLIGHT AND IN AGING

LEX SCHULTHEIS (Johns Hopkins Univ., Baltimore, MD) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 203-214. refs
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Bone loss is notable in elderly persons and in astronauts returning from spaceflight; however, the bone changes in these radically different patient populations appear morphologically similar. Bone structure depends upon several independent basic processes: growth, modeling, and remodeling. Each process follows a stereotyped sequence of steps. Alteration of any step may yield a similar bone loss, although from an entirely different mechanism. Mechanical forces appear to coordinate the fundamental bone shaping processes by a negative feedback control system. Determining how mechanical signals control the mass, architecture, and strength of bone may establish the limits by which exercise can prevent osteoporosis in the elderly and in astronauts despite obvious differences in etiology. Author

A93-20658* National Aeronautics and Space Administration, Washington, DC.

RESEARCH ON SLEEP, CIRCADIAN RHYTHMS AND AGING - APPLICATIONS TO MANNED SPACEFLIGHT

CHARLES A. CZEISLER (Harvard Univ.; Brigham and Women's Hospital; Center for Design of Industrial Schedules, Boston, MA), AUGUST J. CHIASERA (Center for Design of Industrial Schedules, Boston, MA), and JEANNE F. DUFFY (Harvard Univ.; Brigham and Women's Hospital, Boston, MA) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 217-232. Research supported by Krug Life Sciences refs
 (Contract NAGW-1863; NIH-1-RO1-AG06072; NIH-GCRC5-M01-RR00888)
 Copyright

Disorders of sleep and circadian rhythmicity are characteristic of both advancing age and manned spaceflight. Sleep fragmentation, reduced nocturnal sleep tendency and sleep efficiency, reduced daytime alertness, and increased daytime napping are common to both of these conditions. Recent research on the pathophysiology and treatment of disrupted sleep in older people has led to a better understanding of how the human circadian pacemaker regulates the timing of the daily sleep-wake cycle and how it responds to the periodic changes in the light-dark cycle to which we are ordinarily exposed. These findings have led to new treatments for some of the sleep disorders common to older individuals, using carefully timed exposure to bright light and darkness to manipulate the phase and/or amplitude of the circadian timing system. These insights and treatment approaches have direct applications in the design of countermeasures allowing astronauts to overcome some of the challenges which manned spaceflight poses for the human circadian timing system. We have conducted an operational feasibility study on the use of scheduled exposure to bright light and darkness prior to launch in order to facilitate adaptation of the circadian system of a NASA Space Shuttle crew to the altered sleep-wake schedule required for their mission. The results of this study illustrate how an understanding of the properties of the human circadian timing system and the consequences of circadian disruption can be applied to manned spaceflight. Author

A93-20659* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

SLEEP AND CIRCADIAN RHYTHMS

TIMOTHY H. MONK (Pittsburgh Univ., PA) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 233-243. refs

(Contract NIH-AG-06836; NCC2-253)

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Three interacting processes are involved in the preservation of circadian rhythms: (1) endogenous rhythm generation mechanisms, (2) entrainment mechanisms to keep these rhythms 'on track', and (3) exogenous masking processes stemming from changes in environment and behavior. These processes, particularly the latter two, can be dramatically affected in individuals of advanced age and in space travelers, with a consequent disruption in sleep and daytime functioning. This paper presents results of a phase-shift experiment investigating the age-related effects of the exogenous component of circadian rhythms in various physiological and psychological functions by comparing these functions in middle aged and old subjects. Dramatic differences were found between the two age groups in measures of sleep, mood, activation, and performance efficiency. I.S.

A93-20664

IMMUNE RESPONSE DURING SPACE FLIGHT

B. S. CRISWELL-HUDAK (Arizona Univ., Tucson) Experimental Gerontology (ISSN 0531-5565) vol. 26, no. 2-3 1991 p. 289-296. refs

Copyright

The health status of an astronaut prior to and following space flight has been a prime concern of NASA throughout the Apollo series of lunar landings. Skylab, Apollo-Soyuz Test Projects (ASTP), and the new Spacelab-Shuttle missions. Both humoral and cellular immunity has been studied using classical clinical procedures. Serum proteins show fluctuations that can be explained with adaptation to flight. Conversely, cellular immune responses of lymphocytes appear to be depressed in both in vivo as well as in vitro. If this depression in vivo and in vitro is a result of the same cause, then man's adaptation to outer space living will present interesting challenges in the future. Since the cause may be due to reduced gravity, perhaps the designs of the experiments for space flight will offer insights at the cellular levels that will facilitate development of mechanisms for adaptation. Further, if the aging process is viewed as an adaptational concept or model and not as a disease process then perhaps space flight could very easily interact to supply some information on our biological time clocks. Author

A93-20898

INFLUENCE OF VISCOUS RESISTANCE ON HEART RATE AND OXYGEN UPTAKE DURING TREADMILL WALKING IN WATER

SHO ONODERA, KAZUHIKO KIMURA, MOTOHIKO MIYACHI, SHOZO YONETANI (Kawasaki Univ. of Medical Welfare, Okayama, Japan), and HIDEKI HARA (Kokugakuin Univ., Tokyo, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723) vol. 29, no. 3 Sept. 1992 p. 67-72. In Japanese. refs

Copyright

Metabolic responses to 15 min of walking at 4 km/hr in water, viscous water (VW, 1 percent solution of carboxymethyl cellulose with viscous coefficient of 470 cps), and air were compared in five male and two female subjects. Oxygen uptake at steady state (15 min) was 0.85 l/min for VW, 0.71 l/min in air, and 0.63 l/min in water. Heart rate at steady state was 101 bpm for VW, 87 bpm for air, and 86 bpm for water. These results suggest that the energy cost of water resistance may offset the energy saving of buoyancy. It is suggested that walking in VW may be an attractive training method, especially during recovery from musculoskeletal injuries to the legs. C.D.

N93-15824# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

OPERATIONAL USE OF CONTACT LENSES BY MILITARY AIRCREW [L'UTILISATION OPERATIONNELLE DES LENTILLES DE CONTACT]

E. ALNAES, ed. Oct. 1992 36 p
(AGARD-AG-334; ISBN-92-835-0690-1) Copyright Avail: CASI HC A03/MF A01

The text discusses the operational requirements of military personnel relative to the use of contact lenses (CL) and particular emphasis is given to the experience of those NATO air forces that currently have aircrew flying with contact lenses. Topics such as lens optical performance, user compliance, and a definition of adequate eye-care supervision are highlighted. The text seeks to identify the critical factors to be taken into account when the decision is made to permit the use of contact lenses by military aircrew, and weights medical considerations and military field conditions, in this regard. Finally, specific military aeromedical conditions in modern aircraft are discussed, with emphasis on the advantages and disadvantages of CL visual correction. Based on extensive deliberations in the group, WG 16 offers a detailed list of recommendations for the use of CL by military aircrews. These recommendations will also be useful for military medical authorities supervising visual correction guidelines for non-flying personnel.

Author

N93-15900# Michigan Univ., Ann Arbor.
NEW TECHNIQUES FOR POSITRON EMISSION TOMOGRAPHY IN THE STUDY OF HUMAN NEUROLOGICAL DISORDERS
Progress Report, 15 Jun. - 31 Oct. 1992

1992 5 p
(Contract DE-FG02-87ER-60561)
(DE93-002098; DOE/ER-60561/7) Avail: CASI HC A01/MF A01

During the past six months, we have continued work on the fronts of kinetic modeling of radioligands for studying neurotransmitter/receptor systems, iterative reconstruction techniques, and methodology for PET cerebral blood flow activation studies. Initial human PET studies have been performed and analyzed with many different kinetic model formulations to determine the quantitative potential of the neurotransmitter/receptor ligand, (C-11)N-methyl piperidyl benzilate (NMPB), a muscarinic cholinergic antagonist. In addition, initial human studies using (C-11)tetrabenazine (TBZ), a marker for monoamine nerve terminal density. Results of the NWB studies have indicated that this new agent yields better estimates of receptor density than previous muscarinic ligands developed at our facility, (C-11)-TRB and (C-11)scopolamine. TRB and scopolamine have previously been shown to be only partially successful ligands due to sub-optimal values of the individual rate constants, causing varying degrees of flow limitation. This is found to be much less of a problem for NMPB due to the 2.0 to 2.5 fold increase in ligand transport observed in the human studies (approx. 60 pct. first pass extraction). A 2-parameter 2-compartment simplification had previously been implemented for the benzodiazepine ligand, (C-11)FMZ, and a similar model appears to be suitable for TBZ based on the preliminary human data.

DOE

N93-16041# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

ENHANCEMENT OF DRUG DETECTION AND IDENTIFICATION BY USE OF VARIOUS DERIVATIZING REAGENTS ON GC-FTIR ANALYSIS Final Report

EDWIN F. HUFFINE and DENNIS V. CANFIELD Jul. 1992 8 p
(AD-A255582; DOT/FAA/AM-92/25) Avail: CASI HC A02/MF A01

Phenylpropanolamine (PPA) is a relatively common non-prescription sympathomimetic amine. As such, it is frequently detected during forensic analysis. The presence of phenylpropanolamine can be confirmed by using Gas Chromatograph-Fourier Transform Infrared (GC-FTIR) spectrophotometry. One constraint of the GC-FTIR is the quantity of material required to obtain a suitable IR spectrum. If a drug is a relatively weak infrared absorber, several micrograms may be

required in order to obtain a clear, reliable spectrum. While this amount of material may be readily available for some types of analysis, it can easily exceed the quantity of material available in the forensic toxicology setting. One method that can be used to increase a drug's infrared absorption is to derivatize the drug with a polyfluorinated acid anhydride. Since carbonyl and carbon-fluorine bonds are strong infrared absorbers, molecules that possess such bonds have a heightened sensitivity to GC-FTIR analysis. Polyfluorinated acid anhydrides are capable of adding both carbonyl and carbon-fluorine bonds to drugs that possess either a hydroxyl, primary or secondary amine, or primary or secondary amide functional groups. Several derivatizing reagents were used and the extent to which they enhanced the identification of phenylpropanolamine were compared. Of the reagents studied, heptafluorobutyric acid anhydride (HFAA) produced the greatest increase in the phenylpropanolamine's sensitivity to GC-FTIR identification. Prior to derivatization, 1.8 micrograms of phenylpropanolamine was required for identification on the GC-FTIR, while only 0.032 micrograms of phenylpropanolamine was required after derivatization with HFAA.

GRA

N93-16166# Southwest Research Inst., San Antonio, TX: Dept. of Biosciences and Bioengineering.

INVESTIGATION OF EFFECTS OF 60-HZ ELECTRIC AND MAGNETIC FIELDS ON OPERANT AND SOCIAL BEHAVIOR AND ON THE NEUROENDOCRINE SYSTEM OF NONHUMAN PRIMATES: NEUROENDOCRINE PORTION OF EXPERIMENT 4

W. R. ROGERS and J. W. RHODES 31 Aug. 1992 401 p
(Contract DE-AC02-80RA-50219)
(DE92-040955; DOE/RA-50219/T22) Avail: CASI HC A18/MF A04

The neuroendocrine portion of Experiment 4 is reported. Serum melatonin concentration was measured in individual baboons, each implanted with a chronically indwelling venous cannula. As in Experiment 3, the system of six automatic blood samplers was used to achieve undisturbed, 24 hr per day, simultaneous blood sampling from six individual subjects. The objective was to determine if 30 kV/m electric and 1.0 G magnetic field (E/MF) exposure produced a 50 pct decline in nocturnal serum melatonin concentration. Other groups of subjects were tested concurrently during Experiment 4 to assess E/MF effects on group social and individual operant behavior. The results of these experiments will be covered future reports. The results of Experiment 4, as was the case with the result of Experiments 3 and 3A, provide little or no evidence that E/MF exposure, under the conditions of these experiments, affects nocturnal serum melatonin concentrations of nonhuman primates. Together the negative results of Experiments 3, 2 and 4 indicate that day-time exposure of primates to slow-onset/offset, regularly-scheduled E/MF does not produce melatonin suppression, strongly suggesting that such exposure would not affect human melatonin either. However, before concluding that E/MF exposure in general has no effect on primate melatonin, nighttime exposure needs to be examined, and the possibility, suggested by the Pilot Experiment, that fast onset/offset, irregularly-scheduled E/MF can completely suppress melatonin needs to be investigated.

DOE

N93-16187# Alaska Univ., Anchorage. Denali Medical Research Proj.

NIFEDIPINE FOR TREATMENT OF HIGH ALTITUDE PULMONARY EDEMA Final Report, 1 May 1991 - 30 Sep. 1992

PETER H. HACKETT, R. C. ROACH, E. R. GREENE, and B. LEVINE 30 Jul. 1992 29 p
(Contract DAMD17-91-C-1076; DA PROJ. 3M1-61102-BS-15)
(AD-A256959) Avail: CASI HC A03/MF A01

In 12 subjects with high altitude pulmonary edema, we studied the effects of 10 mg nifedipine on pulmonary and systemic hemodynamics and arterial oxygen saturation. In five of these, repeated dosing was done over 3 hours and spirometry and clinical HAPE scores were also obtained. A single 10 mg nifedipine dose lowered pulmonary vascular resistance and pulmonary arterial pressures, as well as systemic arterial pressure and increased SaO₂ 2 pct. Multiple dosing sustained the drug effect, but with a

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smaller increase SaO₂ 2 pct. Clinical scores improved slightly, and within 3 hours there was no consistent effect on spirometry. In addition, we undertook a survey of pulmonary hypertension (PHT) at high altitude, and surprisingly discovered excessive PHT in asymptomatic individuals. We conclude that nifedipine vasodilates the pulmonary bed in persons with HAPE, and that this appears to be beneficial, although short-term improvement was minimal. Since asymptomatic PHT is common, factors other than PHT are critical in HAPE pathogenesis, and by extension, could be important in prevention and treatment. GRA

N93-16441# Michigan Univ., Ann Arbor.
NON-INVASIVE EVALUATION OF THE CARDIAC AUTONOMIC NERVOUS SYSTEM BY PET

1992 10 p
(Contract DE-FG02-90ER-61091)
(DE92-041077; DOE/ER-61091/2) Avail: CASI HC A02/MF A01

The proposed research addresses the development, validation and application of cardiac positron emission tomography (PET) imaging techniques to characterize the autonomic nervous system of the heart. PET technology has significantly matured over the last two decades. Instrument design, image processing and production of radiochemical compounds have formed an integrative approach to provide a powerful and novel imaging modality for the quantitative in vivo evaluation of the autonomic nervous system of the heart. Animal studies using novel tracers for the sympathetic and parasympathetic nerve terminals will be employed to characterize the functional integrity of nerve terminals. This work will be complemented by the development of agents which bind to postsynaptic receptor sites. The combined evaluation of presynaptic and postsynaptic neuronal function will allow a unique characterization of neuronal function. Initial development in animal studies will be followed by feasibility studies in humans. These studies are designed to test sophisticated imaging protocols in the human heart and validate the scintigraphic findings with independent markers of autonomic innervation. Subsequent clinical application in various cardiac diseases is expected to provide new insights into the neuropathophysiology of the heart. DOE

N93-16552# Argonne National Lab., IL.
EFFECTS OF MAGLEV-SPECTRUM MAGNETIC FIELD EXPOSURE ON CEM T-LYMPHOBLASTOID HUMAN CELL GROWTH AND DIFFERENTIATION

K. R. GROH, C. B. CHUBB, F. R. COLLART, and E. HUBERMAN
1992 9 p Presented at the 1st World Congress for Electricity and Magnetism in Biology and Medicine, Orlando, FL, 14-29 Jun. 1992

(Contract W-31-109-ENG-38)
(DE92-041134; ANL/CP-77257; CONF-920630-2) Avail: CASI HC A02/MF A01

Exposure to magnetic fields similar to those produced by maglev vehicles (combined ac and dc components) was studied for the ability to alter cell growth and chemically induced cellular differentiation processes in cultured human CEM T-lymphoblastoid leukemia cells. A series of continuous and intermittent magnetic field (MF) exposures for varying lengths of time were tested at intensities up to 7-fold greater than that produced by the German TR07 maglev vehicle. Phorbol 12-myristate 13-acetate or mycophenolic acid were used to induce cell differentiation. Changes in cell number, morphology, and fluorescence expression of antigenic markers of differentiation were monitored. The results indicated that maglev-spectrum magnetic field exposures up to 2 gauss had little effect on culture growth or chemically induced cellular differentiation when exposed to maglev-spectrum magnetic fields compared to chemically treated but MF-unexposed controls. DOE

N93-16619*# National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.

A COMPARISON OF HAND GRASP BREAKAWAY STRENGTHS AND BARE-HANDED GRIP STRENGTHS OF THE ASTRONAUTS, SML 3 TEST SUBJECTS, AND THE SUBJECTS FROM THE GENERAL POPULATION

SUDHAKAR L. RAJULU (Lockheed Engineering and Sciences Co., Houston, TX.) and GLENN K. KLUTE Jan. 1993 17 p
(Contract NAS9-17900)
(NASA-TP-3286; S-690; NAS 1.60:3286) Avail: CASI HC A03/MF A01

Astronauts have the task of retrieving and deploying satellites and handling massive objects in a around the payload bay. Concerns were raised that manual handling of such massive objects might induce loads to the shuttle suits exceeding the design-certified loads. The Crew and Thermal Division of NASA JSC simulated the satellite handling tasks (Satellite Manload Tests 1 and 3) and determined the maximum possible load that a suited member could impart onto the suit. In addition, the tests revealed that the load to the suit by an astronaut could be calculated from the astronaut's maximum hand grasp breakaway strength. Thus, this study was conducted to document that hand grasp breakaway strengths of the astronauts who were scheduled to perform EVA during the upcoming missions. In addition, this study verified whether the SML 3 test results were sufficient for documenting the maximum possible load. An attempt was made to predict grasp strength from grip strength and hand anthropometry. Based on the results from this study, the SML 3 test results were deemed sufficient to document the maximum possible load on the suit. Finally, prediction of grasp strength from grip strength was not as accurate as expected. Hence, it was recommended that grasp strength be collected from the astronauts in order to obtain accurate load estimation. Author

N93-16962# Rome Univ. (Italy). Dipt. di Fisica.
CONVERSION OF TEMPORAL CORRELATIONS BETWEEN STIMULI TO SPATIAL CORRELATIONS BETWEEN ATTRACTORS

M. GRINIASTY (Hebrew Univ., Jerusalem, Israel), M. V. TSODYKS (Hebrew Univ., Jerusalem, Israel), and DANIEL J. AMIT (Istituto Nazionale di Fisica Nucleare, Rome, Italy) 17 Jan. 1992 15 p
Sponsored by Ministry of Science and Technology
(PREPRINT-856; ETN-93-92958) Avail: CASI HC A03/MF A01

A simple modification of synaptic structures, constructed to produce autoassociative attractors, is shown to produce neural networks whose attractors are correlated with several patterns used in the construction of the matrix. The modification stores in the matrix a fixed sequence of uncorrelated patterns. The network has correlated attractors, provoked by the uncorrelated stimuli. The network converts the temporal order into spatial correlations expressed in the distributions of neural activities in attractors. The model captures phenomena observed in single electrode recordings in performing monkeys. The correspondence is close enough to reproduce the fact that, given uncorrelated patterns as sequentially learned stimuli, the attractors produced are significantly correlated up to a separation of five in the sequence. This number is universal in a range of parameters, and requires no tuning. Learning scenarios, which could lead to this synaptic structure as well as experimental predictions following from it, are studied. The cognitive utility of such arrangement is considered. ESA

N93-17058*# National Aeronautics and Space Administration.
Marshall Space Flight Center, Huntsville, AL.

BRIGHT LIGHT DELIVERY SYSTEM Patent Application
BENITA C. HAYES, inventor (to NASA) 4 Dec. 1992 14 p
(NASA-CASE-MFS-28723-1; NAS 1.71:MFS-28723-1;
US-PATENT-APPL-SN-986631) Avail: CASI HC A03/MF A01

A bright light therapy delivery system is disclosed. The system enhances the efficient delivery of bright light therapy by directing the light to the user's eyes while permitting the user to engage in other sedentary activities, such as reading. A shroud is disclosed which has reflective non-specular interior surfaces and which enclosed a bright light source of known kind. The shroud can be configured for delivery of bright light therapy in a direct, indirect, or direct/indirect mode. In the direct mode, the bright light source is located at the back of the shroud and faces the user; in the indirect mode, the bright light source is located within the shroud and faces away from the user; in the direct/indirect mode, the

bright light source is located within the shroud, and has two luminous apertures, one facing the user and the other facing opposite the user. NASA

N93-17230# Sandia National Labs., Albuquerque, NM.
APPLICATION OF RADTRAN TO ESTIMATION OF DOSES TO PERSONS IN ENCLOSED SPACES

K. S. NEUHAUSER 1992 4 p Presented at the 10th International Symposium on the Packaging and Transportation of Radioactive Materials, Yokohama, Japan, 13-18 Sep. 1992 (Contract DE-AC04-76DP-00789) (DE93-000758; SAND-91-2603C; TTC-1121; CONF-920905-32) Avail: CASI HC A01/MF A01

The RADTRAN computer code for transportation risk analysis can be used to estimate doses to persons in enclosed volumes. This application was developed in response to a need to examine consequences of a hypothetical container leak during accident-free transportation by cargo air. The original problem addressed tritium containers, but the method can be applied to any gaseous or suspended particulate material potentially released in an airplane or other enclosed area (e.g., warehouse) under accident-free conditions. Such leakage can occur during shipment of any radioactive gas or material with a gaseous phase. Atmospheric dispersion is normally modeled in RADTRAN as a series of downwind isopleths each of which is assigned a dilution factor (also known as time-integrated concentration or X/Q value). These values are located in look-up tables in RADTRAN and are normally taken from externally performed Gaussian dispersion calculations. The dilution factors are used to estimate inhalation dose to persons in the specified downwind areas. DOE

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A93-17673* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

MODEL FOR THE COMPUTATION OF SELF-MOTION IN BIOLOGICAL SYSTEMS

JOHN A. PERRONE (NASA, Ames Research Center, Moffett Field; Stanford Univ., CA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232) vol. 9, no. 2 Feb. 1992 p. 177-194. refs (Contract NCC2-307). Copyright

A technique is presented by which direction- and speed-tuned cells, such as those commonly found in the middle temporal region of the primate brain, can be utilized to analyze the patterns of retinal image motion that are generated during observer movement through the environment. The developed model determines heading by finding the peak response in a population of detectors or neurons each tuned to a particular heading direction. It is suggested that a complex interaction of multiple cell networks is required for the solution of the self-motion problem in the primate brain. R.E.P.

A93-17800* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

FACTORS INFLUENCING PERCEIVED ANGULAR VELOCITY

MARY K. KAISER (NASA, Ames Research Center, Moffett Field, CA) and JACK B. CALDERONE (San Jose State Univ., CA) Perception & Psychophysics (ISSN 0031-5117) vol. 50, no. 5 1991 p. 428-434. refs Copyright

Angular velocity perception is examined for rotations both in depth and in the image plane and the influence of several object properties on this motion parameter is explored. Two major object properties are considered, namely, texture density which determines

the rate of edge transitions for rotations in depth, i.e., the number of texture elements that pass an object's boundary per unit of time, and object size which determines the tangential linear velocities and 2D image velocities of texture elements for a given angular velocity. Results of experiments show that edge-transition rate biased angular velocity estimates only when edges were highly salient. Element velocities had an impact on perceived angular velocity; this bias was associated with 2D image velocity rather than 3D tangential velocity. Despite these biases judgements were most strongly determined by the true angular velocity. Sensitivity to this higher order motion parameter appeared to be good for rotations both in depth (y-axis) and parallel to the line of sight (z-axis). O.G.

A93-17971
PSYCHOPHYSIOLOGICAL STRESS RESEARCH - METHODOLOGY AND RESULTS OF AN INVESTIGATION INVOLVING AIR TRAFFIC CONTROLLERS [PSYCHOPHYSIOLOGISCHE STRESSFORSCHUNG - METHODIK UND ERGEBNISSE EINER UNTERSUCHUNG BEI FLUGVERKEHRSLEITERN]

HANS ZEIER (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) Bern Verlag Paul Haupt 1992 137 p. In German and English. refs (ISBN-3-258-04585-2) Copyright

A method for evaluating psychophysiological stress is presented and its application to air traffic controllers is reported. The method uses a questionnaire and measurements of the levels of the stress hormone cortisol. C.D.

A93-17974* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

INVOLUNTARY ATTENTIONAL CAPTURE BY ABRUPT ONSETS

ROGER W. REMINGTON, JAMES C. JOHNSTON (NASA, Ames Research Center, Moffett Field, CA), and STEVEN YANTIS (Johns Hopkins Univ., Baltimore, MD) Perception and Psychophysics (ISSN 0031-5117) vol. 51, no. 3 1992 p. 279-290. refs (Contract NCA2-413; NIH-RO1-MH-43924) Copyright

Five experiments were carried out to examine the extent to which brief abrupt-onset visual stimuli involuntarily capture spatial attention. A fundamental limitation on the conscious control of spatial attention is demonstrated. Data obtained reveal conditions under which the control of spatial attention is completely involuntary: attention is captured by an irrelevant event despite subjects' intentions to ignore the event. The paradigm used provided strong incentives to ignore the distracting abrupt onset, but these were insufficient to prevent capture. Results suggest that voluntary control of attention is limited to focusing attention in advance on locations, objects, or properties of interest. Under appropriate conditions, spatial attention can be involuntarily drawn to abrupt-onset events despite the intention of subjects' to ignore them. O.G.

A93-18046
RECENT DEVELOPMENTS IN U.S. AIR FORCE PILOT CANDIDATE SELECTION AND CLASSIFICATION

THOMAS R. CARRETTA (USAF, Armstrong Lab., Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 12 Dec. 1992 p. 1112-1114. refs Copyright

Recent U.S. Air Force policy decisions regarding Specialized Undergraduate Pilot Training (SUPT) have eliminated the need to classify pilot candidates into training specialties prior to entering primary jet training. Under the new system, specialized training assignments will occur at the completion of primary jet training and will be based on flying and academic performance, student preferences, and aircraft availability. Another significant change to the SUPT program was the development of a refined pilot candidate selection model that reduced potential threats to test compromise and gaming strategies. Author

A93-18412

PHYSICAL FITNESS AS A CRITERION OF READINESS FOR SPACEFLIGHTS [ZHIZNEUSTOICHIVOST' CHELOVEKA KAK KRITERII GOTOVOSTI K KOSMICHESKIM POLETAM]

A. I. IAROTSKII *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 37-42. In Russian. refs
Copyright

The 35 components of an 'algorithm' defining the physical and physiological factors determining the ability of man to adapt to the conditions of space travel are presented, with particular attention given to the ability of man to endure hypogravity and hypokinesia as well as conditions inducing motion sickness. These special physical-fitness prerequisites were determined using results of 30 years of physiological studies of reactions in space crews, as well as results from more than a 1000 literature reports. I.S.

A93-18413

K.E. TSIOLKOVSKY ON INDIVIDUAL TIME PERCEPTION AND SOME CHARACTERISTICS OF INTUITIVE PERCEPTION OF THE PROPERTIES OF TIME AT DIFFERENT LEVELS OF MOTOR ACTIVITY AND HEALTH [K.E. TSIOLKOVSKII OB INDIVIDUAL'NOM VREMENI I NEKOTORYE OSOBNENOSTI INTUITIVNOGO VOSPRIIATIIA SVOISTV VREMENI PRI RAZNOM UROVNE DVIGATEL'NOI AKTIVNOSTI I ZDOROV'IA]

V. G. TRISTAN *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 48-53. In Russian. refs
Copyright

The effects of health condition and of the level of daily motor activity on an individual's perception of time were investigated in subjects separated into five groups of those of increasingly poor health and in healthy subjects separated into six groups of those leading increasingly active life styles. It was found that the conditions of both poor health and hypokinesia adversely affected most of the properties of perception of time in the present, past, and future. I.S.

A93-18414

CONSEQUENCES OF A BASIC MODEL OF EXTERNAL-INFORMATION PERCEPTION [SLEDSTVIA IZ OSNOVNOI MODELI VOSPRIIATIIA VNESHNEI INFORMATSII]

I. V. SMIRNOV *In* K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 54-62. In Russian. refs
Copyright

Smirnov's (1987) theory of information perception is discussed, and the algorithms of the model are presented. In this model, the source of external information acts as a stimulus consisting of factors defining the significance of the external information and its complexity. Depending on the character and the value of these factors, the information stimuli may cause various and often controversial reactions (e.g. when an intensification of an information stimulus causes a delayed reaction). Examples of the application of the model are presented. I.S.

A93-18769

TRAINING ANALYSIS FOR THE EUROPEAN FIGHTER AIRCRAFT - 'A VOYAGE INTO THE UNKNOWN'

ALAN PARFITT and MICHAEL WRAIGHT (Ministry of Defence, London, United Kingdom) *In* Flight simulation - European opportunities; Proceedings of the Conference, London, United Kingdom, May 1, 2, 1991 London Royal Aeronautical Society 1991 p. 5.1-5.9. refs
Copyright

The aircrew training challenges posed by the introduction of European Fighter Aircraft (EFA) are outlined, and the efforts of

the Royal Air Force to meet them are described. Training analyses conducted for EFA have produced a series of package options which include airborne training, flight simulators, and other synthetic aids. The package options are evaluated against criteria such as training effectiveness, user acceptability, and resource needs. Information required to make a first selection of synthetic training devices is obtained. The evaluation provides an EFA training data base, which is being updated as aircraft development proceeds, and is to serve as a base for detailed course design. It also provides flexible tools to examine the impact, in resource and training terms, of changes in policy or device capabilities. C.A.B.

A93-18773

EXAMINATION OF THE RELATIONSHIP BETWEEN CHANGES IN THE DEMAND FOR CIVIL AVIATION SERVICES AND THE VOLUME OF FLIGHT SIMULATOR TRAINING

EDWIN T. WILD (British Caledonian Flight Training Group, Crawley, United Kingdom), MERVYN JOHN, and MICHAEL J. RICHARDS (Cranfield Inst. of Technology, United Kingdom) *In* Flight simulation - European opportunities; Proceedings of the Conference, London, United Kingdom, May 1, 2, 1991 London Royal Aeronautical Society 1992 p. 10.1-10.19. refs
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An investigation into whether or not it is possible to establish statistically measureable relationships between changes in the economic circumstances of the airline industry, the addition of aircraft to the civil aviation fleet, and the resulting purchase and use of flight simulators for aircrew training is presented. A number of models are used to explore the historical data base and find the degree of significance that can be attributed to this chain of cause and effect. Attention is also focused on the statistical relation between purchases of jet airliners and simulators, aircrew training needs of new aircraft, and the use of data analysis for forecasts. C.A.B.

A93-18775

ADVANCES IN TRAINING TECHNOLOGY AND THE ROLE OF THE INSTRUCTOR

DAVID WELHAM (Rediffusion Simulation, Ltd., Burgess Hill, United Kingdom) and MARK BRUNT (Rediffusion Simulation, Ltd., Crawley, United Kingdom) *In* Flight simulation - European opportunities; Proceedings of the Conference, London, United Kingdom, May 1, 2, 1991 London Royal Aeronautical Society 1992 p. 12.1-12.6.
Copyright

The influence of technological advances on the traditional role of the instructor is examined. The electronic classroom gives the instructor a greater opportunity to tailor instruction to the capability of the student and the nature of the training material. Instructors are now able to evaluate and review whole sequences of actions, keypresses, and nonverbal responses by employing the wealth of computer- and video-based monitoring facilities. Instructor design training now has to take into account the method of ascertaining task mastery prior to the design of a technology-based training scenario. In the future, the simulator and training device manufacturing industry will depend more than ever on justifying the match of training media and device to training requirements. C.A.B.

A93-20275* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

INFLUENCE OF ANIMATION ON DYNAMICAL JUDGMENTS

MARY K. KAISER (NASA, Ames Research Center, Moffett Field, CA), DENNIS R. PROFFITT, SUSAN M. WHELAN, and HEIKO HECHT (Virginia Univ., Charlottesville) Journal of Experimental Psychology: Human Perception and Performance (ISSN 0096-1523) vol. 18, no. 3 1992 p. 669-689. refs
(Contract AF-AFOSR-91-0057; NCA2-248)

The motions of objects in the environment reflect underlying dynamical constraints and regularities. The conditions under which people are sensitive to natural dynamics are considered. In particular, the article considers what determines whether observers can distinguish canonical and anomalous dynamics when viewing

ongoing events. The extent to which such perceptual appreciations are integrated with and influence common-sense reasoning about mechanical events is examined. It is concluded that animation evokes accurate dynamical intuitions when there is only 1 dimension of information that is of dynamical relevance. This advantage is lost when the observed motion reflects higher dimension dynamics or when the kinematic information is removed or degraded. Author

A93-20692* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

THE PERCEPTION OF HEADING DURING EYE MOVEMENTS
 CONSTANCE S. ROYDEN (MIT, Cambridge, MA), MARTIN S. BANKS, and JAMES A. CROWELL (California Univ., Berkeley)
Nature (ISSN 0028-0836) vol. 360, no. 6404 Dec. 10, 1992 p. 583-585. Research supported by NIH, NASA, and Life Sciences Research Foundation refs
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Warren and Hannon (1988, 1990), while studying the perception of heading during eye movements, concluded that people do not require extraretinal information to judge heading with eye/head movements present. Here, heading judgments are examined at higher, more typical eye movement velocities than the extremely slow tracking eye movements used by Warren and Hannon. It is found that people require extraretinal information about eye position to perceive heading accurately under many viewing conditions. C.D.

N93-16111# Maryland Univ., Baltimore. School of Medicine.
DEVELOPMENT AND ENHANCEMENT OF A MODEL OF PERFORMANCE AND DECISION MAKING UNDER STRESS IN A REAL LIFE SETTING Final Quarterly Report, 31 Jan. - 1 May 1992

COLIN F. MACKENZIE 8 May 1992 22 p
 (Contract N00014-91-J-1540)
 (AD-A255699) Avail: CASI HC A03/MF A01

A system for acquiring data from which to model human performance under stress is described. An anesthesiologist and a nurse anesthetist at work on trauma cases are recorded, video taped, and evaluated in a post-trauma questionnaire. Four locations in two operating rooms and two admitting areas are cabled with a camera, a microphone, a computer, interfaces to physiological monitors, and a network interface. The system is fully automated, but tapes may need to be replaced after 2 hours. The methods for analyzing data are also discussed. J.P.S.

N93-16189# Advanced Aviation Concepts, Jupiter, FL.
WORKSHOP ON AERONAUTICAL DECISION MAKING (ADM). VOLUME 1: EXECUTIVE SUMMARY Final Report
 RONALD J. LOFARO Aug. 1992 76 p Workshop held in Denver, CO, 6-7 May 1992
 (Contract DTFA01-90-C-00042)
 (AD-A257016; DOT/FAA/RD-91/14-VOL-1) Avail: CASI HC A05/MF A01

This report presents Aeronautical Decision Making (ADM) training accomplishments, limitations, and future needs from the perspectives of commercial operators, general aviation, military aviation, and research development. A select group of experts on ADM was convened to share ideas, identify and explore future directions for advanced training. Cognitive training requirements based upon decision making task demands of both airplane and helicopter pilots and crews are analyzed. A major question which requires definitional research is the following: What is a real aircrew/pilot decision? That is, when does an event generate a true decisional opportunity for a pilot or crew versus a one-path only reaction, where the actual emphasis is not on cognitive decision making, but the application of procedures and basic airmanship. Going one step further, the group analyzed the decision making differences between expert and novice pilots when a real decision was required. GRA

N93-16783*# Ohio State Univ., Columbus. Dept. of Psychology.

COGNITIVE AND AFFECTIVE COMPONENTS OF MENTAL WORKLOAD: UNDERSTANDING THE EFFECTS OF EACH ON HUMAN DECISION MAKING BEHAVIOR

THOMAS E. NYGREN /n Hampton Univ., NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1992 p 154-156 Sep. 1992
 Avail: CASI HC A01/MF A03

Human factors and ergonomics researchers have recognized for some time the increasing importance of understanding the role of the construct of mental workload in flight research. Current models of mental workload suggest that it is a multidimensional and complex construct, but one that has proved difficult to measure. Because of this difficulty, emphasis has usually been placed on using direct reports through subjective measures such as rating scales to assess levels of mental workload. The NASA Task Load Index (NASA/TLX, Hart and Staveland) has been shown to be a highly reliable and sensitive measure of perceived mental workload. But a problem with measures like TLX is that there is still considerable disagreement as to what it is about mental workload that these subjective measures are actually measuring. The empirical use of subjective workload measures has largely been to provide estimates of the cognitive components of the actual mental workload required for a task. However, my research suggests that these measures may, in fact have greater potential in accurately assessing the affective components of workload. That is, for example, TLX may be more likely to assess the positive and negative feelings associated with varying workload levels, which in turn may potentially influence the decision making behavior that directly bears on performance and safety issues. Pilots, for example, are often called upon to complete many complex tasks that are high in mental workload, stress, and frustration, and that have significant dynamic decision making components -- often ones that involve risk as well. Author

N93-16801*# National Aeronautics and Space Administration, Washington, DC.

SUMMARY OF PRESENTATION FOR RESEARCH ON SOCIAL STRUCTURE, AGREEMENT, AND CONFLICT IN GROUPS IN EXTREME AND ISOLATED ENVIRONMENTS

In its Biomedical Polar Research Workshop Minutes 1 p 11
 Oct. 1990

Avail: CASI HC A01/MF A02

Despite a vast amount of research, little is known concerning the effect of group structure, and individuals' understanding of that structure, on conflict in Antarctic groups. The overall objective of the research discussed is to determine the interrelationships of group structure, social cognition, and group function and conflict in isolated and extreme environments. In the two decades following WWII, a large body of research focused on the physiological, psychological, and social psychological factors affecting the functioning of individuals and groups in a variety of extreme and isolated environments in both the Arctic and Antarctic. There are two primary reasons for further research of this type. First, Antarctic polar stations are considered to be natural laboratories for the social and behavioral sciences and provide an opportunity to address certain theoretical and empirical questions concerned with agreement and conflict in social groups in general and group behavior in extreme, isolated environments in particular. Recent advances in the analysis of social networks and intracultural variation have improved the methods and have shifted the theoretical questions. The research is motivated by three classes of questions: (1) What are the characteristics of the social relations among individuals working and living together in extreme and isolated environments?; (2) What do individuals understand about their group, how does that understanding develop, and how is it socially distributed?; and (3) What is the relationship between that understanding and the functioning of the social group? Answers to these questions are important if we are to advance our knowledge of how individuals and groups adapt to extreme environments. Second, although Antarctic winter-over candidates may be evaluated as qualified on the basis of individual

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characteristics, they may fail to adapt because of certain characteristics of the social group. Consequently, the ability of winter-over-groups to adapt to these extreme conditions has varied dramatically from year to year. In the past, differences in personality, background, and social status have led to conflicts between individuals or cliques precipitating, in turn, an overall decline in morale, failure to accomplish work tasks, and increases in insomnia, depression, anxiety, and alcohol abuse. A better understanding of the role of group structure and social cognition in processes of group adaptation and conflict in Antarctica would contribute towards the revision of existing screening methods, potentially leading to a reduction of group conflict and improved performance of scientific research and support activities. An improved screening protocol for the Antarctic would also have applications for other isolated environments such as scientific outposts and the proposed NASA space station. In sum, this research will (1) contribute significantly to our theoretical understanding of the role of social structure and cognition in the functioning of groups in isolation; (2) complement current work on health and adaptation in polar environments; and (3) provide for models of the formation of group structure that will aid in the development of improved procedures for assembling groups for the Antarctic and other isolated environments (e.g., space stations). Author

N93-16808* Anacapa Sciences, Inc., Santa Barbara, CA.
LONG-DURATION ISOLATION AND CONFINEMENT: HUMAN FACTORS ISSUES AND RESEARCH REQUIREMENTS
JACK STUSTER /n NASA. Headquarters, Biomedical Polar Research Workshop Minutes 22 p 11 Oct. 1990
Avail: CASI HC A01/MF A02

Viewgraphs for a presentation on habitability issues and requirements of long-term isolation and confinement are provided. Analogous situations were scored, design implications were listed, and research requirements that could be satisfied by behavioral studies conducted in the Antarctic are itemized, as well as habitat projects already designed. J.P.S.

N93-17026# Rome Univ. (Italy). Dipt. di Fisica.
CONSTRAINTS ON LEARNING IN DYNAMIC SYNAPSES
DANIEL J. AMIT (Istituto Nazionale di Fisica Nucleare, Rome, Italy) and STAFANO FUSI (Istituto Nazionale di Fisica Nucleare, Rome, Italy)
2 Jun. 1992 24 p
(PREPRINT-890; ETN-93-92990) Avail: CASI HC A03/MF A01

Hebbian type learning is discussed. A network whose synapses are analog, dynamic variables, whose values have to be periodically refreshed due to possible exponential decay, or other instability of continuous synaptic efficacies, is considered. It is shown that the end product of learning in such networks is very sensitive to the relation between the rate of presentation of patterns and the size of the refresh time interval. It is shown that in the limit of slow presentation, the network can learn at most $O(\ln N)$ patterns in N neurons, and must learn each one in one shot, thus learning all errors present in a corrupt stimulus presented for retrieval. The analysis shows that as the rate of presentation is increased, the performance is increased rapidly. The refresh mechanism acting stochastically is investigated. The network and the three learning models are defined. It is shown that the capacity of the network can be expressed in terms of a single parameter: the fraction of the synapses which retain a dependence on every pattern in the sequence of learned patterns. The storage capacities for all learning scenarios are analyzed. The expressions for the relevant fractions are derived. The results are supported by simulations. ESA

N93-17310* Alabama Univ., Huntsville. Dept. of Industrial Engineering.
DEVELOPMENT OF A PROTOTYPE INTERACTIVE LEARNING SYSTEM USING MULTI-MEDIA TECHNOLOGY FOR MISSION INDEPENDENT TRAINING PROGRAM
JACK E. MATSON /n Alabama Univ., 1992 NASA/ASEE Summer Faculty Fellowship Program 6 p Dec. 1992
Avail: CASI HC A02/MF A03

The Spacelab Mission Independent Training Program provides an overview of payload operations. Most of the training material

is currently presented in workbook form with some lecture sessions to supplement selected topics. The goal of this project was to develop a prototype interactive learning system for one of the Mission Independent Training topics to demonstrate how the learning process can be improved by incorporating multi-media technology into an interactive system. This report documents the development process and some of the problems encountered during the analysis, design, and production phases of this system. Author

N93-17684# Dayton Univ., OH.
AUTOMATIC INFORMATION PROCESSING AND HIGH PERFORMANCE SKILLS: INDIVIDUAL DIFFERENCES AND MECHANISMS OF PERFORMANCE IMPROVEMENT IN SEARCH-DETECTION AND COMPLEX TASKS Interim Technical Report, Nov. 1990 - Dec. 1991
ARTHUR D. FISK, KEVIN A. HODGE, WENDY A. ROGERS, MARK D. LEE, and CHRISTOPHER K. HERTZOG Sep. 1992 384 p
Prepared in cooperation with Georgia Inst. of Tech., Atlanta, GA (Contract F33615-88-C-0015)
(AD-A257711; AL-TP-1992-0048) Avail: CASI HC A17/MF A03

This document summarizes Phase 3 of the basic research effort investigating automatic processing theory and high-performance skills training. Research issues such as skill acquisition, skill retention, and part-task training are explored. The studies were conducted to examine: individual differences in performance improvement in memory, visual, and hybrid memory/visual search; effects of varying degrees of inconsistency on skilled visual search; development of optimal search strategies; and part-task training effects in learning and retaining complex task performance. The results of this work suggest further investigation of the principles for the application of automatic processing theory to training complex skills. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A93-18347
EVALUATION OF THE EFFICIENCY OF THE PILOT'S CONTROL ACTIVITY IN A FLIGHT SIMULATOR [OTSENKA EFEKTIVOSTI UPRAVLIAIUSHCHEI DEIATEL'NOSTI PILOTA NA TRENAZHERE VOZDUSHNOGO SUDNA]
N. I. VLADIMIROV (Rizhskii Inst. Inzhenerov Grazhdanskoi Aviatsii, Riga, Latvia) and M. A. ZHUKOVSKII /n Improvement of aircraft maintenance methods Riga Rizhskii Institut Inzhenerov Grazhdanskoi Aviatsii 1990 p. 105-118. In Russian. refs
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A characteristic which can be used as an indicator of the efficiency of the pilot's control activity is proposed. The efficiency indicator allows for the quality of piloting and for the stress level of the pilot. A method for normalizing the efficiency indicator is examined. V.L.

A93-18409
K.E. TSIOLKOVSKY ON THE ROLE OF THE HUMAN FACTOR IN THE PROBLEM OF SPACE FLIGHT SAFETY [K.E. TSIOLKOVSKII O ROLI CHELOVECHESKOGO FAKTORA V PROBLEME BEZOPASNOSTI KOSMICHESKIKH POLETOV]
V. I. KOPANEV /n K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 20-23. In Russian. refs
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Tsiolkovsky in his book 'Outside Earth' emphasized the

importance of selecting the future crewmembers of spaceships and the first inhabitants of space-based colonies not only according to high standards of physical fitness but also according to the presence or the absence of certain psychological characteristics and social traits and skills. It is noted that these special requirements are all retained in the presently set criteria of spacecrew selection. Moreover, the methods suggested by Tsiolkovsky for the preparation and the protection of spacecrews against the hazards of exposure to space are all being used by modern space explorers, including special physical training; the use of insulation against extreme temperatures, of liquid immersion to counteract acceleration forces, and of oxygen vessels and pressure suits for exploring asteroids and solar planets; tethered EVA activity; and details related to food and water ingestion and to bathing in space. I.S.

A93-18418

EFFECTS OF POSSIBLE POLLUTION SOURCES OF THE ATMOSPHERE OF A CLOSED ECOSYSTEM ON THE GROWTH OF TEST MICROORGANISMS [VLIANIE VOZMOZHNYKH ISTOCHNIKOV ZAGRIAZNENIYA ATMOSFERY ZAMKNUTOI EKOSISTEMY NA ROST TEST-MIKROORGANIZMOV]

L. S. TIRANEN, G. T. TITOVA, and M. P. SHILENKO /in K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions Moscow AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki 1991 p. 80-83. In Russian. refs
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Results are presented on the effects of several possible sources of volatile pollutants that may occur in the atmosphere of a closed ecosystem on the growth of species belonging to the *Arthrobacter*, *Bacillus*, *Brevibacterium*, *Corynebacterium*, *Enterobacter*, *Erwinia*, *Flavobacter*, *Micrococcus*, *Mycobacterium*, *Nocardia*, and *Pseudomonas* genera. It was found that the most effective inhibitors of bacterial growth in closed systems were gases emitted during the baking of bread. Ozone and ethylene were found to strongly inhibit bacteria as well as plant growth. I.S.

A93-18530

METHODOLOGY FOR ERGONOMIC TESTS OF THE INFORMATION DISPLAY ON MONITOR INDICATORS [METODYKA BADAN ERGONOMICZNYCH ZOBRAZOWAN INFORMACJI NA WSKAZNIKACH MONITOROWYCH]

EWA BIEZANOWSKA-TUSIEWICZ (Inst. Lotnictwa, Warsaw, Poland) Instytut Lotnictwa, Prace (ISSN 0509-6669) no. 129-130 1992 p. 13-27. In Polish. refs

Three basic methods for ergonomic test were presented, used for evaluation of the presentation of information sent in a technical system, and transmitted to the operator as indications on instruments. Exemplary tests of subjective evaluation and a test of the accuracy of the performance of a piloting-navigation task were presented. Tests were performed on a laboratory stand developed and constructed in the Aviation Institute. Also secondary task tests (STT) were proposed together with measurements of eye fixation. Usability of the laboratory stand for simulation tests was proved. Author

A93-18531

ERGONOMIC ASPECTS OF THE PRESENTATION OF PILOTING-NAVIGATION INFORMATION [ERGONOMICZNE ASPEKTY PREZENTACJI INFORMACJI PILOTAZOWO-NAWIGACYJNEJ]

EWA BIEZANOWSKA-TUSIEWICZ (Inst. Lotnictwa, Warsaw, Poland) Instytut Lotnictwa, Prace (ISSN 0509-6669) no. 129-130 1992 p. 28-61. In Polish. refs

In this article principles of ergonomic design of integrated piloting-navigation indicators were presented regarding their lay-out in areas of optimum vision and manipulation. Technical literature data were used, a method for tests was developed and ergonomic tests were performed of signs projected in the screen technology. On the ground of obtained results the form of an integrated vertical situation indicator VSI was proposed. Its functional tests were

performed and the designed indicator was modified according to test results. Also possibility of specialized tests was indicated on a laboratory stand designed and constructed in the Aviation Institute. Author

A93-18569* National Aeronautics and Space Administration, Langley Research Center, Hampton, VA.

TELEOPERATION TO ROBOTICS AT LANGLEY RESEARCH CENTER

JACK E. PENNINGTON (NASA, Langley Research Center, Hampton, VA) Journal of Applied Intelligence vol. 2 1992 p. 155-162. refs

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Experience of NASA Langley Research Center in teleoperation, telerobotics, and robotics in applications related to possible space tasks is reviewed. Shared control based on manual and sensor blending in a rate command control system made it possible to simultaneously control two or more manipulators executing a telerobotic task from a single hand controller. It is concluded that telerobotics combines the best features of teleoperation and robotics and is sufficiently mature for simple space tasks. Robotics is considered to be feasible but less mature and must be highly reliable. O.G.

A93-18710* National Aeronautics and Space Administration, Langley Research Center, Hampton, VA.

EVALUATION OF INERTIAL DEVICES FOR THE CONTROL OF LARGE, FLEXIBLE, SPACE-BASED TELEROBOTIC ARMS

RAYMOND C. MONTGOMERY, SEAN KENNY (NASA, Langley Research Center, Hampton, VA), DAVE GHOSH, and JORAM SHENHAR (Lockheed Engineering and Sciences Co., Hampton, VA) Mar. 1992 14 p. NASA/DOD Control/Structures Interaction Technology Conference, 5th, Lake Tahoe, NV, Mar. 3-5, 1992, Paper

Batch simulation studies which show that torque-wheels can reduce the overshoot in abrupt stop commands by 82 percent for a two-link arm are presented. For man-in-the-loop evaluation, a real-time simulator has been developed that samples a hand-controller, solves the nonlinear equations of motion, and graphically displays the resulting motion on a computer workstation. It is shown that, for a single-link arm, a reaction-mass/torque-wheel combination at the payload end can yield a settling time of 3 s for disturbances in the first flexible mode as opposed to 10 s utilizing only a hub motor. R.E.P.

A93-19090

EYE SLAVED POINTING SYSTEM FOR TELEOPERATOR CONTROL

RIKKI RAZDAN and ALAN KIELAR (ISCAN, Inc., Cambridge, MA) /in Mobile robots V; Proceedings of the Meeting, Boston, MA, Nov. 8, 9, 1990 Bellingham, WA Society of Photo-Optical Instrumentation Engineers 1991 p. 361-371. refs
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An electrooptic system to automatically compute the eye position of a teleoperator and feedback onto the video display a reticle slaved to his eye movements is described. The system enables an operator with minimal hand/eye coordination skills to designate targets within PRV imagery. The eye slaved pointing system has been linked with an autotracking system to demonstrate autotracker control via eye movements. O.G.

A93-19104

OPERATOR/SYSTEM COMMUNICATION - AN OPTIMIZING DECISION TOOL

TAREK M. SOBH and TAREK ALAMELDIN (Pennsylvania Univ., Philadelphia) /in Mobile robots V; Proceedings of the Meeting, Boston, MA, Nov. 8, 9, 1990 Bellingham, WA Society of Photo-Optical Instrumentation Engineers 1991 p. 524-535. refs

Copyright

In this paper we address the problem of operator/system communication. In particular, we discuss the issue of efficient and adaptive transmission mechanisms over possible physical links.

We develop a tool for making decisions regarding the flow of control sequences and data from and to the operator. The issue of compression is discussed in details, a decision box and an optimizing tool for finding the appropriate thresholds for a decision are developed. Physical parameters like the data rate, bandwidth of the communication medium, distance between the operator and the system, baud rate, levels of discretization signal to noise ratio and propagation speed of the signal are taken into consideration while developing our decision system. Theoretical analysis is performed to develop mathematical models for the optimization algorithm. Simulation models are also developed for testing both the optimization and the decision tool box. Author

A93-19256

IN SEARCH OF THE HUMAN TOUCH

IVAN AMATO Science (ISSN 0036-8075) vol. 258, no. 5087 Nov. 27, 1992 p. 1436, 1437. Copyright

Engineers trying to design sensitive robotic hands that can explore and deftly manipulate objects consider lessons of neurophysiology and biology. Mechanical engineers are devising new research tools for neuroscientists that will be capable of simulating thousands of textures, an ability central to probing the patterns of neural activity underlying tactile sensing. It is pointed out that deeper insight into how the human hands work and how robots can imitate it will make it possible to create limb prostheses whose built-in sensors could convey tactual information through the intact sensory nerves in the stump of an amputee. O.G.

A93-19984

GRAPHICAL DISPLAYS - IMPLICATIONS FOR DIVIDED ATTENTION, FOCUSED ATTENTION, AND PROBLEM SOLVING

KEVIN B. BENNETT and JOHN M. FLACH (Wright State Univ., Dayton, OH) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 513-533. Research supported by Wright State Univ. refs (Contract AF-AFOSR-91-0150) Copyright

When completing tasks in complex, dynamic domains observers must consider the relationships among many variables (e.g., integrated tasks) as well as the values of individual variables (e.g., focused tasks). A critical issue in display design is whether or not a single display format can achieve the dual design goals of supporting performance at both types of tasks. We consider this issue from a variety of perspectives. One relevant perspective is the basic research on attention and object perception, which concentrates on the interaction between visual features and processing capabilities. The principles of configurability are discussed, with the conclusion that they support the possibility of achieving the dual design goals. These considerations are necessary but not sufficient for effective display design. Graphic displays map information from a domain into visual features; the tasks to be completed are defined in terms of the domain, not in terms of the visual features alone. The implications of this subtle but extremely important difference are discussed. The laboratory research investigating alternative display formats is reviewed. Much like the attention literature, the results do not rule out the possibility that the dual design goals can be achieved. Author

A93-19985

CHOOSING SPECIFIERS - AN EVALUATION OF THE BASIC TASKS MODEL OF GRAPHICAL PERCEPTION

C. M. CARSWELL (Kentucky Univ., Lexington) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 535-554. Research supported by Univ. of Kentucky refs Copyright

Effect sizes obtained from 39 experiments were used to evaluate the predictions of the basic tasks model of graphical efficacy. This model predicts that performance will be attenuated with graphical displays as a function of the particular specifier, or visual dimension, used to code data values. In this review the basic tasks model predicted performance more accurately than

did Tufte's data-ink principle. In addition, variability in effect sizes across studies revealed that the model was more successful at predicting performance in local (focusing) tasks than in global information synthesis tasks. Furthermore, the model was better at predicting performance in tasks requiring the use of physically present rather than remembered graphs. Further differences in effect sizes resulted from variability in the exact specifiers used in experimental graphs. Minimal differences were obtained among graphs that used position, length, or angle as specifiers. However, graphs that used area or volume to represent quantitative values were associated with consistently worse performance than found with other formats. Author

A93-19986* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DISTANCE AND ORGANIZATION IN MULTIFUNCTION DISPLAYS

KAREN S. SEIDLER and CHRISTOPHER D. WICKENS (Illinois Univ., Savoy) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 555-569. refs (Contract NCC2-632) Copyright

One approach to organizing information in a multifunction display (MFD) is to place related screens of information closer to each other. This study identified three metrics that could be used to operationalize the concept of distance in an MFD. The proposed distance metrics - navigational (the number of choice points lying between two screens), organizational (the hierarchical structure of the data base), and cognitive (the user's perception of relationships among screens) - were empirically examined by using a simulated, hierarchically arranged, menu-driven MFD in an aviation context. Subjects engaged in two tasks that required them to access different target screens from various starting screens in a 290-screen MFD. The tasks differed in the navigational mechanisms subjects were allowed to use to navigate around the MFD and the relationships between the starting and target screens. The results suggest that the three distance metrics are meaningful within the context of a multifunction display. Author

A93-19987* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

USING THE STEREOKINETIC EFFECT TO CONVEY DEPTH - COMPUTATIONALLY EFFICIENT DEPTH-FROM-MOTION DISPLAYS

MARY K. KAISER (NASA, Ames Research Center, Moffett Field, CA) and DENNIS R. PROFFITT (Virginia Univ., Charlottesville) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 571-581. refs (Contract NCA2-468) Copyright

Recent developments in microelectronics have encouraged the use of 3D data bases to create compelling volumetric renderings of graphical objects. However, even with the computational capabilities of current-generation graphical systems, real-time displays of such objects are difficult, particularly when dynamic spatial transformations are involved. In this paper we discuss a type of visual stimulus (the stereokinetic effect display) that is computationally far less complex than a true three-dimensional transformation but yields an equally compelling depth impression, often perceptually indiscriminable from the true spatial transformation. Several possible applications for this technique are discussed (e.g., animating contour maps and air traffic control displays so as to evoke accurate depth percepts). Author

A93-19988

SPATIAL JUDGMENTS WITH MONOSCOPIC AND STEREO SCOPIC PRESENTATION OF PERSPECTIVE DISPLAYS

YEI-YU YEY (Wisconsin Univ., Madison) and LOUIS D. SILVERSTEIN (VCD Sciences, Inc., Scottsdale, AZ) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 583-600. refs Copyright

Spatial judgments with monoscopic and stereoscopic presentation of perspective displays were investigated in the present study. The stimulus configuration emulated a visual scene consisting of a volume of airspace above a ground reference plane. Two target symbols were situated at various positions in the space, and observers were instructed to identify the relative depth or altitude of the two symbols. Three viewing orientations (15, 45, or 90 deg elevation angle) were implemented in the perspective projection. In the monoscopic view, depth cues in size, brightness, occlusion, and linear perspective were provided in the format. In the stereoscopic view, binocular disparity was added along the line of sight from the center of projection to reinforce the relative depth in the visual scene. Results revealed that spatial judgments were affected by manipulation of the relative spatial positions of the two target symbols and by the interaction between relative position and viewing orientation. The addition of binocular disparity improved judgments of three-dimensional spatial relationships, and the enhancement was greater when monocular depth cues were less effective and/or ambiguous in recovering the three-dimensional spatial characteristics. Author

A93-19989
CHROMATICITY AND LUMINANCE AS CODING DIMENSIONS IN VISUAL SEARCH

ALLEN L. NAGY and ROBERT R. SANCHEZ (Wright State Univ., Dayton, OH) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 601-614. refs
 (Contract NIH-NEI-R01-EY07046)
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Visual search times were measured as a function of chromaticity and luminance differences between a target and distractor stimuli. Results showed that mean search time increased linearly with the number of distractors if the luminance difference between target and distractors was small but was roughly constant if the luminance difference was large. Similar results were previously found for chromaticity differences. With the number of distractor stimuli held constant, the mean search time decreased with increases in the difference between target and distractors, up to some critical difference. Further increases in target-distractor difference had little effect. Results were similar for targets defined by luminance and chromaticity. There was some advantage to combining luminance differences with chromaticity differences when the target was dimmer than the distractors. Generally there was no advantage for combining a chromaticity difference with a luminance difference when the target was brighter than the distractors. Author

A93-19990
VISIBILITY OF TRANSMISSIVE LIQUID CRYSTAL DISPLAYS UNDER DYNAMIC LIGHTING CONDITIONS

JOHN H. KRANTZ (Hanover College, IN), LOUIS D. SILVERSTEIN (VCD Sciences, Inc., Scottsdale, AZ), and YEI-YU YEH (Wisconsin Univ., Madison) Human Factors (ISSN 0018-7208) vol. 34, no. 5 Oct. 1992 p. 615-632. Research supported by Honeywell, Inc refs
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Liquid crystal displays maintain superior contrast under bright sunlight conditions compared with cathode-ray tube displays. This attribute, along with reduced weight, volume, and power requirements, make liquid crystal displays especially desirable for use in vehicular applications. The present experiment was designed to determine the luminance requirements for transmissive liquid crystal displays viewed under a wide range of lighting conditions typical of many vehicular environments. Both the ambient illumination incident on the display surface and the forward-field-of-view adaptation luminance were parametrically manipulated. The visual task involved speeded spatial discrimination responses for detection of the gap in a modified Landolt-C acuity target. The results indicate that under the worst lighting conditions tested, a display luminance of approximately 180 cd/sq m yielded asymptotic spatial discrimination performance. The results have been incorporated into a predictive visual performance model for spatial discrimination tasks, which describes

the present data well and represents a first step toward a device-independent model of display visibility. Author

A93-19998
A PHYSIOLOGICAL SIGNAL ACQUISITION AND PROCESSING SYSTEM FOR BED-REST LABORATORY

HUA-MING HUANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 212-219. In Chinese. refs

A physiological signal acquisition and processing system for a bed-rest laboratory was developed to meet the requirements of monitoring the physiological indices of every subject continuously, recording a large quantity of original data, and processing them in time for relevant information during experiments. It is a large computer application system with which the physiological status of eight subjects can be monitored simultaneously and their data processed in time. For each subject nine signals are measured: six ECG/EEGs, one respiration, and two body surface temperatures. The monitored indices are heart rate, temperature, and respiratory rate. Analysis items include extraction of signal features, power spectrum correlation function, coherence function, and various trend diagrams, histograms, and spectrum array graphs. Specifications of the physiological amplifiers developed for this system are given. P.D.

A93-19999
A FOUR-POLE ELECTRIC SWING AND ITS APPLICATION TO THE RESEARCH ON VESTIBULAR FUNCTION

YU-CHUN CHEN (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine and Medical Engineering (ISSN 1002-0837) vol. 5, no. 3 1992 p. 220-225. In Chinese. refs

The study presents the differential equation of swing of a four-pole electric swing (FPES), the calculation method of the linear acceleration of the gondola, the gondola and control system design, and the operational principle of the swing and the rotating chair. The physiological signals from subjects are transmitted to measuring and recording instruments through a 25-head-slip-ring system. The incidence of motion sickness in humans, dogs, and cats on an FPES of 6-m length were 30, 20, and 12.5 percent, respectively. After bilateral canals were plugged in cats, no significant changes in dynamic characteristics were found. Similar response patterns of the H-wave of the vestibulo-spinal reflex appeared during experiments using FPES, but significant changes were demonstrated after the destruction of bilateral otolith organs. It is concluded that sinusoidally alternating linear acceleration was satisfactorily produced by this FPES. P.D.

A93-20015
BIOMEDICAL ENGINEERING AND SPACE [LE GENIE BIOLOGIQUE ET MEDICAL ET L'ESPACE]

LAURENT BRAAK (Inst. de Medecine et de Physiologie Spatiales, Toulouse, France) and LEANDRE POURCELOT (Inst. National de la Sante et de la Recherche Medicale, Tours, France) L'Onde Electrique (ISSN 0030-2430) vol. 72, no. 6 Nov.-Dec. 1992 p. 104-110. In French. refs
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It is pointed out that space missions provide a unique opportunity to investigate the effect of gravity on physiological systems; this knowledge is mandatory for controlling the medical risks of space flights. Biomedical devices used in microgravity for basic research, medical checkups, and countermeasures must meet such requirements as safety, reliability, mass and volume limits, low power consumption, and operation in the space environment. The need for developing multiuser facilities compatible with different space transportation systems is emphasized; practical examples from the French-Soviet programs Aragats and Antares are given. In addition, space-related biomedical activities induce commercial spin-offs, which are illustrated here by the Echograph program.

L.M.

A93-20700* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

COMPUTER-ASSISTED THREE-DIMENSIONAL RECONSTRUCTION AND SIMULATIONS OF VESTIBULAR MACULAR NEURAL CONNECTIVITIES

MURIEL D. ROSS, THOMAS CHIMENTO (NASA, Ames Research Center, Moffett Field, CA), DAVID DOSHAY, and REI CHENG (Sterling Software, Palo Alto, CA) New York Academy of Sciences, Annals (ISSN 0077-8923) vol. 656 May 22, 1992 p. 75-91. refs

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Results of computer-assisted research concerned with the three-dimensional reconstruction and simulations of vestibular macular neural connectivities are summarized. The discussion focuses on terminal/receptive fields, the question of synapses across the striola, endoplasmic reticulum and its potential role in macular information processing, and the inner epithelial plexus. Also included are preliminary results of computer simulations of nerve fiber collateral functioning, an essential step toward the three-dimensional simulation of a functioning macular neural network. V.L.

A93-20779

BERYLLIUM TOXICITY - AN UPDATE

MARK D. HOOVER, FRITZ A. SEILER, GREGORY L. FINCH, PATRICK J. HALEY, ARTHUR F. EIDSON, JAMES A. MEWHINNEY, DAVID E. BICE, ANTONE L. BROOKS, and ROBERT K. JONES (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM) In Space nuclear power systems 1989; Proceedings of the 6th Symposium, Albuquerque, NM, Jan. 8-12, 1989. Vol. 1 Malabar, FL Orbit Book Co., Inc. 1992 p. 285-288. Research supported by Sandia National Labs. refs

(Contract DE-AC04-76EV-01013)

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A status evaluation is presented for the prevention and treatment of the acute and chronic diseases which can result from inhalation of the dust of Be, its alloys, and its oxide. Attention is given to current concentration standards for airborne Be and lessons learned from studies of its dispersal. If all due precautions are taken, Be-based materials will remain viable in spacecraft systems; these precautions extend to the mechanisms of aerosol release fractions for both mechanical and high temperature dispersion of Be. O.C.

N93-15710# Aerospace Medical Research Labs., Brooks AFB, TX.

NIGHT VISION MANUAL FOR THE FLIGHT SURGEON

ROBERT E. MILLER, II and THOMAS J. TREDICI Aug. 1992 122 p Revised (AD-A257059; AL-SR-1992-0002) Avail: CASI HC A06/MF A02

This manual is updated and extensively revised successor to the 1985 edition. It is a definitive reference that provides current guidance for flight surgeons who can use it as a source document in providing night vision briefings, conducting NVG training sessions, discussing aeromedical limitations, and applying appropriate medical standards. It can also be used by flight surgeons in conjunction with night vision demonstration kits and other teaching aids. Author

N93-15968# Battelle Columbus Labs., OH.

HUMAN FACTORS DESIGN PRINCIPLES FOR INSTRUMENT APPROACH PROCEDURE CHARTS. VOLUME 1: READABILITY Final Report

SUSAN J. MANGOLD, DONALD ELDREDGE, and ERICK LAUBER Aug. 1992 185 p Sponsored by FAA (AD-A257234; DOTVNTSC-FAA-92-9-VOL-1; DOT/FAA/RD,XH-92/16.1-VOL-1) Avail: CASI HC A09/MF A02

This Handbook is the first of a series of handbooks which address the issue of Instrument Approach Procedure (IAP) chart improvement in design. The intent is twofold: to review relevant literature that might be applicable to improving the presentation of chart information to support effective and efficient access to

information by the user and to develop guidance information based upon this research, that can be easily accessed and implemented by the chart designer. The handbook is intended to offer the chart designer guidance information that can aid in developing charts which clearly present a meaningful visual structure. GRA

N93-16033# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

MEASUREMENT AND EVALUATION OF BLAST OVERPRESSURE DURING F-15A CREW STATION VULNERABILITY ASSESSMENT TEST Final Report, Mar. - Dec. 1991

HARALD K. HILLE Dec. 1991 71 p (Contract AF PROJ. 7231)

(AD-A257152; AL-TR-1992-0033) Avail: CASI HC A04/MF A01

From March 1991 to May 1991 blast overpressures were measured from 21 different projectiles striking a section of the F-15 fuselage to assess potential crew hazards. The velocity of the fired projectiles ranged from 1500 to 5000 ft/sec and the lowest overpressure which was recorded was 7 PSF or 145 dB and the highest level recorded was 1875 PSF or 194 dB sound pressure level (re 20 u Pa). Time histories for each recording and the sound exposure spectrum levels as a function of frequency are presented. A hearing damage risk assessment was made in the context of the Air Force hearing damage risk criteria (AFR 161-35) and laboratory data regarding the effects of high level impulses on man. GRA

N93-16048# Human Engineering Labs., Aberdeen Proving Ground, MD.

GLOVED OPERATOR PERFORMANCE STUDY Final Report

JAN BERKHOUT, GLEN ANDERSON, MICHELLE MCCLEEREY, and MICHAEL GRANAAS Sep. 1992 141 p (Contract DA PROJ. 1L1-62716-AH-70)

(AD-A256894; HEL-TM-7-92) Avail: CASI HC A07/MF A02

This study is to determine whether greater minimum spacing is required between push buttons for gloved operation than for bare-handed operation. Seventy-two undergraduate students served as subjects in groups of 12, one group for each of the six hand-wear conditions. The six hand-wear conditions consisted of one bare-handed group and five glove groups. Each of these five groups were one of the following glove types: a butyl and cotton glove assembly, a butyl and nomex glove assembly, a leather and wool glove assembly, a fire-fighting glove, or a thin vinyl glove. Subjects performed two button-pushing tasks. One task was self paced, allowing subjects to determine response times. The other task was machine paced, allowing subjects decreasing amounts of time to respond. Subjects performed these tasks on three different panels containing nine buttons each. The three panels varied by spacing between the buttons. One panel contained buttons 13 mm apart, another 19 mm apart, and another 25 mm apart. Results from the self-paced task indicate that subjects responded faster on the 13-mm and 19-mm panels than on the 25-mm panel. This suggests that the 13-mm spacing is adequate for speed of operation for gloved operators. Error data and machine-paced time data neither support nor contradict this result. Results also indicate that subjects with larger hands tend to score faster times with more errors in the machine-paced task. This effect does not seem to be because of gender differences. GRA

N93-16258# Defense Technical Information Center, San Diego, CA. MATRIS Office.

DIRECTORY OF DESIGN SUPPORT METHODS

Sep. 1992 162 p (AD-A256987) Avail: CASI HC A08/MF A02

This Directory of Design Support Methods is the product of the Designing for the User Subgroup of the Department of Defense Human Factors Engineering-Technical Group. An annotated directory is provided of human factors design support tools and techniques that have been developed by the DoD, NASA, and industry members of the technical group. The Directory contains human factors databases, handbooks, data guides, texts, journals,

military standards, prototype and interface design tools, analytic techniques, and computer simulation software. The Directory describes the methods to be used and their purpose, products, and availability. It serves as a resource in applying human factors for anyone who is designing a system or evaluating the design of one. The format for each entry offers the name of the method, the sponsor, a point of contact, and a full description including general overview, appropriate uses, input requirements, processing procedures, output products, and uses. GRA

N93-16699*# Massachusetts Univ., Amherst. Dept. of Exercise Science and Industrial Engineering and Operations Research.

**ADAPTATION TO TRANSIENT POSTURAL PERTURBATIONS
Final Report**

ROBERT O. ANDRES Oct. 1992 55 p Prepared in cooperation with Ergonomic Engineering Associates, Pelham, MA (Contract NAG9-291) (NASA-CR-190959; NAS 1.26:190959) Avail: CASI HC A04/MF A01

This research was first proposed in May, 1986, to focus on some of the problems encountered in the analysis of postural responses gathered from crewmembers. The ultimate driving force behind this line of research was the desire to treat, predict, or explain 'Space Adaptation Syndrome' (SAS) and hence circumvent any adverse effects of space motion sickness on crewmember performance. The aim of this project was to develop an easily implemented analysis of the transient responses to platform translation that can be elicited with a protocol designed to force sensorimotor reorganization, utilizing statistically reliable criterion measures. This report will present: (1) a summary of the activity that took place in each of the three funded years of the project; (2) discussion of experimental results and their implications for future research; and (3) a list of presentations and publications resulting from this project. Author

N93-16840*# Tuskegee Inst., AL. Center for Food Production, Processing and Waste Management in CELSS.

ANNUAL REPORT

Dec. 1992 151 p Original contains color illustrations (Contract NAGW-2940) (NASA-CR-191389; NAS 1.26:191389) Avail: CASI HC A08/MF A02; 23 functional color pages

The overall goal of the Tuskegee University Center for Food Production, Processing and Waste Management in Controlled Ecological Life Support Systems (CELSS) is to provide tested information and technologies applicable to bioregenerative food production systems for life support on long-term manned space mission. Specifically, the center is developing information, computer simulated models, methodologies and technology for sweetpotato and peanut biomass production and processing, inclusive of waste management and recycling of these crops selected by NASA for CELSS. The Center is organized into interdisciplinary teams of life scientists and engineers that work together on specific objectives and long-term goals. Integral to the goal of the Center is the development of both basic and applied research information and the training of young scientists and engineers, especially underrepresented minorities that will increase the professional pool in these disciplines and contribute to the advancement of space sciences and exploration. Author

N93-16862*# Hawaii Univ., Honolulu.

**SPACE MIGRATIONS: ANTHROPOLOGY AND THE
HUMANIZATION OF SPACE**

BEN R. FINNEY /In NASA. Johnson Space Center, Space Resources. Volume 4: Social Concerns p 164-188 1992 Repr. from Acta Astronautica, v. 15, 1987 p 189-194 Avail: CASI HC A03/MF A03; SOD HC; 4 functional color pages

Because of its broad evolutionary perspective and its focus on both technology and culture, anthropology offers a unique view of why we are going into space and what leaving Earth will mean for humanity. In addition, anthropology could help in the humanization of space through (1) overcoming socioculture barriers to working and living in space, (2) designing societies appropriate

for permanent space settlement, (3) promoting understanding among differentiated branches of humankind scattered through space, (4) deciphering the cultural systems of any extraterrestrial civilizations contacted. Author

N93-16865*# California Univ., Los Angeles.

**APPLICATIONS OF LIVING SYSTEMS THEORY TO LIFE IN
SPACE**

JAMES GRIER MILLER /In NASA. Johnson Space Center, Space Resources. Volume 4: Social Concerns p 231-259 1992 Presented at the NASA-NSF Conference on the Human Experience in Antarctica: Applications to Life in Space, Sunnyvale, CA, 17 Aug. 1987

Avail: CASI HC A03/MF A03; SOD HC; 4 functional color pages

The conceptual system and methodology of living systems theory appear to be of value to research on life in isolated environments. A space station, which must provide suitable conditions for human life in a stressful environment that meets none of the basic needs of life, is an extreme example of such isolation. A space station would include living systems at levels of individual human beings, groups of people engaged in a variety of activities, and the entire space crew as an organization. It could also carry living systems of other species, such as other animals and plants. Using the subsystem analysis of living systems theory, planners of a station, either in space or on a celestial body, would make sure that all the requirements for survival at all these levels had been considered. Attention would be given not only to the necessary matter and energy, but also the essential information flows that integrate and control living systems. Many variables for each subsystem could be monitored and kept in steady states. Use of living systems process analysis of the five flows of matter energy and information would assure that all members of the crew received what they needed. Author

N93-16866*# State Univ. of North Texas, Denton.

**LIFE SUPPORT AND SELF-SUFFICIENCY IN SPACE
COMMUNITIES**

KARL R. JOHANSSON /In NASA. Johnson Space Center, Space Resources. Volume 4: Social Concerns p 260-271 1992 Avail: CASI HC A03/MF A03; SOD HC; 4 functional color pages

The development of a controlled ecological life support system (CELSS) is necessary to enable the extended presence of humans in space, as on the Moon or on another planetary body. Over a long period, the provision of oxygen, water, and food, and protection from such inimical agents as radiation and temperature extremes, while maintaining the psychological health of the subjects, becomes prohibitively expensive if all supplies must be brought from Earth. Thus, some kind of a regenerative life support system within an enclosure or habitat must be established, thereby cutting the umbilicus to Mother Earth, but not irreversibly. This protective enclosure will enable the survival and growth of an assemblage of terrestrial species of microorganisms, plants, and animals. It is envisioned that the nonterrestrial ecosystem will evolve through the sequential introduction of terrestrial and local materials, together with the appropriate living forms. Author

N93-16867*# Washington Univ., Saint Louis, MO.

HUMAN SAFETY IN THE LUNAR ENVIRONMENT

ROBERT H. LEWIS /In NASA. Johnson Space Center, Space Resources. Volume 4: Social Concerns p 272-294 1992 Original contains color illustrations

Avail: CASI HC A03/MF A03; SOD HC; 4 functional color pages

Any attempt to establish a continuously staffed base or permanent settlement on the Moon must safely meet the challenges posed by the Moon's surface environment. This environment is drastically different from the Earth's, and radiation and meteoroids are significant hazards to human safety. These dangers may be mitigated through the use of underground habitats, the piling up of lunar materials as shielding, and the use of teleoperated devices for surface operations. The lunar environment is detailed along with concepts for survival. E.R.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

N93-17042*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

WHEELS FOR WHEELCHAIRS AND THE LIKE Patent Application

BRUCE WEDDENDORF, inventor (to NASA) and JEFFREY FINCKENOR, inventor (to NASA) 2 Nov. 1992 16 p (NASA-CASE-MFS-28632-1; NAS 1.71:MFS-28632-1; US-PATENT-APPL-SN-970204) Avail: CASI HC A03/MF A01

A wheel is provided herein for vehicles using spoked wheels. Small obstacles, steps, and curbs present serious impediments to wheelchair and bicycle travelers. Yet until recently wheels for these vehicles have remained unchanged. These rigid type vehicles have the disadvantage of transmitting to their users shocks and vibrations generated by traversing over obstacles or rough terrain, creating an uncomfortable ride. The wheel herein responds to loads or shocks while overcoming the difficulties of prior art wheels. The wheel is of the type having a circular rim with the hub at its center, and spokes connected between the hub and the rim. A wheel is provided in which not only the spokes are unique, but the rim as well. NASA

N93-17045*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

PORTABLE SEAT LIFT Patent Application

BRUCE WEDDENDORF, inventor (to NASA) 2 Nov. 1992 12 p (NASA-CASE-MFS-28610-1; NAS 1.71:MFS-28610-1; US-PATENT-APPL-SN-970203) Avail: CASI HC A03/MF A01

A portable seat lift that can help individuals either (1) lower themselves to a sitting position or (2) raise themselves to a standing position is presented. The portable seat lift consists of a seat mounted on a base with two levers, which are powered by a drive unit. NASA

N93-17087*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CONTROL SYSTEM AND METHOD FOR PROSTHETIC DEVICES Patent Application

RICHARD J. BOZEMAN, JR., inventor (to NASA) 31 Aug. 1992 23 p (NASA-CASE-MS-C-21941-1; NAS 1.71:MSC-21941-1; US-PATENT-APPL-SN-937325) Avail: CASI HC A03/MF A01

A control system and method for prosthetic devices is provided. The control system comprises a transducer for receiving movement from a body part for generating a sensing signal associated with that movement. The sensing signal is processed by a linearizer for linearizing the sensing signal to be a linear function of the magnitude of the distance moved by the body part. The linearized sensing signal is normalized to be a function of the entire range of body part movement from the no-shrug position of the movable body part through the full-shrug position of the movable body part. The normalized signal is divided into a plurality of discrete command signals. The discrete command signals are used by typical converter devices which are in operational association with the prosthetic device. The converter device uses the discrete command signals for driving the movable portions of the prosthetic device and its sub-prosthesis. The method for controlling a prosthetic device associated with the present invention comprises the steps of receiving the movement from the body part, generating a sensing signal in association with the movement of the body part, linearizing the sensing signal to be a linear function of the magnitude of the distance moved by the body part, normalizing the linear signal to be a function of the entire range of the body part movement, dividing the normalized signal into a plurality of discrete command signals, and implementing the plurality of discrete command signals for driving the respective movable prosthesis device and its sub-prosthesis. NASA

N93-17088*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

PROTECTIVE HELMET ASSEMBLY Patent Application

FREDERIC S. DAWN, inventor (to NASA), FRED R. WEISS, inventor (to NASA), and JOHN D. ECK, inventor (to NASA) 4

Nov. 1992 12 p

(NASA-CASE-MS-C-21842-1; NAS 1.71:MSC-21842-1; US-PATENT-APPL-SN-971116) Avail: CASI HC A03/MF A01

The invention is a protective helmet assembly with improved safety and impact resistance, high resistance to ignition and combustion, and reduced offgassing. The assembly comprises a hard rigid ballistic outer shell with one or more impact absorbing pads fitted to the interior surface. The pads are made of open cell flexible polyimide foam material, each of which is attached to the inner surface of the ballistic outer shell by cooperative VELCRO fastener strips of hook-and-loop material affixed respectively to the rigid outer shell and the impact absorbing pads. The helmet assembly with shell and pads is sized to fit relatively close over a wearer's head. NASA

N93-17442*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

INFLATABLE HABITATION FOR THE LUNAR BASE

M. ROBERTS *In its* The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 249-253 Sep. 1992

Avail: CASI HC A01/MF A03

Inflatable structures have a number of advantages over rigid modules in providing habitation at a lunar base. Some of these advantages are packaging efficiency, convenience of expansion, flexibility, and psychological benefit to the inhabitants. The relatively small, rigid cylinders fitted to the payload compartment of a launch vehicle are not as efficient volumetrically as a collapsible structure that fits into the same space when packaged, but when deployed is much larger. Pressurized volume is a valuable resource. By providing that resource efficiently, in large units, labor intensive external expansion (such as adding additional modules to the existing base) can be minimized. The expansive interior in an inflatable would facilitate rearrangement of the interior to suite the evolving needs of the base. This large, continuous volume would also relieve claustrophobia, enhancing habitability and improving morale. The purpose of this paper is to explore some of the aspects of inflatable habitat design, including structural, architectural, and environmental considerations. As a specific case, the conceptual design of an inflatable lunar habitat, developed for the Lunar Base Systems Study at the Johnson Space Center, is described. Author

N93-17443*# Reynolds (K. H.), McLean, VA. PRELIMINARY DESIGN STUDY OF LUNAR HOUSING CONFIGURATIONS

K. H. REYNOLDS *In* NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 255-259 Sep. 1992

Avail: CASI HC A01/MF A03

A preliminary design study assesses various configurations for habitation of the lunar surface. The study assumes an initial 4-man habitation module expandable to a 48-man concept. Through the numerous coupling combinations of identical modules, five basic configuration types are identified. A design model presents each configuration in light of certain issues. The issues include circulation, internal and external spatial characteristics, functional organizations, and future growth potential. The study discusses the attributes, potentials, and unique requirements of each configuration. Author

N93-17444*# Architectural Horizon, Makkah (Saudi Arabia).

PREFABRICATED FOLDABLE LUNAR BASE MODULAR SYSTEMS FOR HABITATS, OFFICES, AND LABORATORIES

YOUSEF HIJAZI *In* NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 261-266 Sep. 1992

Avail: CASI HC A02/MF A03

The first habitat and work station on the lunar surface undoubtedly has to be prefabricated, self-erecting, and self-contained. The building structure should be folded and compacted to the minimum size and made of materials of minimum weight. It must also be designed to provide maximum possible

habitable and usable space on the Moon. For this purpose the concept of multistory, foldable structures was further developed. The idea is to contain foldable structural units in a cylinder or in a capsule adapted for launching. Upon landing on the lunar surface, the cylinder of the first proposal in this paper will open in two hinge-connected halves while the capsule of the second proposal will expand horizontally and vertically in all directions. In both proposals, the foldable structural units will self-erect providing a multistory building with several room enclosures. The solar radiation protection is maintained through regolith-filled pneumatic structures as in the first proposal, or two regolith-filled expandable capsule shells as in the second one, which provide the shielding while being supported by the erected internal skeletal structure.

Author

N93-17445*# Construction Technology Labs., Skokie, IL.
CONCRETE LUNAR BASE INVESTIGATION

T. D. LIN, JONATHAN A. SENSENY (Citadel Coll., Charleston, SC.), LARRY D. ARP (Citadel Coll., Charleston, SC.), and CHARLES LINDBERGH (Citadel Coll., Charleston, SC.) /n NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 267-274 Sep. 1992
Previously announced in IAA as A89-34371 Sponsored by NASA. Johnson Space Center, Prestressed Concrete Inst., Chicago Univ., and Lockheed EMSCO
Avail: CASI HC A02/MF A03

This paper presents results of structural analyses and a preliminary design of a precast, prestressed concrete lunar base subjected to 1-atm internal pressure. The proposed infrastructure measures 120 ft in diameter and 72 ft in height, providing 33,000 sq ft of work area for scientific and industrial operations. Three loading conditions were considered in the design (1) during construction, (2) under pressurization, and (3) during an air-leak scenario. A floating foundation, capable of rigid body rotation and translation as the lunar soil beneath it yields, was developed to support the infrastructure and to ensure the airtightness of the system. Results reveal that it is feasible to use precast, prestressed concrete for construction of large lunar bases on the Moon.

Author

N93-17446*# Future Systems Consultants, Los Angeles, CA.
VERTICAL REGOLITH SHIELD WALL CONSTRUCTION FOR LUNAR BASE APPLICATIONS

JAN KAPLICKY, DAVID NIXON, and JANE WERNICK (Arup, Ove and Partners, Los Angeles, CA) /n NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 275-279 Sep. 1992
Avail: CASI HC A01/MF A03

Lunar bases located on the lunar surface will require permanent protection from radiation and launch ejecta. This paper outlines a method of providing physical protection using lunar regolith that is constructed in situ as a modular vertical wall using specially devised methods of containment and construction. Deployable compartments, reinforced with corner struts, are elevated and filled by a moving gantry. The compartments interlock to form a stable wall. Different wall heights, thicknesses, and plan configurations are achieved by varying the geometry of the individual compartments, which are made from woven carbon fibers. Conventional terrestrial structural engineering techniques can be modified and used to establish the structural integrity and performance of the wall assembly.

Author

N93-17447*# Integrated Space Systems Corp., Collegeville, PA.
EVOLVING CONCEPTS OF LUNAR ARCHITECTURE: THE POTENTIAL OF SUBSELENE DEVELOPMENT

ANDREW W. DAGA, MERYL A. DAGA, and WENDEL R. WENDEL (Starnet Structures, Inc., West Babylon, NY.) /n NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 281-291 Sep. 1992
Avail: CASI HC A03/MF A03

In view of the superior environmental and operational conditions that are thought to exist in lava tubes, popular visions of permanent settlements built upon the lunar surface may prove to be entirely

romantic. The factors that will ultimately come together to determine the design of a lunar base are complex and interrelated, and they call for a radical architectural solution. Whether lunar surface-deployed superstructures can answer these issues is called into question. One particularly troublesome concern in any lunar base design is the need for vast amounts of space, and the ability of man-made structures to provide such volumes in a reliable pressurized habitat is doubtful. An examination of several key environmental design issues suggests that the alternative mode of subsele development may offer the best opportunity for an enduring and humane settlement.

Author

N93-17448*# Design Science, Los Angeles, CA.
LUNAR SUBSURFACE ARCHITECTURE ENHANCED BY ARTIFICIAL BIOSPHERE CONCEPTS

JASON D. KLASSI, CARLOS J. ROCHA, and CHARLES A. CARR /n NASA. Johnson Space Center, The Second Conference on Lunar Bases and Space Activities of the 21st Century, Volume 1 p 293-298 Sep. 1992
Avail: CASI HC A02/MF A03

The integration of artificial biosphere technology with subsele architecture can create a life-enhancing, productive habitat that is safe from solar radiation and extreme temperature fluctuations while maximizing resources brought from Earth and derived from lunar regolith. In the short term, the resulting biotecture (biosphere and architectural) designs will not only make the structures more habitable, productive, and manageable, but will ultimately provide the self-sufficiency factors necessary for the mature lunar settlement. From a long-term perspective, this biotecture approach to astronautics and extraterrestrial development (1) helps reduce mass lift requirements, (2) contributes to habitat self-sufficiency, and (3) actualizes at least one philosophy of solar system exploration, which is to exploit nonterrestrial resources in an effort to conserve our natural resources on this planet.

Author

N93-17697# Analysis and Technology, Inc., New London, CT.
EVALUATION OF NIGHT VISION GOGGLES (NVG) FOR MARITIME SEARCH AND RESCUE Final Summary Report, Mar. 1989 - Jun. 1991

R. Q. ROBE, D. L. RAUNIG, J. V. PLOURDE, and R. L. MARSEE
Feb. 1992 17 p
(Contract DTG39-89-C-E10G56)
(AD-A257704; RDC-11/92; USCG-D-16-92) Avail: CASI HC A03/MF A01

Three experiments were conducted in 1989, three in 1990, and one experiment was conducted in 1991 by the U.S. Coast Guard Research and Development (R and D) Center to evaluate night vision goggles (NVG's) for their effectiveness in detecting small targets at night. Three types of NVG's have been evaluated: the AN/AVS-6 Aviator's Night Vision Imaging System (ANVIS) was evaluated onboard U.S. Coast Guard HH-3F, CH-3E, and HH-60J helicopters, and HU-25C and RG-8A fixed-wing aircraft. The AN/PVS-5C and AN/PVS-7A NVG's were evaluated onboard U.S. and Canadian Coast Guard Search and Rescue Units (SRU's) in the 200-foot size range and onboard U.S. Coast Guard 41-foot utility boats (UTB's). During the Spring 1991 experiment, 4- and 6-person unlighted life rafts with retroreflective tape and 18- and 21-foot white boats were employed as targets during realistically-simulated search missions. Three new SRU's were evaluated and newly obtained information is discussed. A total of 4098 target detection opportunities were generated for all the target types employed during the six experiments. These data were analyzed to determine which of 25 search parameters of interest exerted a statistically-significant influence on target detection probability. Lateral range curves and sweep width estimates are presented for SRU/target type combinations that contained sufficient data to support this detailed analysis. Human factors data are presented and discussed. NVG's proved to be an effective nighttime search aid for helicopter searches for small SAR targets. The results for NVG use for SAR on CG Utility Boats indicated that NVG's did not significantly enhance search performance, and their routine use is not recommended.

GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

N93-17710*# Texas Univ., Austin. Mechanical Engineering Design Project Program.

DESIGN OF A RADIATOR SHADE FOR TESTING IN A SIMULATED LUNAR ENVIRONMENT

JAIMI HUFF, RANDY REMINGTON, and TOAN TANG 1992 159 p

(Contract NASW-4435)

(NASA-CR-192080; NAS 1.26:192080) Avail: CASI HC A08/MF A02

The National Aeronautics and Space Administration (NASA) and The Universities Space Research Association (USRA) have chosen the parabolic/catenary concept from their sponsored Fall 1991 lunar radiation shade project for further testing and development. NASA asked the design team to build a shading device and support structure for testing in a vacuum chamber. Besides the support structure for the catenary shading device, the design team was asked to develop a system for varying the shade shape so that the device can be tested at different focal lengths. The design team developed concept variants and combined the concept variants to form overall designs. Using a decision matrix, an overall design was selected by the team from several overall design alternatives. Concept variants were developed for three primary functions. The three functions were structural support, shape adjustments, and end shielding. The shade adjustment function was divided into two sub-functions, arc length adjustment, and width adjustment. Author

N93-17805*# Texas Univ., Austin. Mechanical Engineering Design Projects Program.

DESIGN OF A RESISTIVE EXERCISE DEVICE FOR USE ON THE SPACE SHUTTLE Final Report

DENNIS L. CARLSON, MOHAMMED DURRANI, and CHRISTI L. REDILLA 1992 184 p

(Contract NASW-4435)

(NASA-CR-192079; NAS 1.26:192079) Avail: CASI HC A09/MF A02

The National Aeronautics and Space Administration in conjunction with the Universities Space Research Association sponsored the design of a Resistive Exercise Device (RED) for use on the Space Shuttle. The device must enable the astronauts to perform a number of exercises to prevent skeletal muscle atrophy and neuromuscular deconditioning in microgravity environments. The RED must fit the requirements for limited volume and weight and must provide a means of restraint during exercise. The design team divided the functions of the device into three major groups: methods of supplying force, methods of adjusting force, and methods of transmitting the force to the user. After analyzing the three main functions of the RED and developing alternatives for each, the design team used a comparative decision process to choose the most feasible components for the overall design. The design team selected the constant force spring alternative for further embodiment. The device consists of an array of different sized constant force springs which can be pinned in different combinations to produce the required output forces. The force is transmitted by means of a shaft and gear system. The final report is divided into four sections. An introduction section discusses the sponsor background, problem background and requirements of the device. The second section covers the alternative designs for each of the main functions. The design solution and pertinent calculations comprises the third section. The final section contains design conclusions and recommendations including topics of future work. Author

N93-17806*# Texas Univ., Austin. Dept. of Mechanical Engineering.

CONCEPTUAL DESIGN OF A FLEET OF AUTONOMOUS REGOLITH THROWING DEVICES FOR RADIATION SHIELDING OF LUNAR HABITATS Final Report

KAREM ARMSTRONG, DANIEL A. MCADAMS, and JEFFERY L. NORRELL 1992 245 p

(Contract NASW-4435)

(NASA-CR-192078; NAS 1.26:192078) Avail: CASI HC A11/MF A03

The National Aeronautics and Space Administration (NASA) in conjunction with Universities Space Research Association (USRA) has requested that the feasibility of a fleet of regolith tossing devices designed to cover a lunar habitat for radiation protection be demonstrated. The regolith, or lunar soil, protects the lunar habitat and its inhabitants from radiation. Ideally, the device will operate autonomously in the lunar environment. To prove the feasibility of throwing regolith on the Moon, throwing solutions were compared to traditional, Earth-based methods for moving soil. Various throwing configurations were investigated. A linear throwing motion combined with a spring and motor energizing system proved a superior solution. Three different overall configurations for the lunar device are presented. A single configuration is chosen and critical parameters such as operating procedure, system volume, mass, and power are developed. The report is divided into seven main sections. First, the Introduction section gives background information, defines the project requirements and the design criteria, and presents the methodology used for the completion of this design. Next, the Preliminary Analysis section presents background information on characteristics of lunar habitats and the lunar environment. Then, the Alternate Designs section presents alternate solutions to each of the critical functions of the device. Fourth, a detailed analysis of throwing the regolith is done to demonstrate its feasibility. Then, the three overall design configurations are presented. Next, a configuration is selected and the conceptual design is expanded to include system performance characteristics, size, and mass. Finally, the Conclusions and Recommendations for Future Work section evaluates the design, outlines the next step to be taken in the design process, and suggests possible goals for future design work. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A93-17824 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

COMET HALLEY AS AN AGGREGATE OF INTERSTELLAR DUST AND FURTHER EVIDENCE FOR THE PHOTOCHEMICAL FORMATION OF ORGANICS IN THE INTERSTELLAR MEDIUM

R. BRIGGS (New York State Department of Health, Albany), G. ERTEM, J. P. FERRIS (Rensselaer Polytechnic Inst., Troy, NY), J. M. GREENBERG (Leiden State Univ., Netherlands), P. J. MCCAIN (Rensselaer Polytechnic Inst., Troy, NY), C. X. MENDOZA-GOMEZ (Leiden State Univ., Netherlands), and W. SCHUTTE (Leiden State Univ., Netherlands; NASA, Ames Research Center, Moffett Field, CA) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 22, no. 5 1992 p. 287-307. Research supported by Univ. Nacional Autonoma de Mexico refs (Contract NGR-33-018-148)

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Photolysis of mixtures of CO:NH₃:H₂O at 12 K results in the formation of an organic residue which is not volatile in high vacuum at room temperature. Analysis of this fraction by GC-MS resulted in the detection of C₂-C₃ hydroxy acids and hydroxy amides, glycerol, urea, glycine, hexamethylene tetramine, formamidic acid and ethanolic acid. Use of isotopically labeled gases made it possible to establish that the observed products were not contaminants. The reaction pathways for the formation of these products were determined from the position of the isotopic labels in the mass spectral fragments. The significance of these findings to the composition of comets and the origins of life is discussed. Author

A93-17976* National Aeronautics and Space Administration, Washington, DC.

COMETS AND THE ORIGINS AND EVOLUTION OF LIFE; PROCEEDINGS OF THE CONFERENCE, UNIV. OF WISCONSIN, EAU CLAIRE, SEPT. 30-OCT. 2, 1991

PAUL J. THOMAS, ED. (Wisconsin Univ., Eau Claire) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 179 p.

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Papers are presented on comets and the formation of biochemical compounds on the primitive earth; the cometary origin of carbon, nitrogen, and water on the earth; comets as a possible source of prebiotic molecules; comet impacts and chemical evolution on the bombarded earth; and cometary supply of terrestrial organics (lessons from the K/T and the present epoch). Other papers are on a computational study of radiation chemical processing in comet nuclei, the origin of the polycyclic aromatic hydrocarbons in meteorites, the fate of organic matter during planetary accretion (preliminary studies of the organic chemistry of experimentally shocked Murchison meteorite), recent observations of interstellar molecules (detection of CCO and a limit on H₂C₃O), terrestrial and extraterrestrial sources of molecular monochirality, and dark matter in the solar system (hydrogen cyanide polymers). (For individual items see A93-17977 to A93-17987) I.S.

A93-17977* National Aeronautics and Space Administration, Washington, DC.

COMETS AND THE FORMATION OF BIOCHEMICAL COMPOUNDS ON THE PRIMITIVE EARTH - A REVIEW

J. ORO, T. MILLS (Houston Univ., TX), and A. LAZCANO (Univ. Nacional Autonoma de Mexico, Coyoacan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 267-277. refs

(Contract NGR-44-005-002)

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Thirty years ago it was suggested that comets impacting on the primitive earth may have represented a significant source of terrestrial volatiles, including some important precursors for prebiotic synthesis (Oro, 1961). This possibility is strongly supported not only by models of the collisional history of the early earth, but also by astronomical evidence that suggests that frequent collisions of cometlike bodies from the circumstellar disk around the star Beta Pictoris are taking place. Although a significant fraction of the complex organic compounds that appear to be present in cometary nuclei were probably destroyed during impact, it is argued that cometary collisions with the primitive earth represented an important source of both free-energy and volatiles, and may have created transient, gaseous environments in which prebiotic synthesis may have taken place. Author

A93-17979* National Aeronautics and Space Administration, Washington, DC.

COMETS AS A POSSIBLE SOURCE OF PREBIOTIC MOLECULES

W. F. HUEBNER and D. C. BOICE (Southwest Research Inst., San Antonio, TX) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 299-315. refs

(Contract NAGW-2205; NAGW-2370)

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Prebiotic molecules derive from abiotic organic molecules, radicals, and ions that pervade the universe at temperatures as high as several 1000 K. Here we review the role of organic molecules that condensed at low temperatures before or during comet formation in the early history of the Solar System. Recent spacecraft encounters and ground-based observations of carbon-rich volatile and dust components of comet comae provide a broad database for the investigation of these organic molecules. New laboratory data for some potential cometary organics are presented. Probable icy organic constituents of the nucleus and CHON particles as likely candidates for the distributed sources of gas-phase organic species in the coma are discussed. There is

broad agreement that many organic molecules observed in the coma originate from the dust that must have existed in the solar nebula at the time and place of comet formation. We conclude that complex organic molecules found in comets may be a source of prebiotic molecules that led to the origins of life. Author

A93-17980* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

COMET IMPACTS AND CHEMICAL EVOLUTION ON THE BOMBARDED EARTH

VERNE R. OBERBECK (NASA, Ames Research Center, Moffett Field, CA) and HANS AGGARWAL (Eloret Inst., Sunnyvale, CA) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 317-338. refs

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Amino acids yields for previously published shock tube experiments are used with minimum Cretaceous-Tertiary (K/T) impactor mass and comet composition to predict AIB amino acid K/T boundary sediment column density. The inferred initial concentration of all amino acids in the K/T sea and in similar primordial seas just after 10 km comet impacts would have been at least 10 exp -7 M. However, sinks for amino acids must also be considered in calculating amino acid concentrations after comet impacts and in assessing the contribution of comets to the origin of life. The changing concentration of cometary amino acids due to ultraviolet light is compared with the equilibrium concentration of amino acids produced in the sea from corona discharge in the atmosphere, deposition in water, and degradation by ultraviolet light. Comets could have been more important than endogenous agents for initial evolution of amino acids. Sites favorable for chemical evolution of amino acids are examined, and it is concluded that chemical evolution could have occurred at or above the surface even during periods of intense bombardment of earth before 3.8 billion years ago. Author

A93-17981

COMETARY SUPPLY OF TERRESTRIAL ORGANICS - LESSONS FROM THE K/T AND THE PRESENT EPOCH

DUNCAN STEEL (Anglo-Australian Observatory, Coonabarabran, Australia) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 339-357. Research supported by Australian Research Council refs

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The following plausible sources for extraterrestrial organic matter accumulated by the earth in the first 10 exp 9 years of its history have been suggested: (1) comet-produced dust smaller than 10 exp -6 g; (2) meteorites of mass between 10 and 10 exp 8 g; and (3) direct input from small comets of mass 10 exp 8 to 10 exp 12. This paper presents some evidence available from observations, to help determine the appropriate time-scales and the lifetimes of the asteroids and dust, and to compare these collisional lifetimes with the age of the earth. It is shown that the arrival velocity of the dust in the atmosphere is generally lower, and the probability of collision with the earth higher, than for the meteoroids, asteroids, and comets. This may be interpreted as evidence for the cometary dust as a supplier of organic material to the earth in the first 10 exp 9 yrs of the earth's history, as was suggested by Anders (1989). I.S.

A93-17982

COMPUTATIONAL STUDY OF RADIATION CHEMICAL PROCESSING IN COMET NUCLEI

RAFAEL NAVARRO-GONZALEZ (Univ. Nacional Autonoma de Mexico, Coyoacan), CYRIL PONNAMPERUMA, and RAJ K. KHANNA (Maryland Univ., College Park) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 359-374. refs

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Cometary nuclei have been exposed to high levels of ionizing radiation since their formation. We present here some results of a computer model calculation of the effect of ionizing radiation on cometary material. The external (cosmic rays) and internal (embedded radionuclides) contributions in the processing of

cometary nuclei are considered. As a first approximation we have used the available kinetic data of the liquid water system to model the radiation effects in a frozen cometary environment. Our data suggest that massive radiation chemical processing due to cosmic rays may have taken place only in the outer layers of comets. The internal contribution of radionuclides to the radiation processing of comet cores seems to be modest. Therefore, comets could be carriers of intact homochiral biomolecules. Author

A93-17983**THE ORIGIN OF THE POLYCYCLIC AROMATIC HYDROCARBONS IN METEORITES**

MICHAEL R. WING (Hobart and William Smith Colleges, Geneva, NY) and JEFFREY L. BADA (California Univ., La Jolla) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 375-383. refs
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It is shown that the Fischer-Tropsch hypothesis concerning the formation of polycyclic aromatic hydrocarbons (PAHs), according to which the aromatics and other organic material found in carbonaceous chondrites formed in the solar nebula by mineral-catalyzed reactions of CO, H₂, and NH₃, is not consistent with the available evidence. It is argued that the presence of indigenous PAHs and the absence of indigenous amino acids in the H4 ordinary chondrite Forest Vale supports the contention that PAHs and amino acids in meteorites are synthesized by different processes. Amino acids are synthesized by a process which requires the presence of liquid water, and PAHs by a high-temperature nonaqueous process which occurred before the accretion of meteorite parent bodies. I.S.

A93-17984* National Aeronautics and Space Administration, Washington, DC.

THE FATE OF ORGANIC MATTER DURING PLANETARY ACCRETION - PRELIMINARY STUDIES OF THE ORGANIC CHEMISTRY OF EXPERIMENTALLY SHOCKED MURCHISON METEORITE

TRACY N. TINGLE (Stanford Univ.; SRI International Molecular Physics Lab., Menlo Park, CA), JAMES A. TYBURCZY (Arizona State Univ., Tempe), THOMAS J. AHRENS (California Inst. of Technology, Pasadena), and CHRISTOPHER H. BECKER (SRI International Molecular Physics Lab., Menlo Park, CA) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 385-397. Research supported by Gas Research Inst. refs
(Contract NAGW-1941; NAGW-1953; NSF EAR-86-09782)
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The fate of organic matter in carbonaceous meteorites during hypervelocity (1-2 km/sec) impacts is investigated using results of experiments in which three samples of the Murchison (CM2) carbonaceous chondrite were shocked to 19, 20, and 36 GPa and analyzed by highly sensitive thermal-desorption photoionization mass spectrometry (SALI). The thermal-desorptive SALI mass spectra of unshocked CM2 material revealed presence of indigenous aliphatic, aromatic, sulfur, and organosulfur compounds, and samples shocked to about 20 GPa showed little or no loss of organic matter. On the other hand, samples shocked to 36 GPa exhibited about 70 percent loss of organic material and a lower alkene/alkane ratio than did the starting material. The results suggest that it is unlikely that the indigenous organic matter in carbonaceous chondritelike planetesimals could have survived the impact on the earth in the later stages of earth's accretion. I.S.

A93-17986**TERRESTRIAL AND EXTRATERRESTRIAL SOURCES OF MOLECULAR HOMOCHIRALITY**

WILLIAM A. BONNER (Stanford Univ., CA) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 407-420. refs
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The requirement of an absolute chiral homogeneity of prebiotic molecules was a prerequisite to self-replication. In this paper, the possible terrestrial mechanisms proposed as sources of molecular

homochirality are reviewed, and it is concluded that all terrestrial mechanisms proposed for the origin of chirality have one or more limitations which make them either intrinsically invalid or highly improbable in the chaotic and turbulent environment of the prebiotic earth. An extraterrestrial scenario for the production of terrestrial chirality is proposed, in which circularly polarized synchrotron radiation from the neutron star remnant of a supernova interacts with the organic mantles on interstellar grains, producing chiral molecules by the partial asymmetric photolysis of racemic constituent in the mantles. After this, the interstellar grains with their enantiomerically enriched mantles are transported to earth either by direct accretion or through cometary impact. I.S.

A93-17987**DARK MATTER IN THE SOLAR SYSTEM - HYDROGEN CYANIDE POLYMERS**

CLIFFORD N. MATTHEWS (Illinois Univ., Chicago) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149) vol. 21, no. 5-6 1991-1992 p. 421-434. refs
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The connection between hydrogen cyanide, proteins, and life is examined by way of a discussion of HCN polymerization and its significance for prebiotic and extraterrestrial chemistry. The connection is supported by reports on the interaction, at laboratory conditions, of HCN monomer with itself, and with other key volatiles such as acetylene and formaldehyde, to form a variety of important biomolecules including nitrogen heterocyclic molecules. Moreover, HCN polymers ('black solids') form readily in reducing environments and can be pyrolyzed or hydrolyzed to many kinds of smaller molecules including alpha amino acids. Polyamides are significant components of these HCN polymers, which can serve both as protein ancestors and as prebiotic condensing agents for the parallel synthesis of polypeptides and polynucleotides. I.S.

N93-15825* # Harvard Univ., Cambridge, MA.

WIDE-BANDWIDTH HIGH-RESOLUTION SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE Semiannual Status Report, 15 Jun. - 15 Dec. 1992

PAUL HOROWITZ 15 Jun. 1992 29 p
(Contract NAGW-2872)
(NASA-CR-191618; NAS 1.26:191618) Avail: CASI HC A03/MF A01

Research accomplished in the following areas is discussed: the antenna configuration; HEMT low-noise amplifiers; the downconverter; the Fast Fourier Transform Array; the backend array; and the backend and workstation. Author

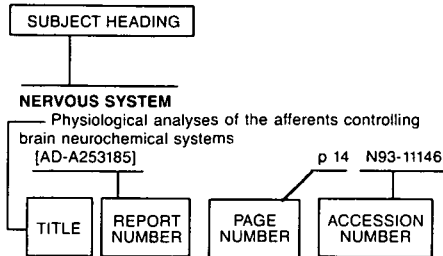
N93-16709* # Harvard Univ., Cambridge, MA.

WIDE-BANDWIDTH HIGH-RESOLUTION SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE Semiannual Status Report, 15 Dec. 1991 - 15 Jun. 1992

PAUL HOROWITZ 15 Jun. 1992 20 p
(Contract NAGW-2872)
(NASA-CR-191807; NAS 1.26:191807) Avail: CASI HC A03/MF A01

This interim report summarizes the research accomplished during the initial 6-month period of the grant. Activities associated with antenna configurations, the channelizing downconverter, the fast Fourier transform array, the DSP (digital signal processing) array, and the backend and UNIX workstation are discussed. Publications submitted during the reporting period are listed. Author

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence.

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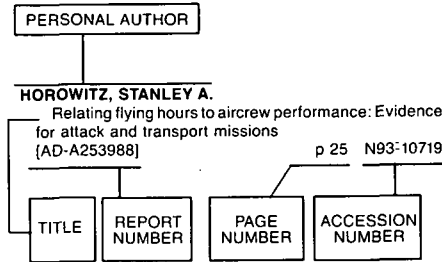
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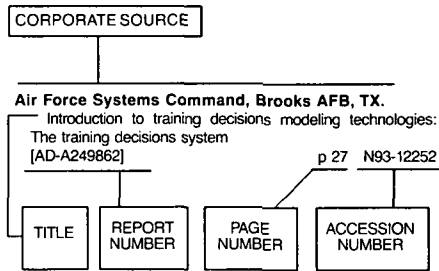
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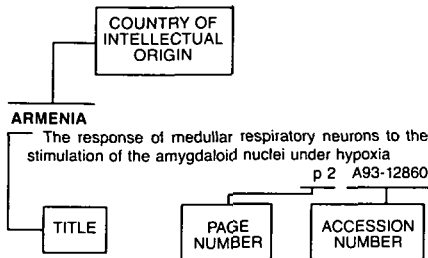
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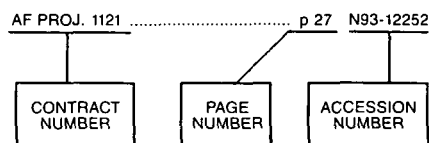
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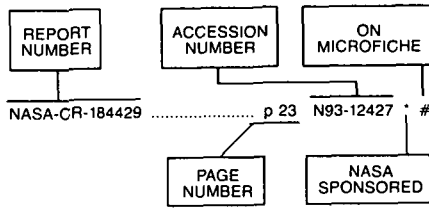
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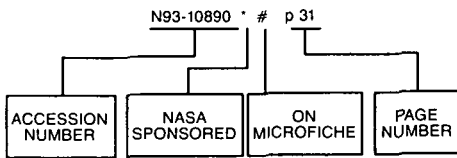


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