



Aerospace Medicine  
and Biology  
A Continuing  
Bibliography  
with Indexes

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## ACCESSION NUMBER RANGES

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# **AEROSPACE MEDICINE AND BIOLOGY**

**A CONTINUING BIBLIOGRAPHY  
WITH INDEXES**

**(Supplement 282)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in February 1986 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



NASA SP-7011 and its supplements are available from the National Technical Information Service (NTIS). Questions on the availability of the predecessor publications, *Aerospace Medicine and Biology* (Volumes I – XI) should be directed to NTIS.

This supplement is available as NTISUB/123/093 from the National Technical Information Service (NTIS), Springfield, Virginia 22161 at the price of \$8.00 domestic; \$16.00 foreign.



# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 154 reports, articles and other documents announced during February 1986 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

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

Each entry in the bibliography consists of a bibliographic citation accompanied 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, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

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

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1986 Supplements.

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# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 282)*

MARCH 1986

51

## LIFE SCIENCES (GENERAL)

Includes genetics.

**A86-13457**

**A HANDBOOK OF RADIATION DOSIMETRY AND HYGIENE [SPRAVOCHNIK PO DOZIMETRII I RADIATSIONNOI GIGIENE]**  
A. A. MOISEEV and V. I. IVANOV Moscow, Energoatomizdat, 1984, 296 p. In Russian. refs

Statistical techniques for estimating the effects of ionizing radiation on human populations are described. Consideration is given to both natural and anthropogenic sources of radioactivity, including: the cosmic ray background radioactive isotopes; radiological examinations; and fallout. Specific dose effects are estimated for the different organic structures in the body including brain and liver cells; bone marrow; the endocrine system; and the liver. The statistical distribution of radiation hazards in different regions of the earth and in different occupations is described in detail. I.H.

**A86-13460**

**THE ENVIRONMENT AND THE HEART [VNESHNAIA SREDA I SERDTSE]**

A. K. KADYRALIEV and A. IU. TILIS Frunze, Izdatel'stvo Kirgystan, 1984, 112 p. In Russian.

The effect of high-altitude (HA) hypoxia on pathophysiological changes in the cardiovascular system (CVS), and the mechanisms of CVS adaptation to HA in animals with experimental mitral valve defect (MVD) were studied. The MVD was initiated by reception of 13-18 pct valve area in dogs either at 760 m above sea level or at 3200 m (adapted or nonadapted animals), and various functional parameters, such as the heart rate, intracardiac and central blood pressure (BP), blood volumes, were measured before, during and in the periods following 60-day adaptation to HA, as well as upon return to 760 m. In addition, microstructural changes in the myocardium were studied by means of electron microscopy. Exposure to HA of dogs with MVD led to a high degree of lethal decompensation. The increase of BP during hyperfunction caused the destruction of intracellular membranes and vacuolation of mitochondria in the cardiomyocytes. Administration of strophanthin decreased the effects of HA hypoxia and lethality in all groups of dogs with MVD. I.S.

**A86-13648**

**EXTREMELY THERMOPHILIC BACTERIA LIVING AT TEMPERATURES ABOVE 100 C [EKSTREMAL'NO-TERMOFIL'NYE BAKTERII, ZHIVUSHCHIE PRI TEMPERATURE VYSHE 100 DEG]**

L. G. LOGINOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Seria Biologicheskaja (ISSN 0002-3329), Sept.-Oct. 1985, p. 700-714. In Russian. refs

Characteristics of extremely thermophilic bacteria grown under laboratory conditions of high temperature and high pressure (necessary to suppress boiling) are presented. All such bacteria belong to the group of Archaeobacteria and are anaerobes, living in nature in hot springs or near the undersea volcanoes at elevated

pressure at which the solubility of oxygen is very low. Many species of thermophilic bacteria isolated by Zillig and Stetter, et al. (e.g., 1983) from hot springs of volcanic origin in Iceland are described in detail including their micrographs. The potential use of extremely thermophilic bacteria in metallurgy (e.g., for leaching out metals and desulfurization of carbon), the chemical industry (e.g., in the production of ethanol from cellulose, and methane from carbon dioxide), as well as in other fields and in research, are discussed. I.S.

**A86-14117**

**HABITABILITY OF THE EARLY EARTH - CLUES FROM THE PHYSIOLOGY OF NITROGEN FIXATION AND PHOTOSYNTHESIS**

K. M. TOWE (Smithsonian Institution, Dept. of Paleobiology, Washington, DC) Origins of Life (ISSN 0302-1688), vol. 15, no. 4, 1985, p. 235-250. refs

The study of nitrogen fixation and photosynthesis in order to determine the habitability of the Archean environment is discussed. The effects of ammonia and oxygen on the nitrogenase enzymes used in nitrogen fixation are described. An ammonia concentration of greater than 0.0001 M inhibited enzyme activity and an oxygen concentration above 16-0.1 micron-M caused destruction of the enzymes in the Archean environment. With the development of oxygenic photosynthesis the process of nitrogen fixation was affected; three evolutionary approaches which explain how an organism could have survived are presented. The utilization of carbon dioxide and sulfides in the photosynthesis processes is studied. The effect of oxygen on photosynthesis is analyzed and the importance of superoxide dismutases and RuBP oxygenase is discussed. It is concluded that with a carbon concentration of 100 PAL, sulfides at 0.0004M, and oxygen greater than 21 percent photosynthesis was possible in the Archean environment. I.F.

**A86-14119**

**CARBON ISOTOPE DISCREPANCY BETWEEN PRECAMBRIAN STROMATOLITES AND THEIR MODERN ANALOGS - INFERENCES FROM HYPERSALINE MICROBIAL MATS OF THE SINAI COAST**

M. SCHIDLOWSKI (Max-Planck-Institut fuer Chemie, Mainz, West Germany) Origins of Life (ISSN 0302-1688), vol. 15, no. 4, 1985, p. 263-277. DFG-supported research. refs

An isotope survey of hypersaline cyanobacterial mats from the Sinai Peninsula is used to analyze the high delta C-13 values found in ancient stromatolites. The carbon fixation of benthic microbial communities via the C3 pathway and the fractionation of the ribulose biphosphate carboxylase reaction are described. Fractionations result from limitations of a diffusion-controlled assimilatory pathway in which the isotope effect of the enzymatic reaction is suppressed. The influence of the protective slim coatings and reduced CO2 solubilities on the transport of CO2 is discussed. It is proposed that increased ratios of CO2 in Precambrian atmosphere contributed to the elimination of the diffusion barrier in the carbon-fixing pathways, thereby resulting in the increased delta C-13 concentrations found in ancient mat-forming microbiota. I.F.



## 51 LIFE SCIENCES (GENERAL)

**A86-14124\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

### **THE MICROBIAL COMMUNITY AT LAGUNA FIGUEROA, BAJA CALIFORNIA MEXICO - FROM MILES TO MICRONS**

J. F. STOLZ (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; Boston University, MA) *Origins of Life* (ISSN 0302-1688), vol. 15, no. 4, 1985, p. 347-352. refs

The changes in the composition of the stratified microbial community in the sediments at Laguna Figueroa following floods are studied. The lagoon which is located on the Pacific coast of the Baja California peninsula 200 km south of the Mexican-U.S. border is comprised of an evaporite flat and a salt marsh. Data collected from 1979-1983 using Landsat imagery, Skylab photographs, and light and transmission electron microscopy are presented. The flood conditions, which included 1-3 m of meteoric water covering the area and a remnant of 5-10 cm of siliciclastic and clay sediment, are described. The composition of the community prior to the flooding consisted of *Microcoleus*, *Phormidium* sp., a coccoid cyanobacteria, *Phloroflexus*, *Ectothiorhodospira*, *Chloroflexus*, *Thiocapsa* sp., and *Chromatium*. Following the floods *Thiocapsa*, *Chromatium*, *Oscillatoria* sp., *Spirulina* sp., and *Microcoleus* are observed in the sediments.

I.F.

**A86-14313\*** Maryland Univ., Baltimore.

### **EFFECTS OF SUSPENSION HYPOKINESIA/HYPODYNAMIA ON RAT SKELETAL MUSCLE**

S. R. MAX (Maryland, University, Baltimore) and D. E. FLYNN (Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1065-1069. Research supported by the University of Maryland. refs (Contract NAG2-100)

The effects of suspension hypokinesia/hypodynamia (H/H) on properties of soleus and plantaris muscles of rats were studied. The objective was to compare the effects of this model to those of disuse atrophy. After 12 d of H/H, there were significant decreases in soleus and plantaris muscle wet weight and citrate synthase activity. Soleus muscle was affected to a greater extent than plantaris muscle. There was a significant decrease in noncollagen protein content of H/H soleus muscle. Triceps brachii muscles did not display significant changes in any parameters measured, suggesting that observed changes were not due to systemic factors. There was no significant change in the water content of H/H soleus or plantaris muscles. Suspension H/H causes muscle changes different from those secondary to limb immobilization, in which soleus and plantaris muscles are equally affected.

Author

**A86-14314**

### **EFFECTS OF HEAD AND BODY RESTRAINT ON EXPERIMENTAL MOTION-INDUCED SICKNESS IN SQUIRREL MONKEYS**

C. R. WILPIZESKI, L. D. LOWRY, R. B. CONTRUCCI, S. J. GREEN, and W. S. GOLDMAN (Thomas Jefferson University, Philadelphia, PA) *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1070-1073. Research supported by the Ben Franklin Partnership. refs

Each of 16 Bolivian-phenotype squirrel monkeys of mixed sex had a machine bolt mounted on the skull with acrylic cement; 13 were provided with temporary plaster body casts allowing free movement. With eyes open, all were rotated in the horizontal plane at 30 rpm every other day until vomiting occurred or for a maximum duration of 120 min/spin. Latencies for motion-sickness signs were recorded under three experimental conditions: (1) free movement, (2) torso fixed to an aluminum frame and (3) both torso and head restrained by bolting to the frame. Subsequently, 10 monkeys from this sample were rotated while blindfolded with head and torso immobilized. Results partially confirmed human and animal findings reported by others: reduced mobility was accompanied by a reduction in the incidence and an increase in the latency of motion sickness. The importance of optokinetic input for the generation of motion sickness in this species was clear.

Author

**A86-14386#**

### **MICROBIOLOGICAL MANAGEMENT OF SPACELAB 3 RODENTS**

G. A. FUNK and W. E. HINDS (Management and Technical Services Co., Moffett Field, CA) IN: *Shuttle Environment and Operations II Conference*, Houston, TX, November 13-15, 1985, Technical Papers. New York, AIAA, 1985, p. 70-74. (AIAA PAPER 85-6090)

The 24 laboratory rats recently flown aboard Spacelab 3 were subjected to a stringent microbiological management program designed to minimize the risk to crew of animal-borne disease. The rodents had to be shown free of several specific microorganisms to be acceptable for flight. Efforts to acquire such rodents began with vendor testing one year before flight. No animals were shipped to Kennedy Space Center without immediate prior demonstration of the microbiological acceptability of their source colony. All flight rodents were recertified to be in concurrence with flight requirements eight days before launch, and were tested upon landing to confirm their continued flight acceptability.

Author

**A86-14593**

### **PROTEINS AND RNA IN THE NEURON-NEUROGLIA SYSTEM OF N. RAPHE DORSALIS NEURONS OF THE GROUND SQUIRREL BRAIN DURING HIBERNATION [BELKI I RNK V SISTEME NEIRON-NEIROGLIA N. RAPHE DORSALIS GOLOVNOGO MOZGA SUSLIKA V DINAMIKE ZIMNEI SPIACHKI]**

T. N. GOLOVINA, U. M. MALIKOV, T. KH. SHORTANOVA, and N. N. DEMIN (Kabardino-Balkarskii Gosudarstvennyi Universitet, Nalchik; AN SSSR, Institut Fiziologii, Leningrad, USSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 71, Aug. 1985, p. 945-950. In Russian. refs

**A86-14594**

### **HEAT SENSITIVITY OF THE MEDIAL PREOPTIC REGION OF THE HYPOTHALAMUS DURING SEASONAL ADAPTATION AND ACCLIMATIZATION TO HIGH AMBIENT TEMPERATURE [TEPLOVAIA CHUVSTVITEL'NOST' MEDIAL'NOI PREOPTICHESKOI OBLASTI GIPOTALAMUSA PRI SEZONNOI ADAPTATSII I AKKLIMATSII K VYSOKOI VNESHNEI TEMPERATURE]**

M. D. KHUDAIBERDIEV (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 71, Aug. 1985, p. 952-957. In Russian. refs

**A86-14595**

### **NECK AND OCULOMOTOR REFLEXES INDUCED BY ELECTRICAL STIMULATION OF THE SEMICIRCULAR CANAL AMPULLAE IN THE PIGEON [SHEINYE I GLAZODVIGATEL'NYE REFLEKSY, VYZVANNYE ELEKTRICHESKOI STIMULIATSIEI POLUKRUZHNYKH KANALOV U GOLUBIA]**

I. V. ORLOV (AN SSSR, Institut Fiziologii, Leningrad, USSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 71, Aug. 1985, p. 977-984. In Russian. refs

The ampullae of horizontal, anterior, and posterior canals of the alert pigeon were stimulated by short electrical pulses of 1.2-1.5 microseconds duration in order to study the amplitudes and latency characteristics of synaptic responses. It is found that double pulses evoke a synchronized biphasic short-latency synaptic response in the neck muscles, their amplitudes depending on the interpulse delay. Angular acceleration of short pulse trains evoked eye movements in the plane of the simulated canal and the neck which were associated with the nystagmic rhythm. The experimental results are discussed within the framework of the central vestibulo-oculomotor integrator concept.

I.H.

A86-14714

**ENCODING OF SPATIAL LOCATION BY POSTERIOR PARIETAL NEURONS**

R. A. ANDERSEN, G. K. ESSICK, and R. M. SIEGEL (Salk Institute for Biological Studies, San Diego, CA) *Science* (ISSN 0036-8075), vol. 230, Oct. 25, 1985, p. 456-458. refs  
(Contract NIH-EY-05522)

The cortex of the inferior parietal lobule in primates is important for spatial perception and spatially oriented behavior. Recordings of single neurons in this area in behaving monkeys showed that the visual sensitivity of the retinotopic receptive fields changes systematically with the angle of gaze. The activity of many of the neurons can be largely described by the product of a gain factor that is a function of the eye position and the response profile of the visual receptive field. This operation produces an eye position-dependent tuning for locations in head-centered coordinate space. Author

A86-15444

**RADIATION-SICKNESS MECHANISMS [MEKHANIZMY LUCHEVOI PATOLOGII]**

IU. B. KUDRIASHOV, ED. (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Moscow, Izdatel'stvo Moskovskogo Universiteta*, 1984, 140 p. In Russian. No individual items are abstracted in this volume.

Papers are presented concerning biophysical mechanisms of radiation sickness, the modification of cytogenic radiation effects by inhibitors of DNA synthesis, liver cell plasma membranes in animals with different radiation sensitivity, mechanisms of disorders of nitrogen and energy metabolism under ionizing radiation from various sources, and the effect of varying doses of ionizing radiation on the Na(+)-K(+)-ATPase in rat organs of different radiation sensitivity. Also included are papers concerning the injury and recovery of the blood regenerating system in the course of acute radiation sickness, the pathogenesis of the radiation-induced gastrointestinal syndrome, the heterogeneity of the critical systems as the principal factor determining their resistance to radiation, and regulation of the radiation resistance of an organism by altering the metabolic state of cellular mitochondria. In addition, synergistic effects in the radiobiology of bacteria and the general scheme of the modification of the radiation cell damage are discussed. I.S.

A86-15467

**VISUAL-CONTRAST MEASUREMENT - MEASUREMENT OF THE SPATIAL TRANSFER FUNCTIONS OF THE VISUAL SYSTEM [VIZOKONTRASTOMETRIIA IZMERENIE PROSTRANSTVENNYKH PEREDATOCHNYKH FUNKTSII ZRITEL'NOI SISTEMY]**

IU. E. SHELEPIN, L. N. KOLESNIKOVA, and IU. I. LEVKOVICH Leningrad, *Izdatel'stvo Nauka*, 1985, 109 p. In Russian. refs

Theoretical and experimental studies of spatial transfer functions (TFs) of the visual system in normal and pathological vision are reviewed. Particular consideration is given to the interrelationship between the retinoscopic organization of the visual analyzer and the transfer of spatial information in this analyzer; a spatial-frequency analysis of the mechanisms underlying binocular vision; disorders of these mechanisms during amblyopia; and the unified character of spatial-temporal transfer functions. Techniques for the measurement of modulation transfer functions in clinical and experimental conditions are described. B.J.

A86-15474

**MOLECULAR MECHANISMS OF CELL DEATH INDUCED BY RADIATION [MOLEKULIARNYE MEKHANIZMY RADIATIONNOI GIBELI KLETOK]**

K. P. KHANSON and V. E. KOMAR Moscow, *Energoatomizdat*, 1985, 152 p. In Russian. refs

Recent data concerning the mechanisms of radiation-induced cell death are presented. The role of structural and metabolic changes occurring in the genome, membranes, and metabolism of a cell in the course of reproductive, or 'mitotic', death and the interphase death are described. It is shown that the experimental data concerning the radiation dose/cell inactivation relationships

can be successfully interpreted by means of different quantitative models for reproductive cell death. Programmed interphase cell death (PICD) is compared with the radiation-induced cell death, and a genetic hypothesis for the PICD is proposed. I.S.

A86-15513

**BLOOD CIRCULATION CHANGES IN THE CAROTID ARTERIES POOL CAUSED BY ANTIORTHOSTASIS AND ANTIORTHOSTATIC HYPOKINESIA [IZMENENIE KROVOBRASHCHENIIA V BASSEINE SONNYKH ARTERII PRI ANTIORTOSTAZE I ANTIORTOSTATICHESKOI GIPOKINEZII]**

B. M. FEDOROV, E. N. STRELTSOVA, and T. V. SEBEKINA *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 755-762. In Russian. refs

The effect of antiorthostasis (AO) on circulation in the carotid pool was studied in healthy men placed in a -8 deg head-down tilt, and in anesthetized dogs subjected to -45 deg or -90 deg AO. The 5-day-long antiorthostatic hypokinesia in men led to a decreased blood flow in the carotid and orbital arteries, an increase in the peripheral resistance index, a decreased reactivity to the compression test, and a decreased functioning of the flow along the anterior communicating artery when the common carotid was compressed. During the later phases of the 30-day long AO, these blood flow indices tended to return to normal. In dogs, the AO led to a sharp increase in pressure in the jugular veins and in peripherals of the carotid pool, and to a decrease of blood flow rate in the carotid arteries. I.S.

A86-15521

**NEUROCHEMICAL BASIS OF CHEMICAL THERMOREGULATION AND ARTIFICIAL HYPOBIOSIS [NEIROKHIMICHESKIE OSNOVY KHIMICHESKOI TERMOREGULIATSII I ISKUSSTVENNYI GIPOBIOZ]**

N. N. TIMOFEEV (AMN SSSR, Institut Farmakologii, Moscow, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 839-851. In Russian. refs

The state of hypothermia (HT) occurs when contractile or chemical thermogenesis (CT) is uncoupled from noncontractile thermoregulation. A block in CT can be achieved by interfering with the activation of the presynaptic membrane by noradrenaline (NA), thus preventing the release of acetylcholine. Four possible approaches that can be used to induce artificial HT are: depletion of stored NA from its adrenergic or adrenal pool, blocking the NA release, inhibition of catecholamine synthesis, and induction of the synthesis of faulty NA. The methods and drugs available for uncoupling CT by each of the four approaches, as well as various combinations of these, are described, together with the effects produced in the respective experiments. Clinical applications of artificial biogenesis in situations where deceleration of biological or pathological processes would be beneficial to the patient are discussed. I.S.

A86-15525

**NEUROCHEMICAL MECHANISMS OF ARTIFICIAL HYPOBIOSIS AND CHEMICAL THERMOREGULATION [NEIROKHIMICHESKIE MEKHANIZMY ISSKUSSTVENNOGO GIPOBIOZA I KHIMICHESKOI TERMOREGULIATSII]**

N. N. TIMOFEEV and G. A. KONSTANTINOV (AMN SSSR, Institut Farmakologii, Moscow, USSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 71, Sept. 1985, p. 1145-1150. In Russian. refs

A state of hypobiosis not coupled with chemical thermoregulatory processes was induced in rats and rabbits by injecting the animals with ornid, a drug known to block the release of neuromediator from the adrenergic neurons. Within 1-2 hrs of i.p. injections (30 mg/kg for rats and 50 mg/kg for rabbits) and 1-2 min of 10 pct i.v./90 pct i.p. injections of ornid, the animals exhibited a 20-30 percent loss in the oxygen consumption and a lowering of emotional/stress reactions. There was no loss of arbitrary mobility or any evidence of shivering, attesting to the attainment of a hypobiotic state that was uncoupled from the chemical thermoregulation processes. The poikilothermic state could be maintained for 5-6 days at room temperature and could

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be reversed without the use of any drug, by increasing the body temperature. I.S.

**A86-16054**

### **DECOMPRESSION OUTCOME FOLLOWING SATURATION DIVES WITH MULTIPLE INERT GASES IN RATS**

R. S. LILLO, E. T. FLYNN, and L. D. HOMER (U.S. Navy, Naval Medical Research Institute, Bethesda, MD) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 59, Nov. 1985, p. 1503-1514. refs

(Contract NAVY TASK M0099PN,01A,0009)

**A86-16055**

### **MODE OF NEURAL CONTROL MEDIATING RAT TAIL VASODILATION DURING HEATING**

D. S. OLEARY, J. M. JOHNSON, and W. F. TAYLOR (Texas, University, San Antonio) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 59, Nov. 1985, p. 1533-1538. refs

(Contract NIH-HL-20663)

**N86-12949\*#** Management and Technical Services Co., Washington, D.C.

### **USSR SPACE LIFE SCIENCES DIGEST, ISSUE 2**

L. R. HOOKE, ed., M. RADTKE, ed., V. GARSHNEK, ed., J. E. ROWE, ed., and R. TEETER, ed. Washington NASA Oct. 1985 96 p

(Contract NASW-3676)

(NASA-CR-3922(02); NAS 1.26:3922(02)) Avail: NTIS HC

A05/MF A01 CSCL 06C

The second issue of the bimonthly digest of USSR Space Life Sciences is presented. Abstracts are included for 39 Soviet periodical articles in 16 areas of aerospace medicine and space biology and published in Russian during the first half of 1985. Selected articles are illustrated with figures from the original. Translated introductions and tables of contents for 14 Russian books on 11 topics related to NASA's life science concerns are presented. Areas covered are: adaptation, biospheric, body fluids, botany, cardiovascular and respiratory systems, cybernetics and biomedical data processing, gastrointestinal system, group dynamics, habitability and environmental effects, health and medical treatment, hematology, immunology, life support systems, metabolism, musculoskeletal system, neurophysiology, psychology, radiobiology, and space biology. Two book reviews translated from Russian are included and lists of additional relevant titles available either in English or in Russian only are appended. E.A.K.

**N86-12950#** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.

### **ENVIRONMENTAL IMPACT RESEARCH PROGRAM. STATUS AND SOURCE OF HABITAT MODELS AND LITERATURE REVIEWS, DECEMBER 1984 Final Report**

T. H. ROBERTS, L. J. ONEIL, and W. E. JABOUR Apr. 1985 18 p Revised

(AD-A156899; WES/MP/EL-85-1-REV) Avail: NTIS HC A02/MF A01 CSCL 06F

This report summarizes the status and availability of selected species habitat models and other habitat-related documents developed by the US Fish and Wildlife Service and other agencies. This listing is not comprehensive since many universities and other organizations are now involved with model development and testing. Animal groups included are birds, mammals, amphibians, reptiles, fish, molluscs, and other crustaceans. Information listed includes scientific name, special status of the species (if any), the organization responsible for the development of the model or the literature review, the stage of development of the document, and whether the document has received outside review or testing.

GRA

**N86-12951#** Los Alamos National Lab., N. Mex.

### **RAMAN ACTIVITY IN SYNCHRONOUSLY DIVIDING BACTERIA**

S. P. LAYNE 1985 12 p refs Presented at the Computer Anal. for Life Sci., Okayama, Japan, 9 Jul. 1985

(Contract W-7405-ENG-36)

(DE85-015672; LA-UR-85-2368; CONF-850784-1) Avail: NTIS HC A02/MF A01

Using a spectrometer equipped with an optical-multichannel analyzer as the detector (OMA), we have observed the Stokes laser-Raman spectra of metabolically active *Escherichia coli* and *Bacillus magaterium* from 100 to 2100  $\text{cm}^{-1}$ . After lengthy investigation, no Raman lines attributable to the metabolic process nor the cells themselves were found. Previous Raman spectra of active bacteria cannot be used to support nonlinear theories in biology. DOE

**N86-12952#** California Univ., Berkeley. Lawrence Berkeley Lab.

### **MONITORING OF CIRCADIAN WAVEFORMS IN RODENTS EXPOSED TO HIGH-INTENSITY STATIC MAGNETIC FIELDS**

T. S. TENFORDE, L. LEVY, and E. VEKLEOV Oct. 1984 38 p refs Presented at the 23rd Hanford Life Sci. Symp., Interaction of Biol. Systems with Static and ELF Elec. and Magnetic Fields, Richland, Wash., 2 Oct. 1984

(Contract DE-AC03-76SF-00098)

(DE85-015225; LBL-18384; CONF-841041-2) Avail: NTIS HC A03/MF A01

A system was developed for the noninvasive monitoring of circadian variables in mice exposed to a 1.50 T static magnetic field. The ambient light level, temperature and relative humidity within the exposure chamber are closely regulated, and physiological monitoring systems provide simultaneous measurements of seven circadian variables: (1) climbing activity on a triangular bar; (2) migratory activity; (3) body mass; (4) respired carbon dioxide; (5) nutrient consumption; (6) urine excretion; and (7) fecal excretion. Data from the various transducers and environmental monitoring devices within the exposure system are recorded on magnetic tape at 5-min intervals throughout experiments of 50 to 60 days duration, and the circadian waveforms of behavior and physiological parameters are analyzed by a modification of the cosiner method using a high-speed computer. Exposure of adult female LAF-1 mice to a 1.50-T homogeneous field for 5 continuous days, or for 10 consecutive days with intermittent daily exposures on an 8-hr-on/16-hr-off cycle, is found to produce no significant alterations in the circadian waveforms of behavioral or physiological parameters. DOE

**N86-12953#** Oak Ridge National Lab., Tenn.

### **BIOMEDICAL AND ENVIRONMENTAL SCIENCES PROGRAM PUBLICATIONS 1984**

H. E. GERSTNER, K. M. BRANAM, L. W. LITTLETON, V. S. NORMAN, and E. H. THOMPSON Jul. 1985 86 p

(Contract DE-AC05-84OR-21400)

(DE85-015070; ORNL-6201) Avail: NTIS HC A05/MF A01

A bibliography is given containing 665 references to journal articles, books, book chapters, proceedings, reports, and abstracts. Certain types of publications are not included: theses, book reviews, internal documents, and periodic progress reports (with the exception of annual reports). Publications from divisions that report to the Associate Laboratory Director for Biomedical and Environmental Sciences (ADBES) are listed here, as well as publications from divisions that receive funding through the ADBES office. The references are sorted by type (journal articles, etc.), then by division, and, within each division, alphabetically by first author. Author and journal indexes are included in the back.

DOE



**N86-13878\*#** Louisville Univ., Ky. Dept. of Microbiology and Immunology.

**DEVELOPMENT AND TESTING OF A MOUSE SIMULATED SPACE FLIGHT MODEL Semiannual Progress Report, May - Oct. 1985**

G. SONNENFELD 1985 6 p refs

(Contract NCC2-213)

(NASA-CR-176359; NAS 1.26:176359; SAPR-6) Avail: NTIS HC A02/MF A01 CSCL 06C

The development and testing of a mouse model for simulating some aspects of weightlessness that occur during space flight, and the carrying out of immunological flight experiments on animals was discussed. The mouse model is an antiorthostatic, hypokinetic, hypodynamic suspension model similar to the one used with rats. It is shown that this murine model yield similar results to the rat model of antiorthostatic suspension for simulating some aspects of weightlessness. It is also shown that mice suspended in this model have decreased interferon-alpha/beta production as compared to control, nonsuspended mice or to orthostatically suspended mice. It is suggested that the conditions occurring during space flight could possibly affect interferon production. The regulatory role of interferon in nonviral diseases is demonstrated including several bacterial and protozoan infections indicating the great significance of interferon in resistance to many types of infectious diseases. E.A.K.

**N86-13879\*#** National Aeronautics and Space Administration, Washington, D.C.

**LIFE SCIENCES ACCOMPLISHMENTS**

Sep. 1985 95 p refs Original contains color illustrations (NASA-TM-88177; NAS 1.15:88177) Avail: NTIS HC A05/MF A01 CSCL 06C

From its inception, the main charter of Life Sciences has been to define biomedical requirements for the design and development of spacecraft systems and to participate in NASA's scientific exploration of the universe. The role of the Life Sciences Division is to: (1) assure the health, well being and productivity of all individuals who fly in space; (2) study the origin, evolution, and distribution of life in the universe; and (3) to utilize the space environment as a tool for research in biology and medicine. The activities, programs, and accomplishments to date in the efforts to achieve these goals are detailed and the future challenges that face the division as it moves forward from the shuttle era to a permanent manned presence in space space station's are examined. E.A.K.

**N86-13880#** Wisconsin Univ., Madison.

**STUDY OF TOXIC AND ANTIGENIC STRUCTURES OF BOTULINUM NEUROTOXINS Annual and Final Report, 1 Aug. 1980 - 31 Aug. 1984**

B. R. DASGUPTA Feb. 1985 14 p

(Contract DAMD17-80-C-0100; DA PROJ. 3M1-62770-A-871)

(AD-A156642) Avail: NTIS HC A02/MF A01 CSCL 06E

Amino acid compositions of botulinum neurotoxin (NT) types A, B, E and F were determined. The heavy and light chains of types A, B and E NT were separated, purified, and analyzed for amino acid compositions and partial N-terminal sequence. Selective modification of tyr, his and arg residues and also carboxyl and amino groups of types A and E NT demonstrated the role of these amino acid residues in toxicity and antigenicity. Type E NT completely detoxified following modification of his, tyr or amino groups has potential as a toxoid. Effects of types A and B NT on rat neuromuscular junctions appear non-identical. Author (GRA)

**N86-13881#** Systems and Applied Sciences Corp., Anaheim, Calif.

**NEW PHYSICAL METHODS FOR BIOLOGICAL AEROSOL DETECTION Contractor Report, Aug. 1982 - Sep. 1984**

C. C. CHOU and M. LU May 1985 99 p

(Contract DAAK11-82-C-0113)

(AD-A158218; CRDC-CR-84131) Avail: NTIS HC A05/MF A01 CSCL 15B

For biological aerosol detection, Fourier transform secondary negative ion mass spectrometry appears to be on the forefront among various new analytical methods evaluated. Various gases liberated upon pyrolyzing bacterial cells lead to several possible techniques. Preliminary experimental results indicated an integrated detection system incorporating non-dispersive IR spectroscopy, piezoelectric sensing, and optical density change measurement would render a fast, accurate detection for pyrolysis gaseous products. GRA

**N86-13882#** Stanford Univ., Calif.

**SMALL X-RAY DIFFRACTION OF IMMUNOGLOBULIN-MEMBRANE COMPLEXES Final Technical Report, 15 Apr. 1981 - 14 Oct. 1984**

S. DONIACH and K. HODGSON 15 Aug. 1985 8 p

(Contract N00014-81-K-0496)

(AD-A158252) Avail: NTIS HC A02/MF A01 CSCL 06A

In the first part of this research, specially designed hapten-phospholipid molecules were synthesized to enable the binding of immunoglobulins to artificial phospholipid membranes. In subsequent work, using these immunoglobulin-membrane complexes, electron microscopy was used to reveal the detailed crystalline structure of a two dimensional (2D) immunoglobulin crystal attached to an electron microscope grid. These studies enabled the discovery of a new conformational arrangement of crystals formed from intact immunoglobulin molecules. In a third part of the study, monolayers of protein-membrane complex (in this case the purple membrane from halobacterium halobium) were deposited on a single crystal silicon substrate. Using the technique of grazing incidence X-ray diffraction, diffraction patterns from a single monolayer of protein-lipid complex were obtained for the first time. GRA

**N86-13883#** Battelle Northwest Labs., Richland, Wash.

**DESIGN, CONSTRUCTION AND TESTING OF A DC BIOEFFECTS ENCLOSURE FOR SMALL ANIMALS Final Report**

Jul. 1985 180 p refs Sponsored by EPRI

(Contract DE-AC06-76RL-01830; EPRI PROJ. 1774-1)

(DE05-016798; EPRI-EA-4189) Avail: NTIS HC A09/MF A01

Large air-ion concentrations moving in high-strength static electric fields are unique to the environment near high-voltage dc (HVdc) transmission lines. To assess the possible biological effects of this environment, a small-animal exposure system was designed to produce well-characterized levels of the major components of the HVdc environment. Initial steps in the development of this exposure system included studies of various housing geometries and housing materials. Dielectric materials, such as plexiglass and lexan, unacceptably perturbed electric-field and air-ion environments in their vicinity these perturbations depended on the cleanliness of the housing materials and were spatially and temporally variable. Semiconducting materials were also investigated, with satisfactory results. The final cage design employs semiconducting glass walls which span the entire space between the grounded metal-screen cage floors the overhead high-voltage electrodes used to generate the exposure electric fields. The surface conductivity of the glass walls is controlled by a system of energized guard strips located on the outer surfaces of the walls. Electric-field strengths up to 100 kV/m and air-ion concentrations up to 1,000,000 cu b c, are attainable. Initial dosimetric measurements were also performed as part of this project. The ion current collected by the body of a grounded animal was measured as a function of ion concentration and electric-field strength. The ion current collected by a live animal was observed to be significantly less than that collected by a

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conducting animal model of similar size and shape. This deviation appears to be due to accumulation of electric charge on the fur of exposed animals. DOE

**N86-13884#** Washington Univ., Seattle. Social Management of Technology Program.

### **MOLECULAR MECHANISMS OF MUTAGENESIS DETERMINED BY THE RECOMBINANT DNA TECHNOLOGY**

W. R. LEE 1985 10 p refs Presented at the 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985 (Contract DE-AS05-76EV-03728) (DE85-016353; CONF-8506137-11) Avail: NTIS HC A02/MF A01

A study of the alteration of the DNA in the mutant gene can determine mechanisms of mutation by distinguishing between mutations induced by transition, transversion, frameshifts of a single base and deletions involving many base pairs. The association of a specific pattern of response with a mutagen will permit detecting mutants induced by the mutagen with a reduced background by removing mutations induced by other mechanisms from the pool of potential mutants. From analyses of studies that have been conducted, it is quite apparent that there are substantial differences among mutagens in their modes of action. Of 31 X-ray induced mutants, 20 were large deletions while only 3 showed normal southern blots. Only one mutant produced a sub-unit polypeptide of normal molecular weight and charge in the *in vivo* test whereas *in vitro* synthesis produced a second one. In contrast, nine of thirteen EMS induced mutants produced cross-reacting proteins with sub-unit polypeptide molecular weights equivalent to wild type. DOE

**N86-13885#** Southwest Research Inst., San Antonio, Tex. **EFFECTS OF 60 HZ ELECTRIC FIELDS ON OPERANT AND SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES Project Technical Status Report, 16 Feb. - 12 Apr. 1985**

W. R. ROGERS 19 Apr. 1985 33 p (Contract DE-AC02-80RA-50219) (DE85-011992; DOE/RA-50219/T4) Avail: NTIS HC A03/MF A01

The objective was to investigate possible behavioral effects of exposure to high-intensity 60 Hz electric fields. Four projects are conducted: (1) aversive sensory character of exposure to fields, (2) threshold intensity for detection of fields, (3) chronic exposure effects on performance of two operant tasks, and (4) observation of behavior of social groups under chronic exposure. Electric field testing with animals has begun. Behavioral testing was suspended for repair of cages and to suppress corona, and to conduct engineering tests. DOE

**N86-14080\*#** Fayetteville State Univ., N.C. Dept. of Biology. **THE SCANNING ELECTRON MICROSCOPE AS A TOOL IN SPACE BIOLOGY Final Report**

R. A. BARRETT *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports 9 p Sep. 1983 refs Avail: NTIS HC A18/MF A01 CSCL 06B

Normal erythrocytes are disc-shaped and are referred to here descriptively as discocytes. Several morphologically variant forms occur normally but in rather small amounts, usually less than one percent of total. It has been shown though, that spiculed variant forms referred to as echinocytes are generated in significant amounts at zero g. Normal red cells have been stressed *in vitro* in an effort to duplicate the observed discocyte-echinocyte transformation at zero g. The significance of this transformation to extended stay in space and some of the plausible reasons for this transformation are discussed. Author

**N86-14088\*#** North Texas State Univ., Denton. Dept. of Biological Sciences.

### **INTERACTION BETWEEN ESCHERICHIA COLI AND LUNAR FINES Final Report**

K. R. JOHANSSON *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports 21 p Sep. 1983 refs Avail: NTIS HC A18/MF A01 CSCL 06B

A sample of mature lunar fines (10084.151) was solubilized to a high degree (about 17 percent) by the chelating agent salicylic acid (0.01 M). The neutralized (pH adjusted to 7.0) leachate was found to inhibit the growth of *Escherichia coli* (ATCC 25992) in a minimal mineral salts glucose medium; however, the inhibition was somewhat less than that caused by neutralized salicylic acid alone. The presence of lunar fines in the minimal medium was highly stimulatory to growth of *E. coli* following an early inhibitory response. The bacterium survived less well in the lunar leachate than in distilled water, no doubt because of the salicylate. It was concluded that the sample of lunar soil tested has nutritional value to *E. coli* and that certain products of fermentation helped to solubilize the lunar soil. Author

**N86-14097\*#** Morgan State Univ., Baltimore, Md. **COMPARATIVE EFFECT OF LUNAR FINES AND TERRESTRIAL ASH ON THE GROWTH OF A BLUE-GREEN ALGA AND GERMINATING RADISH SEEDS Final Report**

E. J. RIDLEY *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports 15 p Sep. 1983 refs Avail: NTIS HC A18/MF A01 CSCL 06B

Although it is understood that photosynthetic organisms will be required as components of a closed ecological life support system (CELSS) for a manned lunar based, a basic problem is to identify organisms best capable of utilizing lunar regolith materials. Also, there is need to determine what nutrient supplements have to be added to lunar soils, and at what levels in order to promote high bio-mass production. Author

**N86-14162#** Joint Publications Research Service, Arlington, Va. **ENERGY EXCHANGE OF PLANTS UNDER WEIGHTLESSNESS CONDITIONS Abstract Only**

M. G. TAIRBEKOV and A. V. DEVYATKO *In its* USSR Rept.: Space (JPRS-USP-85-005) p 80 30 Sep. 1985 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 280, no. 2, Jan. 1985 p 509-512 Original language document announced in IAA as A85-24193

Avail: NTIS HC A08

The plant energy-transfer experiment aboard the Cosmos-1514 biosatellite in December 1983 is considered. Heat release from corn sprouts was measured by a biocalorimeter operating in the 0 to 100 mW range. Results indicate that weightlessness has no effect on the intensity of energy transfer in sprouting seeds. The design of the biocalorimeter is described in some detail. IAA

## AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

## A86-13298

**PREDICTION OF THE FUNCTIONAL STATE OF THE BODY DURING ADAPTATION TO HIGH ALTITUDES [PROGNOZ FUNKSIONAL'NOGO SOSTOIANIA ORGANIZMA PRI ADAPTATSII K VYSOKOGOR'IU]**

V. P. MAKHNOVSKII, E. I. KUZIUTA, and E. E. VOLKOV  
Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1985, p. 50-52. In Russian.

The endurance of the cardiovascular system of 111 men aged 18-20 years was measured by the Flack stress method, first after a 20-day stay at 1700 m above sea level, and then during a 60-day adaptation to 3600 m. A control group remained at 800 m. The heart rate (HR), and the systolic (CP) and mean arterial pressures were measured before and after stress, and the Kerdo index of the vegetative system (VIK) was calculated. According to the endurance results at 1700-m altitude, all men could be grouped into 'strong' (S) and 'weak' (W) categories. The W group displayed sharp changes in HR and CP, which were only minimal and transitory in men of the S group. The changes in the VIK were negative and transitory in the S group, and positive in the W group. The results at 3600 m have confirmed the prognosis made at the lower altitude: the functional parameters in the subjects of the S group returned to normal after only 30 days of adaptation, while the W group remained unadapted even after 60 days. I.S.

## A86-13299

**DETERMINATION OF VESTIBULAR ASYMMETRY WITH APPLICATION TO AVIATION MEDICINE [OPREDELENIE VESTIBULIARNOI ASIMMETRII PRIMENITEL'NO K ZADACHAM VRAHEBNO-LETNOI EKSPERTIZY]**

E. V. LAPAEV and O. A. VOROB'EV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1985, p. 53-56. In Russian. refs

Nystagmic (N), vestibulo-spinal (V-S) and vestibulo-vegetative stability (V-VS) reactions, both spontaneous and those caused by rotatory and caloric stimulations of the semicircular canals, were measured in pilots, flight trainees and non-flying (C) subjects. It was found that the V-S asymmetry increased in all subjects after 12-hr night-time wakefulness. The N and V-S asymmetries were significantly lower in the flight crew and trainees than in C subjects. Some pilots disclosed hidden functional asymmetry after prolonged flights. The methods of testing, its evaluation, and the need for additional analyses (concerning the changing character of the expression and direction of the N, V-S and V-VS asymmetry reactions) are discussed. I.S.

## A86-13300

**THE USE OF REFLEX THERAPY IN THE PROPHYLAXIS AND TREATMENT OF MOTION SICKNESS [ISPOL'ZOVANIE REFLEKSOTERAPII V PROFILAKTIKE I LECHENII UKACHIVANIIA]**

A. L. IVANOV and V. M. SNITKO Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1985, p. 56, 57. In Russian. refs

The results of measuring the electric conductivity (EC) at 24 acupuncture relief points (APs) known to be most functionally labile and to reflect the state of the twelve standard acupuncture channels are reported. It was found that the channels of the heart, three torso sections, spleen-pancreas, small intestine, and urinary bladder were most indicative in terms of the changes of EC. The changes in EC were either negative (APs in the channels of the trunk and small intestine) or positive (in the other three channels). Based on these results the electropuncture method was used successfully to ameliorate the symptoms of sea sickness in the sensitive crew and passengers during long-term sea trips. I.S.

## A86-13567

**COMPLETE RIGHT BRANCH BLOCKING AND THE FLIGHT FITNESS OF PILOTS [BLOC DE BRANCHE COMPLET GAUCHE ET APTITUDE A L'EMPLOI DANS LE PERSONNEL NAVIGANT]**

J. P. OLLIVIER, J. DRONIOU (Hopital d'Instruction des Armees Val-de-Grace, Paris, France), G. LEGUAY, and A. SEIGNEURIC (Hopital d'Instruction des Armees Dominique Larrey, Versailles, France) Medecine Aeronautique et Spatiale, vol. 24, 3rd Quarter, 1985, p. 143-147. In French. refs

The rates, ages of occurrences and noninvasive means of detecting complete right branch blocking (CBB) in pilots is examined, together with the implications of CBB for flight fitness certification. A study was performed of 23 middle-aged humans with CBB and no previous history of cardiac problems or symptoms. The subjects submitted to ECG, echocardiography, myocardial scintigraphy, angiography, coronography and catheterization. No correlation was found between risk factors, e.g., smoking, cholesterol intake and high blood pressure, and CBB. A series of tests were developed for identifying asymptomatic CBB. The onset of symptoms is considered sufficient reason to perform a catheterization. It is concluded that although there is only a 15 percent chance of detecting CBB, the seriousness of the condition is sufficient reason for conducting a series of tests on middle-aged pilots, who cannot be certified as flight-fit if CBB is found.

M.S.K.

## A86-13568

**POSITIVE PRESSURE RESPIRATION, A MEANS OF PROTECTING AGAINST +GZ ACCELERATIONS - A THEORETICAL APPROACH [LA RESPIRATION EN PRESSION POSITIVE, MOYEN DE PROTECTION CONTRE LES ACCELERATIONS +GZ - APPROCHE THEORIQUE]**

H. MAROTTE and H. VIEILLEFOND (Centre d'Essais en Vol, Bretigny-sur-Orge, France) Medecine Aeronautique et Spatiale, vol. 24, 3rd Quarter, 1985, p. 147-149. In French. refs

A literature review was carried out to examine the possibility that deep breathing by pilots of jet aircraft will serve as a replacement for M1 maneuvers to offset long duration high-g acceleration-induced loss of functioning. The object of deep breathing, as with the M1 maneuver, is to enhance the arterial cerebral perfusion of blood. It was found that deep breathing must commence before initiating high-g maneuvers, a difficult task in flight combat conditions. Finally, there is a limit to the length of time that deep breathing can safely be performed. M.S.K.

## A86-13572

**NONHYPOXIC SYNCOPES AT HIGH ALTITUDE - THE RESULTS OF TWO OBSERVATIONAL TRIALS IN A HYPOBARIC CHAMBER [SYNCOPES NON HYPOXIQUES EN ALTITUDE - A PROPOS DE DEUX OBSERVATIONS EN CAISSON HYPOBARE]**

H. MAROTTE, H. VIEILLEFOND, and J. L. POIRIER (Centre d'Essais en Vol, Bretigny-sur-Orge, France) Medecine Aeronautique et Spatiale, vol. 24, 3rd Quarter, 1985, p. 169-172. In French.

Two instances of loss of consciousness were observed in successive trials with subjects in a pressure chamber. One subject sat for 120 min at a simulated 17,000 ft altitude; the second trial simulated a climb to 60,000 ft, while being supplied with oxygen at a level equivalent to 128 kPa. The second subject lost consciousness during simulated descent, following the onset of hyperventilation 40 min into the session. With regard to fighter pilots, the first subject behaved as if experiencing an anxiety attack prior to blacking out. Either unconscious episode could have occurred to pilots in high altitude flight; neither would be detectable by post-accident investigations. M.S.K.



A86-13573

**THE BENDS AT HIGH ALTITUDE [LA MALADIE DE DECOMPRESSION D'ALTITUDE]**H. VIEILLEFOND *Medecine Aeronautique et Spatiale*, vol. 24, 3rd Quarter, 1985, p. 185-193. In French.

Aircrew can experience the bends after sudden decompression in high altitude flight. The bends is the formation of N<sub>2</sub> gas bubbles in the muscle tissues as the gas escapes the bodily fluids due to a lowered partial pressure of the atmosphere holding the gas in the liquids. An analysis is carried out of the processes by which some of the excess N<sub>2</sub> is expelled through the lungs, while too slow an expulsion allows bubbles to form. The pressure differential has to be from 1.5-1.6 for the bubbles to form. Consideration is also given to the effects of the temporal duration at an altitude, the age and sex of the person, the ambient temperature, and protective measures (e.g., denitrogenation). M.S.K.

A86-13941#

**INVESTIGATION OF EUSTACHIANAL FUNCTION IN JASDF PILOTS BY NEW APPARATUS. I - ON THE PRESSURAL REGULATION OF THE EUSTACHIAN TUBE IN NORMAL HUMAN**J. OKUBO, Y. MANO, M. SHIBAYAMA, S. TAKAHASHI, N. DOI (Tokyo Medical and Dental University, Japan) et al. *Japan Air Self Defence Force, Aeromedical Laboratory, Reports* (ISSN 0023-2858), vol. 26, June 1985, p. 41-48. In Japanese, with abstract in English. refs

A device has been designed and built to measure the sound pressure inside the Eustachian tube during the ventilation process. The device, a sonotubometer operates using a 7-kHz octave band noise which corresponds to the low frequency sound load of the Eustachian tube. Sonotubometer measurements of the duration and amplitude of sound during dry swallowing were obtained in children and adult men and women in order to evaluate the effectiveness of the device. The results were used to calibrate the device for high-altitude measurements of Eustachian sound in JASDF pilots. I.H.

A86-14310

**PSYCHOMOTOR PERFORMANCE AFTER FORWARD-FACING IMPACT**B. F. HEARON and J. W. BRINKLEY (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1043-1051. refs (Contract F33615-83-C-0500)

The effect of a forward-facing whole-body impact (-G<sub>x</sub>) on psychomotor performance (PP) was studied on ten male subjects using the manikin psychomotor task (Reader et al., 1981), which is a complex reaction time and response accuracy test. The impact severity (at 0, 8, 10, and 12 G levels) was tested in the AFAMRL Horizontal Decelerator Facility, using two initial head positions (up or forward) at the 12 G impact level. No statistically significant evidence of impaired PP upon the increasing severity of impact was found in this test. However, significantly lower angular head acceleration was observed at 12 G when the head was prepositioned forward and downward prior to the impact than when it was positioned upright, strapped against the headrest. Thus, the potential for temporary stunning of aircrew personnel during an operational crash landing or ditching may be reduced by positioning the head forward and downward, if time permits, prior to an imminent crash. I.S.

A86-14312\* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**BLOOD PRESSURE AND PLASMA RENIN ACTIVITY AS PREDICTORS OF ORTHOSTATIC INTOLERANCE**M. H. HARRISON, S. E. KRAVIK, G. GEELLEN, L. KEIL, and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA) *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1059-1064. refs

The effect of 3 h standing, followed by a period of head-up tilt (HUT) on physiological response (orthostatic tolerance, blood

pressure and heart rate), as well as on plasma vasopressin (PVP) and renin activity (PRA) were studied in 13 dehydrated (to 2.4 pct loss of body weight) subjects. Seven subjects showed signs of orthostatic intolerance (INT), manifested by sweating, pallor, nausea and dizziness. Prior to these symptoms, the INT subjects exhibited lower systolic (SP) and pulse (PP) pressures, and an elevated PRA, compared to the tolerant (TOL) subjects. HUT has aggravated increases of RPA in the INT subjects and caused an increase, higher than in TOL subjects, in PVP, while rehydration has greatly attenuated the PVP response to the HUT and decreased the PRA response. It is concluded that dehydration, together with measurements of SP, PP and PRA, may serve as a means of predicting orthostatic intolerance and may provide a physiological model for studying the causes of intolerance. I.S.

A86-14315

**TACHYGASTRIA AND MOTION SICKNESS**R. M. STERN, K. L. KOCH, H. W. LEIBOWITZ, I. M. LINDBLAD, C. L. SHUPERT (Pennsylvania State University, University Park) et al. *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1074-1077. refs (Contract NIH-EY-03276)

Cutaneously-recorded electrogastrograms (EGGs) were obtained from 21 healthy volunteers who were seated within a drum, the rotation of which produced vection or illusory self-motion. Fourteen subjects developed symptoms of motion sickness during vection and in each the EGG frequency shifted from the normal 3 cpm to 5-8 cpm, tachygastric, an abnormal pattern. In 6 of 7 asymptomatic subjects, the 3 cpm EGG pattern was unchanged during vection. It was concluded that illusory self-motion produces tachygastric and motion sickness in susceptible subjects. Author

A86-14316

**ALDOSTERONE, CORTISOL, AND ELECTROLYTE RESPONSES TO HYPOBARIC HYPOXIA IN MODERATE-ALTITUDE NATIVES**C. M. MARESH, B. J. NOBLE, K. L. ROBERTSON, and J. S. HARVEY, JR. (Wyoming University, Laramie; Midwest Research Institute, Kansas City, MO) *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1078-1084. Research supported by the University of Wyoming. refs

The effect of 2-d decompression at simulated high altitude (4270 m, 447 mm Hg) on blood and urine aldosterone (Aldo), cortisol (C), and electrolyte concentrations, all measured three times a day, were studied in seven low-altitude (373 m, 740 mg Hg) natives, LAN, and nine moderate-latitude (1830-2200 m, 585 mg Hg) natives, MAN, aged 19-25 yr. The LAN group has demonstrated higher serum C concentration and respiration rates, and lower serum Aldo and K concentrations, as well as lower urinary Aldo, Na and K concentrations at certain times during decompression, compared to their home values. On the other hand, the respective parameters in the MAN group were basically unchanged at the high altitude. Moreover, manifestations of acute mountain sickness at 4270 m were significantly lower in the MAN than in the LAN group, indicating smaller effect of the drop of ambient oxygen tension in the MAN group. I.S.

A86-14317

**CARDIORESPIRATORY FITNESS AND COGNITIVE PERFORMANCE BEFORE AND AFTER CONFINEMENT IN A NUCLEAR SUBMARINE**B. L. BENNETT, C. L. SCHLICHTING, and K. R. BONDI (U.S. Navy, Naval Submarine Medical Research Laboratory, Groton, CT) *Aviation, Space and Environmental Medicine* (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1085-1091. Navy-supported research. refs

A86-14318

**BLOOD PRESSURE LEVELS OF ACTIVE PILOTS COMPARED WITH THOSE OF AIR TRAFFIC CONTROLLERS**

C. F. BOOZE, JR. (FAA, Civil Aeromedical Institute, Oklahoma City, OK) and L. S. SIMCOX (Oklahoma, University, Oklahoma City) Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1092-1096. refs

Currently some 15,212 active airmen are certified to fly with a diagnosis of hypertension. Federal Aviation Administration blood pressure standards for certification of airmen are considered to be quite liberal. A systematic sample of pre-strike air traffic controllers was extracted from automated medical files maintained by the Aeromedical Certification Branch of the Civil Aeromedical Institute for comparison with airman data. Distributions of blood pressure by age were compared by using conventional non-parametric techniques for 10-year age intervals. Data were also compared with general population findings. Prevalence of hypertension is greater in the general United States population than found with any of the groups reported here. Prevalence of borderline and definite hypertension is seen to increase with age for all groups studied. Prevalence of any degree of hypertension is lower for airline pilots than either the all-airmen group or the air traffic controller group. Author

A86-14319

**EFFECT OF EXPOSURE TO HEAT, HYPOXIA, COLD, ACCELERATION, AND VIBRATION STRESS ON THE TOTAL BLOOD SULFHYDRYL GROUPS IN HUMAN SUBJECTS**

E. M. IYER, M. B. DIKSHIT, and S. SURYANARAYANA (Indian Air Force, Institute of Aviation Medicine, Bangalore) Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1097-1101. Sponsorship: Indian Armed Forces. refs

(Contract IARF PROJECT 1247/1981)

The effect of various types of stress on the rate of utilization of the total blood thiols (bl-SH), measured as an index of activity of the hypophyseal-sympathoadrenocortical (H-SAC) system, was studied in 100 healthy air force personnel. Total bl-SH changes caused by exposures to elevated temperature and relative humidity (RH), cold pressure test, hypoxia, acceleration, low-frequency vibration, and head-up tilt were measured by the method of Ellman. Exposure to a hot, dry environment (57 C, 25 pct RH) and hot, humid environment (50 C, 50 pct RH) and to 4572 m simulated altitude for 50 min, all caused significant decreases in bl-SH (49.7, 61.0 and 36.7 pct, respectively), as did a 2-min long hand immersion into 4 C water (42.7 pct decrease) and acceleration (to up to 4.3 Gz for various periods of time), indicating a stimulating effect of these stresses on the H-SAC system. On the other hand, sinusoidal vibration at 4.9 Hz caused a 42.7 percent rise in bl-SH, suggesting inhibition of the H-SAC system by this stress. The 70 deg head-up tilt produced no change in bl-SH. I.S.

A86-15443

**UNSTEADY BLOOD FLOW IN HUMANS UNDER ARTIFICIAL CONDITIONS [NESTATIONARNYI KROVOTOK U CHELOVEKA V ISKUSSTVENNYKH USLOVIYAKH]**

E. N. MESHALKIN, I. P. VERESHCHAGIN, I. A. VLASOV, E. E. LITASOVA, G. N. OKUNEVA et al. Novosibirsk, Izdatel'stvo Nauka, 1984, 232 p. In Russian. refs

Physiological studies of human body under conditions of anesthesia and light hypothermia during open-heart surgery are presented. It is concluded that the disengaging the heart from the rest of the cardiovascular system does not result in complete cessation of blood flow and vital processes, i.e., in clinical death. Low level of metabolism and limited capillary blood flow are maintained. However, application of protective measures during the cardiac disengagement is necessary for the support of the body metabolism. The protective effect of limited biothermia during the open-heart surgery is discussed. The observed changes in the blood cell morphology, lymph flow, and immunoglobulins during interrupted cardiovascular circulation indicate an increased level of lymph circulation within the closed system consisting of tissue capillaries, intercellular fluid, lymphatic vessels, central lymph

stream, vena cava superior, peripheral veins, and vascular capillaries. I.S.

A86-15512

**ELECTROENCEPHALOGRAMS AND THE READ-OUT OF INFORMATION IN THE VISUAL CORTEX DURING IMAGE RECOGNITION [ELEKTROENTSEFALLOGRAMMA I SCHITYVANIE INFORMATSII V ZRITEL'NOI KORE CHELOVEKA PRI OPOZNAMII OBRAZOV]**

I. A. SHEVELEV, N. B. KOSTELIANETS, V. M. KAMENTOVICH, G. A. SHARAEV, and V. A. ILIANOK (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neurofiziologii, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 707-711. In Russian.

A86-15514

**HEMODYNAMICS DURING SHORT-TERM APPLICATION OF LOWER BODY NEGATIVE PRESSURE [GEMODINAMIKA PRI KRATKOVREMENNOM OTRITSATEL'NOM DAVLENII NA NIZHNIJU CHAST' TELA]**

M. M. MIRRAKHIMOV, T. A. AZHIMAMATOV, and T. B. BALTABAEV (Kirgizskii Nauchno-Issledovatel'skii Institut Kardiologii, Frunze, Kirgiz SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 763-769. In Russian. refs

The effect of lower body negative pressure (LBNP) on the cardiovascular functions was studied in 42 normal male subjects aged 31-64 yrs, using noninvasive methods of electrocardiography, phonocardiography and tetrapolar thoracic rheography. The responses to the LBNP included increases in heart rate and in systemic vascular pressure, decreases in the heart rate and the cardiac indices as well as in the volumes of the cardiac chambers, caused by partial detainment of blood in the large-capacity blood vessels of the lower body. The degree of these changes depended on the magnitude of applied LBNP, which was in the range of 20-60 mm. Rapid (2-3 sec) decompression caused the temporarily detained blood to enter the circulation, leading to short-term increases of the cardiac volume load and to reversal of the hemodynamic effects caused by the LBNP. I.S.

A86-15515

**TYPOLGICAL ANALYSIS OF CENTRAL AND PERIPHERAL HEMODYNAMICS DURING ORTHOSTASIS IN NORMAL SUBJECTS AND IN PATIENTS WITH ARTERIAL HYPERTONIA [TIPOLOGICHESKII ANALIZ TSENTRAL'NOI I PERIFERICHESKOI GEMODINAMIKI V ORTOSTATIKE U ZDOROVYKH LITS I BOL'NYKH S ARTERIAL'NOI GIPERTONIEI]**

V. A. DARTSMELIJA, G. S. BELKANIJA, and A. N. DEMIN (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Patologii i Terapii, Sukhumi, Georgian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 770-777. In Russian. refs

The effect of active orthostasis (OS) on the hemodynamics of the central and peripheral circulation systems was studied in normal subjects and in patients in the first and second stages of arterial hypertension (AH). The hemodynamic shifts and changes in the redistribution indices brought about by OS relative to the clinostatic (control, C) state were measured by use of tetrapolar rheography. The characteristic parameters were measured 30 min after the subjects were put into horizontal position, and then 1, 5, 10, 15, and 20 min after they were transferred into the state of OS. Three orthostatic types of circulation were observed in both C and AH subjects. The observed differences in the circulation types and the changes in the redistribution shifts effected by the OS in both groups of subjects are discussed from the viewpoint of the diagnosis of AH severity and possible therapeutic applications. I.S.

A86-15516

**TYPES OF WORK CAPACITY AND THE FREQUENCY OF THE DEVELOPMENT OF ISCHEMIC HEART DISEASE AND HYPERTONIC DISEASE [TIPY RABOTOSPOBOSTI I CHASTOTA RAZVITIIA ISCHEMICHESKOI BOLEZNI SERDTSIA I GIPERTONICHESKOI BOLEZNI]**

I. IU. BORISOVA, N. A. KRUCHININA, and S. V. CHERNIGOVSKAIA (AN SSSR, Institut Fiziologii, Leningrad, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 778-782. In Russian. refs

A test was conducted on 309 male engineers, who were divided into two types according to the circadian rhythm of their work capacity (WC): (1) the differentiated (D) type, whose WC is optimal either in the morning or in the evening; and (2) the undifferentiated (UD) type, whose WC was uniform throughout the day. All subjects were tested for arterial hypertension (AH) and for heart ischemia (HI) in the beginning of the study and 6.5 years later. The rate of occurrence of the initially diagnosed HI disease was twice as high in the subjects of the D type than in the UD subjects, while the frequency of AH was found to be unrelated to the WC type. Six years later, new cases of HI disease among the first-time suspected HI subjects were found to occur 2.5 times as frequently in the D subjects than in the UD subjects. Moreover, in the subjects with initially marginal AH, new cases of hypertension occurred twice as often in the D types than in the UD subjects. I.S.

A86-15517

**BIOPHYSICAL BASIS OF THE TWO-COMPONENT ANALYSIS OF BIOSIGNALS OF THE PULSED FILLING OF THE BLOOD VESSELS [BIOFIZICHESKIE OSNOVY METODA DVUKHKOMPONENTNOGO ANALIZA BIOSIGNALOV PUL'SOVOGO KROVENAPOLNENIYA]**

I. V. SOKOLOVA *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 783-787. In Russian. refs

A86-15518

**COMPARISON BETWEEN THE ANTIHYPOXIC EFFECTIVENESS OF DRUGS AND PRESSURE-CHAMBER TRAINING [SRAVNITEL'NAIA KHARAKTERISTIKA ANTIGIPOKSICHESKOI EFFEKTIVNOSTI FARMAKOLOGICHESKIKH PREPARATOV I BAROKAMERNOI TRENIROVKI CHELOVEKA]**

E. A. KOVALENKO, A. IU. KATKOV, V. L. POPKOV, M. P. BOBROVNITSKII, R. N. CHABDAROVA et al. *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 808-813. In Russian. refs

Resistance to induced acute hypoxia (AH) was determined in subjects before and after 3-day training (three daily 1-hr periods) in an altitude chamber at either 5000, 6000, or 7500 m, with or without exercise and compared to the effect produced by a single dose of antihypoxic drugs, tiguril and sidnocarb. AH was induced by either a rapid (20 m/sec) rise to high altitude (Method I) or successive 10-min periods at 5000, 6000, etc., up to 10,000 m altitude levels (Method II) and was monitored by measuring the heart beat frequency, breathing frequency, arterial pressure, respiration volume, and by electroencephalography. Resistance to AH induced by either method could be significantly increased by 3-day training at 6000 m and above, with no effect of physical exercise, and remained high for the next 10 or 20 days. Single doses of tiguril (25 mg/kg) or sidnocarb (0.35 mg/kg) were as effective as high-altitude training against AH induced by Method II but not by Method I. I.S.

A86-15519

**LEUKOCYTIC REACTIONS CAUSED BY EMOTIONAL STRESS [LEIKOTSITARNYE REAKTSII PRI EMOTSIONAL'NOM NAPRIAZHENII]**

N. M. PLOTNIKOVA, E. V. BELOVA, and T. A. PALOSOVA (Moskovskii Meditsinskii Stomatologicheskii Institut, Moscow, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 829-833. In Russian. refs

The effect of 25-45-min periods of emotional stress (ES) upon leukocytic reactions (LR) was evaluated in male students during the course of an academic year and an examination period. The

state of ES was induced by assigning to subjects mental tasks which were to be performed in conditions of time shortage and continuous critical comments by the experimenter. The leukocyte counts and the excretion rate of total 17-ketosteroids (17-KS) were determined 2-3 min preceding the ES period, 2-3 min following its completion, and 1 hr later. The majority (39 out of 71 total) of the ES subjects exhibited one of two leukocyte reactions: a decrease in the number of leukocytes and lymphocytes (reaction of stress), or a rise of neutrophils (reaction of adaptation). The levels of excreted 17-KS changed in the subjects with LR, but were not related to the type of LR. I.S.

A86-15520

**COMPARATIVE ANALYSIS OF CORTICOSTEROID AND CATECHOLAMINE LEVELS EXCRETED IN URINE OF PERSONS WITH DIFFERENT OCCUPATIONS [SRAVNITEL'NYI ANALIZ SODERZHANIYA KORTIKOSTEROIDOV I KATEKHOLAMINOV V MOCHE U LITS S RAZLICHNOI PROFESSIONAL'NOI PODGOTOVKOI]**

K. M. SMIRNOV, A. A. VIRU, and T. A. SMIRNOVA (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Okhrany Truda, Leningrad, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 834-838. In Russian. refs

The effect of occupation (of 5 types, including intellectual activity) and work conditions on the excretion (in two 24-hr periods) of 17-oxycorticosteroids (17-OXS), adrenaline (A), and noradrenaline (NA) was studied in healthy men (aged 18-47 yrs) not engaged in athletic activities. Excretion of A and NA was found to be higher in persons whose work involved continuous responsibility and thus emotional stress (e.g., in operators of control boards) or adverse environmental conditions (cold, noise), although only NA rose above the accepted physiological norm levels. The level of 17-OXS in these groups was slightly raised. The maximal levels of the 17-OXS, A, and NA excretion occurred at different diurnal periods (morning, day, or evening), and the excretion of a particular compound could maximize differently in different groups. I.S.

A86-15522

**PREDICTION OF HUMAN PHYSICAL WORK CAPACITY IN HIGH-TEMPERATURE ENVIRONMENTS [PROGNOZIROVANIE FIZICHESKOI RABOTOSPOBOSTI CHELOVEKA V USLOVIYAKH VYSOKIKH TEMPERATUR VNESHNEI SREDY]**

O. S. GORETSKII, V. A. MAKSIMOVICH, L. S. SHEVCHENKO, and D. IA. MIRONIUK (Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevani, Donetsk, Ukrainian SSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 852-855. In Russian. refs

Various physiological and biochemical factors were analyzed in 200 healthy men aged 20-30 yrs before exposure to work (61 watt) in a hot environment and correlated with their ergothermic resistance (ETR), using several statistical models (Sepetiev, 1968; Gubler, 1978). The values of the erythrocyte thermal resistance, the ratio of the measured peripheral pressure to its normal value, the ratio of the measured vital lung capacity of its normal value, the vegetative index of Kerdo, the cardiac index, and the content of creatine in urine were found to be most informative in predicting ETR. Correlation analysis using combinations of these values made it possible to predict the expected ETR with 70-75 percent reliability. I.S.

A86-15523

**USE OF A LINGUISTIC TEST IN THE COURSE OF LARGE-SCALE PHYSIOLOGICAL SELECTION OF MEN FOR WORK IN AN ADVERSE ENVIRONMENT [PRIMENENIE LINGVISTICHESKOGO TESTA PRI MASSOVOM FIZIOLOGICHESKOM OTBORE DLIA RABOTY V EKSTREMAL'NYKH USLOVIYAKH]**

V. I. MEDVEDEV, D. L. SPIVAK, A. A. AIDARALIEV, and R. KURMANALIEVA (Voenno-Meditsinskaya Akademiya, Leningrad, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 11, Sept.-Oct. 1985, p. 861, 862. In Russian. refs

Preliminary estimates of adaptability to a high-altitude environment were obtained on the basis of a short written test, conducted by the method of Spivak (1983), on 1500 men stationed in the mountains. Such linguistic indices as the number of words used to answer the stated questions, the number of verbs used, syntagmatic associations, and changes in verbal strategy were used to assess advancing fatigue and adaptability. Relatively good adaptability was characterized by a more regularly predictable linguistic strategy. The estimates made by the linguistic test showed good correlation with the results of the physiological evaluation of adaptability. I.S.

A86-15637#

**UTILIZATION OF SPACE STATIONS IN THE FIELD OF LIFE SCIENCES**

M. VIEILLEFOSSE (CNES, Toulouse, France) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 9 p. refs (IAF PAPER 85-51)

A number of French life science experiments conducted in space are presented. The influence of microgravity and the space environment on physiology, ontogeny, and phylogeny is studied. The equipment, its function, and the results of cardiovascular, neurosensorial, eye, cellular, and genetic experiments are described and diagrams are provided. The importance of a space station facility for space medicine and physiology, and the role of man on the space station is discussed. A list of necessary captors, treatment and analysis, storage, stimulation, and plant and animal facilities on a space station is presented. I.F.

A86-15822\*# Miami Univ., Oxford, Ohio.

**SPACE MOTION SICKNESS PREFLIGHT ADAPTATION TRAINING PRELIMINARY STUDIES WITH PROTOTYPE TRAINERS**

D. E. PARKER, L. OUYANG (Miami University, Oxford, OH), J. C. ROCK, H. E. VON GIERKE (USAF, Wright-Patterson AFB, OH), M. F. RESCHKE (NASA, Johnson Space Center, Houston, TX) et al. IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p. Research supported by Miami University and USAF. refs (Contract NAS9-14538) (IAF PAPER 85-311)

Based on the otolith tilt-translation reinterpretation hypothesis (Parker et al., 1985), preflight adaptation procedures and several preflight adaptation trainers (PATs) have been developed. Two PAT prototypes, the Miami University Seesaw (MUS) and the Dynamic Environmental Simulator (DES), include a physical room that is moved relative to the restrained subject. Results from the MUS and DES PAT experiments indicate that exposure to the produced sensory rearrangement can change eye movement reflexes. The changes persisted for a period longer than the training exposure period, indicating similarity with the eye-movement reflexes observed immediately postflight in weightlessness-adapted astronauts. It is concluded that the apparatus and procedures to preadapt astronauts to the sensory rearrangement of weightless space flight can be developed on the basis of the reported PATs and procedures. The third PAT prototype tested, which employs a computer-generated scene, failed to produce changes similar to those recorded in the MUS and DES experiments. I.S.

A86-15823\*# Massachusetts Inst. of Tech., Cambridge.

**SPACELAB EXPERIMENTS ON SPACE MOTION SICKNESS**

C. M. OMAN (MIT, Cambridge, MA) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 17 p. refs (Contract NCC9-1; NAS9-15343) (IAF PAPER 85-312)

Recent research results from ground and flight experiments on motion sickness and space sickness conducted by the Man Vehicle Laboratory are reviewed. New tools developed include a mathematical model for motion sickness, a method for quantitative measurement of skin pallor and blush in ambulatory subjects, and a magnitude estimation technique for ratio scaling of nausea or discomfort. These have been used to experimentally study the time course of skin pallor and subjective symptoms in laboratory motion sickness. In prolonged sickness, subjects become hypersensitive to nauseogenic stimuli. Results of a Spacelab-1 flight experiment are described in which 4 observers documented the stimulus factors for and the symptoms/signs of space sickness. The clinical character of space sickness differs somewhat from acute laboratory motion sickness. However SL-1 findings support the view that space sickness is fundamentally a motion sickness. Symptoms were subjectively alleviated by head movement restriction, maintenance of a familiar orientation with respect to the visual environment, and wedging between or strapping onto surfaces which provided broad contact cues confirming the absence of body motion. Author

A86-15824\*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,

**PHYSIOLOGIC ADAPTATION TO SPACE - SPACE ADAPTATION SYNDROME**

J. M. VANDERPLOEG (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 4 p. (IAF PAPER 85-313)

The adaptive changes of the neurovestibular system to microgravity, which result in space motion sickness (SMS), are studied. A list of symptoms, which range from vomiting to drowsiness, is provided. The two patterns of symptom development, rapid and gradual, and the duration of the symptoms are described. The concept of sensory conflict and rearrangements to explain SMS is being investigated. I.F.

A86-15825\*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,

**THE HUMAN CARDIOVASCULAR SYSTEM IN THE ABSENCE OF GRAVITY**

M. W. BUNGO and J. B. CHARLES (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 5 p. refs (IAF PAPER 85-315)

The data collected from a Space Shuttle crew to investigate cardiovascular changes due to microgravity are presented. The experimental procedures which involved preflight, immediate postflight, and one week following postflight echocardiograms of 13 individuals are described. The immediate postflight results reveal a 20 percent decrease in stroke volume, a 16 percent decrease in left ventricular diastolic volume index (LVDVI), no change in systolic volume, blood pressure, or cardiac index, and a 24 percent increase in heart rate. One week later a 17 percent stroke volume increase, a 29 percent increase in cardiac index, and normal blood pressure, and LVDVI were observed. It is concluded that upon reexposure to gravity a readaptation process for the cardiovascular system occurs. I.F.

**A86-15826\*#** National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center, **SPACELAB LIFE SCIENCES FLIGHT EXPERIMENTS - AN INTEGRATED APPROACH TO THE STUDY OF CARDIOVASCULAR DECONDITIONING AND ORTHOSTATIC HYPOTENSION** F. A. GAFFNEY (NASA, Johnson Space Center, Houston; Texas, University, Dallas) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 9 p. refs (IAF PAPER 85-316)

A Spacelab experiment to study cardiovascular deconditioning and orthostatic hypotension is proposed. Previous experiments that have attempted to explain the factors which cause alterations in cardiovascular regulation are investigated. Based on these observations a hypothesis which states cephalad fluid shift produces cardiovascular changes is studied. The testing of the hypothesis is to include the analysis of physiological and anatomical changes in humans and animals for preflight and in-flight periods. The procedures and measurement techniques for the experiment are described. I.F.

**A86-15827#** **QUANTITATIVE EVALUATION OF HUMAN ARTERIAL BARORECEPTOR REFLEXES** D. L. ECKBERG, J. M. SPRENKLE, and R. L. GOBLE (USVA, Medical Center; Virginia, Medical College, Richmond) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 6 p. refs (IAF PAPER 85-317)

A device for studying the carotid baroreceptor-cardiac reflex responses of humans subjected to microgravity is examined. The components and function of the device, which provokes sigmoid baroreceptor-cardiac reflex responses and produces R-R interval responses, are described. The relation between arterial pressure, sympathetic nerve activity, and venous plasma norepinephrine is discussed. It is concluded that changes in baroreflex functions and autonomic cardiovascular control, while in space, may alter vagal and sympathetic outflows and cause symptomatic hemodynamic changes. I.F.

**A86-15828#** **PULMONARY FUNCTION IN MICROGRAVITY - SPACELAB 4 AND BEYOND** H. J. GUY, G. K. PRISK, and J. B. WEST (California, University, San Diego) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p. refs (IAF PAPER 85-322)

A study to observe the influence of topographic gradients on lung function and the overall function of the lung at the onset of exposure to microgravity is proposed. The experimental procedure involves the analysis of instantaneous gas concentrations and flow at the lips as a subject switches from breathing cabin air to the inhalation and exhalation of a series of test gas mixtures. The components and functions of the gas analyzer, bag-in-box assembly, and electronic controlling assembly are described. Hypotheses concerning the observed effect of uneven ventilation, perfusion, pulmonary capillary volume and blood flow, and forced expiratory spirometry are presented. I.F.

**A86-15829\*#** National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center, **RED BLOOD CELL DECREASES OF MICROGRAVITY** P. C. JOHNSON (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p. (IAF PAPER 85-324)

Postflight decreases in red blood cell mass (RBCM) have regularly been recorded after exposure to microgravity. These 5-25 percent decreases do not relate to the mission duration, workload, caloric intake or to the type of spacecraft used. The decrease is accompanied by normal red cell survivals, increased ferritin levels, normal radioactive iron studies, and increases in mean red blood cell volume. Comparable decreases in red blood cell mass are

not found after bed rest, a commonly used simulation of the microgravity state. Inhibited bone marrow erythropoiesis has not been proven to date, although reticulocyte numbers in the peripheral circulation are decreased about 50 percent. To date, the cause of the microgravity induced decreases in RBCM is unknown. Increased splenic trapping of circulating red blood cells seem the most logical way to explain the results obtained.

Author

**A86-15830\*#** Management and Technical Services Co., Washington, D.C. **UNDERSTANDING METABOLIC ALTERATIONS IN SPACE FLIGHT USING QUANTITATIVE MODELS - FLUID AND ENERGY BALANCE** J. I. LEONARD (GE Management and Technical Services Co., Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 21 p. refs (Contract NAS9-15487; NAS9-16328; NAS9-15850; NAS9-17151) (IAF PAPER 85-325)

The results of an integrated multidisciplinary and multiexperimental investigation, using data from the Skylab program, of metabolic adaptation to space flight are summarized and discussed. The effects of space flight on fluid-electrolyte regulation, mechanisms of hormone disturbances, energy balance, and the etiology of weight loss are emphasized. A composite picture of the fluid, electrolyte, and energy response to weightlessness, based primarily on data gathered from the nine Skylab crewmen, is presented. C.D.

**A86-15832\*#** National Aeronautics and Space Administration, Washington, D.C. **DEVELOPMENT OF COUNTERMEASURES FOR USE IN SPACE MISSIONS** A. E. T. NICOGOSSIAN, S. POOL, C. S. L. HUNTOON, and J. I. LEONARD (NASA, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 4 p. refs (IAF PAPER 85-327)

Several measures used to mitigate the inappropriate adaptive responses of space flight are investigated. Weightlessness results in a cephalic fluid shift, which causes a reduction in the circulating blood volume, and removal of weight bearing forces from musculoskeletal systems. The physiological changes that occur from one-g initiated hypovolemia and zero-g initiated fluid shifts are analyzed and compared. The role of baroreceptors on the activation of the adrenergic responses that occurs as a result of hypovolemia is studied. The proper selection and administration of in-flight and post flight countermeasures, which include passive and active physical conditioning techniques, drugs, and vitamins are examined. I.F.

**A86-16051** **MUSCLE METABOLISM DURING EXERCISE IN THE HEAT IN UNACCLIMATIZED AND ACCLIMATIZED HUMANS** D. S. KING, D. L. COSTILL, W. J. FINK, M. HARGREAVES, and R. A. FIELDING (Ball State University, Muncie, IN) Journal of Applied Physiology (ISSN 0161-7567), vol. 59, Nov. 1985, p. 1350-1354. Army-supported research. refs

**A86-16052** **THERMOREGULATORY AND BLOOD RESPONSES DURING EXERCISE AT GRADED HYPOHYDRATION LEVELS** M. N. SAWKA, A. J. YOUNG, R. P. FRANCESCONI, S. R. MUZA, and K. B. PANDOLF (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Journal of Applied Physiology (ISSN 0161-7567), vol. 59, Nov. 1985, p. 1394-1401. refs



A86-16053

**EFFECTS OF HEMODILUTION ON O<sub>2</sub> TRANSPORT IN HIGH-ALTITUDE POLYCYTHEMIA**

R. M. WINSLOW, C. C. MONGE, E. G. BROWN, H. G. KLEIN, F. SARNQUIST (PHS, Centers for Disease Control, Atlanta, GA; Universidad Peruana Cayetano Heredia, Lima, Peru; Mt. Sinai Medical Center, New York; National Institute of Health, Bethesda, MD; Stanford University, CA) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 59, Nov. 1985, p. 1495-1502. refs (Contract NSF INT-77-21795; NSF INT-80-07728)

A native of the Peruvian Andes (4,250 m) was studied before and after isovolemic hemodilution of the hematocrit from 62 to 42 percent. O<sub>2</sub> transport was studied with newly developed catheters in the radial and pulmonary arteries. These catheters allowed continuous measurement of arteriovenous O<sub>2</sub> content and intermittent cardiac output by thermodilution. During exercise tests, breath-by-breath gas exchange measurements also allowed cardiac output to be calculated by the O<sub>2</sub>-Fick technique. A complex series of interrelated physiological changes occurred in response to hemodilution. These included increased ventilation, increased arterial and mixed venous PO<sub>2</sub>, increased cardiac output (both heart rate and stroke volume), and improved ventilation-flow match. The general improvement in symptoms that followed hemodilution correlated well with increased anaerobic threshold and mixed venous PO<sub>2</sub> during exercise. Author

**N86-12377#** Tokyo Denki Univ. (Japan). Faculty of Engineering.

**EFFECTS OF CATION IONS IN NERVE EXCITATION**

K. AIHARA, M. KOTANI, and T. UTSUNOMIYA *In its Res. Rept. of the Faculty of Eng., Tokyo Denki Univ., No. 32* p 67-78 Dec. 1984 refs In JAPANESE; ENGLISH summary Avail: NTIS HC A09/MF A01

A bifurcation process of the self-sustained oscillation state of action potentials as a dissipative structure in squid giant axons is theoretically analyzed in relation to a nonequilibrium property inherent to biological membranes. A bifurcation diagram is numerically calculated by the use of the modified Hodgkin-Huxley equations which are derived by considering both an adaptation effect of axons and an effect of divalent cations upon membrane conductance. Further, the result is confirmed by the Hopf bifurcation theory. These analyses clarify the relations between the Hopf bifurcation of the dissipative structure with the limit cycle in squid giant axons and the nonequilibrium property of the ionic concentration differences across the membrane. Author

**N86-12458#** Joint Publications Research Service, Arlington, Va. **HUMAN HEMODYNAMIC CHANGE UNDER HIGH ATMOSPHERIC PRESSURE**

Z. HENGDU and D. DUANYANG *In its China Rept.: Sci. and Technol. (JPRS-CST-85-030)* p 55-56 4 Sep. 1985 Transl. into ENGLISH from *Jiefangjun Yixue Zazhi* (Beijing), no. 1, 20 Feb. 1985 p 63

Avail: NTIS HC A08/MF A01

For the purpose of observing human hemodynamic change under high atmospheric pressure, nontraumatic means were adopted to record sphygmograms during a 26 day continuous nitrogen-oxygen saturation dive simulation trial 36.5 m. The test subjects assumed a supine position and the sphygmogram was recorded on closed vessels on the left side using a mercurial sphygmomanometer to measure blood pressure in the arteria brachialis of the left arm. The data from the initial measurements was processed through electronic computer. The voluntary test subjects were seven young males averaging 22.6 + or - 3.9 years of age. The simulated pressure measured 4.65 ATA, cabin temperature was 26.05 + or - 0.8 deg C and relative humidity measured 70.3 + or - 0.9 percent. Differential pressure measured 0.31 + or - 0.08 ATA for oxygen, 0.002 ATA for carbon dioxide and 4.34 ATA for nitrogen. The subjects lived and worked under the above conditions for 26 continuous days and nights and underwent 4 days of decompression to return to normal pressure. The results of these tests are briefly described. Author

**N86-12954\*** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY CONTINUING BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY WITH INDEXES**

Oct. 1985 64 p  
(NASA-SP-7011(276); NAS 1.21:7011(276)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 184 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1985. F.M.R.

**N86-12955** Department of the Navy, Washington, D. C. **INFRARED OPTICAL MEASUREMENT OF BLOOD GAS CONCENTRATIONS AND FIBER OPTIC CATHETER Patent**

T. J. MANUCCIA and J. G. EDEN, inventors (to Navy) 9 Apr. 1985 7 p

(AD-D011836; US-PATENT-4,509,522; US-PATENT-APPL-SN-331091; US-PATENT-CLASS-128-634) Avail: US Patent and Trademark Office CSCL 06L

This patent pertains to a simple compact optical device and method for quickly measuring the concentration of CO and CO<sub>2</sub>, bound to hemoglobin or dissolved in a person's blood using optical techniques which do not require removing a blood sample from the body. It also provides a simple fiber optic device for measuring blood-gas concentrations of critical internal points of the circulatory system such as the aorta. GRA

**N86-12956\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**PLASMA VOLUME METHODOLOGY: EVANS BLUE, HEMOGLOBIN-HEMATOCRIT, AND MASS DENSITY TRANSFORMATIONS**

J. E. GREENLEAF and H. HINGHOFER-SZALKAY Nov. 1985 25 p refs

(NASA-TM-86834; REPT-85406; NAS 1.15:86834) Avail: NTIS HC A02/MF A01 CSCL 06P

Methods for measuring absolute levels and changes in plasma volume are presented along with derivations of pertinent equations. Reduction in variability of the Evans blue dye dilution technique using chromatographic column purification suggests that the day-to-day variability in the plasma volume in humans is less than + or - 20 ml. Mass density determination using the mechanical-oscillator technique provides a method for measuring vascular fluid shifts continuously for assessing the density of the filtrate, and for quantifying movements of protein across microvascular walls. Equations for the calculation of volume and density of shifted fluid are presented. E.A.K.

**N86-12957#** Department of the Army, Washington, D. C. **FORWARD FIELD AUTOTRANSFUSION DEVICE Patent Application**

E. I. SCHWEITZER and K. G. SWAN, inventors (to Army) 10 May 1985 12 p

(AD-D011763; US-PATENT-APPL-SN-732335) Avail: NTIS HC A02/MF A01 CSCL 06L

A typical embodiment of the invention enables blood to be drawn from the pleural cavity of an injured patient for autotransfusion purposes. A chest tube is connected to an inlet check valve within a resilient bulb suction pump. Blood, drawn into the bulb, is expelled therefrom by manipulating the bulb to cause the blood to flow out of the bulb through a filter and a discharge check valve to a blood collection bag. GRA

**N86-12958#** Department of the Army, Washington, D. C.

**SUTURE NEEDLE HOLDER Patent Application**

E. J. SCHWEITZER and J. R. BRESCH, inventors (to Army) 3 Jun. 1985 15 p

(AD-D011764; US-PATENT-APPL-SN-740610) Avail: NTIS HC A02/MF A01 CSCL 06L

A typical embodiment on the invention enables a surgeon to occupy only one hand in manipulating a suture needle. The instrument thumb handle has, on one end, a freely rotatable short

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roller. The ring finger handle, moreover, has a long roller that is journalled within that handle. One end of the long roller bears against the short roller to form a nip that engages the suture needle. The other end of the long roller terminates near the ring finger handle grip to enable the surgeon to rotate the long roller with another finger of the same hand and thereby draw the needle through the nip, repositioning the needle for another stitch. GRA

**N86-12959#** School of Aerospace Medicine, Brooks AFB, Tex.  
**PROCEEDINGS OF A WORKSHOP ON RADIOFREQUENCY RADIATION BIOEFFECTS HELD AT WACHTBERG-WERTHHOVEN, WEST GERMANY ON 11-13 SEPTEMBER 1984 Final Report**

J. C. MITCHELL Apr. 1985 241 p Presented at Workshop held at Wachtberg-Werthhoven, West Germany, 11-13 Sep. 1984 (Contract AF PROJ. 7757) (AD-A157090; USAFSAM-TP-85-14) Avail: NTIS HC A11/MF A01 CSCL 06R

The workshop was convened to address new developments in the setting and application of RFR (Radiofrequency Radiation) safety standards, assessment of RFR levels in the military environment, RFR instrumentation and dosimetry, the medical approach to specific problems, and important state-of-the-art research regarding the biological effects of long-term low-level RFR exposures, pulsed versus continuous wave effects, and the effects of unique pulse modulation. The collected papers represent the contributions of various experts in the field from the NATO countries, brought together under the the sponsorship of Defense Research Group, Panel 8, NATO AS/243, at the Research Establishment for Applied Science, D-5307 Wachtberg-Werthhoven, Federal Republic of Germany. GRA

**N86-12960#** Letterman Army Inst. of Research, San Francisco, Calif.

**ENERGY EXPENDITURE AND ACTIVITY PATTERNS OF CADETS AT THE UNITED STATES MILITARY ACADEMY, WEST POINT, NEW YORK Final Report, for Period Ending Oct. 1979**

M. J. KRETSCH, M. O. OCONNOR, and H. E. SAUBERLICH Jun. 1985 42 p (AD-A157857; LAIR-IR-200) Avail: NTIS HC A03/MF A01 CSCL 06P

A study was conducted in October, 1979, at the United States Military Academy, West Point, New York, to evaluate factors contributing to weight gain in cadets over the course of their academic career. This report presents the average daily energy expenditure (EE) and activity patterns of male and female cadets. A total of 136 male and 54 female cadets from the classes of 1980, 1981, 1982, and 1983 were studied. Five consecutive days (Wednesday through Sunday) of activity data were collected from each study participant by the factorial method. The average pattern of EE usage was similar between male and female cadets: about 20% at rest; 35 to 40% in very light activities; 5 to 10% in light activities; about 25% in moderate activities; and the remaining 5 to 15% in heavy or very heavy activities. Average energy expenditure when expressed as kcal/kg body weight was not significantly different between male and female cadets of the same class for weekdays or weekend days. There was a tendency for the cadets to become more sedentary with advance in class. This was more noticeable for the females than for the males. There was a significant decrease in weekday, but not weekend day, EE for the females with advance in class. This same decrease was not significant for the male cadets, but there was a weekday trend in that direction. For the females, the lower weekday EE for the 1980 and 1981 classes may be explained by the lower amount of energy and time spent in running and sports activities. Whether the decrease in weekday EE with advance in class is due to differences in program requirements should be examined. GRA

**N86-12961#** Brown Univ., Providence, R. I. Center for Neural Science.

**CORTICAL PLASTICITY: THEORETICAL ANALYSIS, EXPERIMENTAL RESULTS**

L. N. COOPER 31 Jul. 1985 34 p

(Contract N00014-81-K-0136)

(AD-A157965; TR-27) Avail: NTIS HC A03/MF A01 CSCL 06O

An account is given of a theory of and experimental results on development and modification of selectivity and ocular dominance in visual cortex. The single cell theory is generalized to be applicable to a neural network. Also discussed, in the context of the theoretical ideas, are experiments on the modifiability of inhibitory cells and on possible candidates for global controllers of learning. GRA

**N86-12962#** Department of the Army, Washington, D. C.  
**DERMAL SUBSTANCE COLLECTION DEVICE Patent Application**

C. C. PECK, inventor (to Army) 11 Feb. 1985 29 p

(AD-D011848; US-PATENT-APPL-SN-660778) Avail: NTIS HC A03/MF A01 CSCL 14B

This patent application describes a dermal substance collection device (DSCD) which provides means for the non-invasive, instantaneous and continuous monitoring of chemical substances which are present in a detectable amount in either or both interstitial fluid or sweat or which are on or in the skin. The transdermal substance collection device of this invention is comprised of three essential components: (1) a substance binding reservoir, wetttable by, (2) a liquid transfer medium which allows for liquid bridge transfer of a soluble substance from the skin surface to the binding reservoir by virtue of its wettability by the liquid, and (3) an occlusive cover. GRA

**N86-12963#** School of Aerospace Medicine, Brooks AFB, Tex.  
**THE EFFECTS OF HYPOXIA INDUCED BY LOW ATMOSPHERIC PRESSURE ON SOFT CONTACT LENS WEAR Final Report, 1 Jun. 1983 - 1 Jan. 1985**

W. J. FLYNN, R. E. MILLER, II, M. G. BLOCK, and T. J. TREDICI Jun. 1985 16 p

(Contract AF PROJ. 2729)

(AD-A158556; USAFSAM-TR-85-30) Avail: NTIS HC A02/MF A01 CSCL 06L

Contact lens use in aviation has long been a subject of debate and controversy. One of the major concerns for contact lens wear at altitude is the potential for corneal edema and subsequent visual degradation, due to the reduced levels of oxygen available for normal corneal metabolism. Four subjects were tested, wearing both high-and low-water content soft contact lenses, for visual changes and adverse corneal physiological responses due to hypoxia induced by an atmospheric pressure level equivalent to 10,000 ft. Results of this study indicate that, although the cornea is placed under higher levels of physiological stress at an altitude of 10,000 ft, the absence of visual degradation or significant symptoms suggests that lenses can be safely worn under the conditions of this study. Author (GRA)

**N86-12964#** National Academy of Sciences - National Research Council, Washington, D. C.

**STUDIES OF PARTICIPANTS IN NUCLEAR TESTS Final Report, 1 Sep. 1978 - 31 Oct. 1984**

C. D. ROBINETTE, S. JABLON, and T. L. PRESTON May 1985 102 p refs

(Contract DE85-AI08-78EV-01577)

Avail: NTIS HC A06/MF A01

Mortality, by cause of death, was studied on a cohort of 46,186 participants in one or more of five test series. The series studied were UPSHOT-KNOTHOLE (1953) and PLUMBBOB (1957) at the Nevada Test Site, and GREENHOUSE (1951), CASTLE (1954), and REDWING (1956) which were conducted at the Pacific Proving Ground at Enewetak and Bikini. The number of deaths attributed to particular causes was compared with the number expected to occur at US cause and age-specific mortality rates. A total of

5113 deaths from all causes was ascertained; this was 11.1% of the number of participants. The number was, however, only 83.5% of the number expected at US mortality rates. Mortality from leukemia among the 3554 participants at SMOKY - 10 deaths below age 85 - were 2.5 times the expected number. When the leukemia deaths are compared to other deaths in all six data sets, the differences among the series are not significant. No cancer other than leukemia was ascertained to have occurred in significant excess among SMOKY participants and the number of deaths from other cancers (67) was less than the number expected at population rates (83.8). The total body of evidence cannot convincingly affirm or deny that the higher than statistically expected incidence of leukemia among SMOKY participants (or of prostate cancer among REDWING participants) is the result of radiation exposure incident to the tests. DOE

**N86-12965#** Pacific Northwest Lab., Richland, Wash.  
**ACCIDENTAL EXPOSURE TO AMERICIUM**  
 K. R. HEID Apr. 1985 13 p refs Presented at the Health Phys. Summer School Conf., Evanston, Ill., 3 Jun. 1985 (Contract DE-AC06-76RL-01830) (DE85-012794; PNL-SA-13155; CONF-8506136-1) Avail: NTIS HC A02/MF A01

An accident in which a 64 year old Hanford nuclear worker was exposed to high levels of americium while working in an americium recovery facility in 1976 is described. As a result of the accident, he was heavily externally contaminated with americium, sustained with a substantial internal deposition of this isotope, and was burned with concentrated nitric acid and injured by flying debris about the face and neck. The immediate and longer term treatment given the patient, including the decontamination efforts and clinical laboratory studies, are discussed. Special in vivo equipment and techniques were used to measure the americium deposited in the patient. These and subsequent in vivo measurements were used to estimate the dose rates and the accumulated doses to body organs. Urinary and fecal excreta were collected and analyzed for americium content. The interpretation of these data was complicated by the fact that the intake resulted both from inhalation and from solubilization of the americium embedded in facial tissues as a result of the accident. A total of 1100 (MU)Ci was excreted in urine and feces during the first 2 years following the accident. The long term use of diethylenetriaminepentaacetic acid (DTPA), used principally as the zinc salt, is discussed including the method, route of administration, and effectiveness. To date, the patient has apparently experienced no complications attributable to this extensive course of therapy, even though he was given approximately 560 g of DTPA. DOE

**N86-12966#** Joint Publications Research Service, Arlington, Va.  
**CHINA REPORT: SCIENCE AND TECHNOLOGY**  
 18 Jun. 1985 117 p refs Transl. into ENGLISH from various Chinese articles (JPRS-CST-85-019) Avail: NTIS HC A06/MF A01

Progress in science and technology in the People's Republic of China is reported. Topics discussed include: national developments, life sciences, biochemistry, biology, cement industry, chemistry, computers, engineering, industrial hygiene, medical science, microbiology, pharmacology, radiology, semiconductor materials, and telecommunications.

**N86-12967#** Joint Publications Research Service, Arlington, Va.  
**PROTECTION OF EYES AGAINST LASER DAMAGE STUDIED**  
 G. CHONGWEN, W. RONGZHEN, and J. HUMEI *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-019) p 41-48 18 Jun. 1985 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), no. 2, 20 Feb. 1985 p 113-117 Avail: NTIS HC A06/MF A01

The potential hazards of lasers were analyzed in eye injuries caused by lasers. Hygienic physical experiments were performed on reflected laser light from hitting spots which caused most eye injuries. Measures for the protection of eyes against laser damage are discussed. E.A.K.

**N86-13886\*#** National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,  
**ENDOCRINE AND FLUID METABOLISM IN MALES AND FEMALES OF DIFFERENT AGES AFTER BEDREST, ACCELERATION AND LOWER BODY NEGATIVE PRESSURE**  
 C. S. LEACH, J. VERNIKOS-DANELIS (NASA. Ames Research Center), J. M. KRAUHS (Northrop Services, Inc., Houston, Tex.), and H. SANDLER (NASA. Ames Research Center) Nov. 1985 52 p refs (NASA-TM-58270; S-550; NAS 1.15:58270) Avail: NTIS HC A04/MF A01 CSCL 06S

Space shuttle flight simulations were conducted to determine the effects of weightlessness, lower body negative pressure (LBNP), and acceleration of fluid and electrolyte excretion and the hormones that control it. Measurements were made on male and female subjects of different ages before and after bedrest. After admission to a controlled environment, groups of 6 to 14 subjects in the age ranges 25 to 35, 35 to 45, 45 to 55 to 65 years were exposed to +3 G sub z for 15 minutes (G1) and to LBNP (LBNP1) on different days. On 3 days during this prebedrest period, no tests were conducted. Six days of bedrest followed, and the G sub z (G2) and LBNP (LBNP2) tests were run again. Hormones, electrolytes, and other parameters were measured in 24-hour urine pools throughout the experiment. During bedrest, cortisol and aldosterone excretion increased. Urine volume decreased, and specific gravity and osmolality increased. Urinary electrolytes were statistically unchanged from levels during the non-stress control period. During G2, cortisol increased significantly over its control and bedrest levels. Urine volume, sodium, and chloride were significantly lower; specific gravity and osmolality were higher during the control period or bedrest. The retention of fluids and electrolytes after +G sub z may at least partially explain decreased urine volume and increased osmolality observed during bedrest in this study. There were some who indicated that space flight would not affect the fluid and electrolyte metabolism of females or older males any more severely than it has affected that of male astronauts. Author

**N86-13887#** Army Research Inst. of Environmental Medicine, Natick, Mass.  
**THE EFFECT OF SPIRONOLACTONE ON THE CARDIOCIRCULATORY RESPONSES TO UPRIGHT TILT AT SEA LEVEL AND AT SIMULATED HIGH ALTITUDE**  
 C. S. FULCO, R. LARSEN, P. B. ROCK, A. J. YOUNG, and A. CYMERMAN 19 Jun. 1985 18 p (Contract DA PROJ. 3E1-62777-A-879) (AD-A157734; USARIEM-M33/85) Avail: NTIS HC A02/MF A01 CSCL 06O

The objective of this study was to determine if spironolactone (S) alters the cardiocirculatory responses to upright tilt at sea level (SL;50m) and during 44 hours of simulated altitude (HA;4600m). In a double-blind, crossover-designed study, 9 male subjects (age range: 18 to 25 years) received 25 mg orally, 4x/day of either S or an identically-appearing placebo (P) 2 days prior to and during HA. The crossover was separated by two weeks. Heart rate, stroke volume, cardiac output, calf blood flow, total peripheral resistance and system blood pressure were obtained during supine rest and after 10 minutes of 60 degree head-up tilt using an impedance monitor and an electro-sphygmomanometer. Twenty-four hour determinations of urinary volume, sodium and potassium, as well as venous plasma values for sodium, potassium and chloride were obtained daily. There were no statistically significant differences between P and S treatment periods for: caloric, electrolytes; of fluid ingestion; urinary volume or electrolytes; plasma electrolytes; or any of the cardiocirculatory parameters measured in the supine or upright position at SL or during HA. It was concluded that S did not induce a significant diuresis or significantly alter vascular responsiveness to negatively effect the normal cardiocirculatory responses to upright tilt at sea level or simulated high altitude. GRA

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**N86-13888#** School of Aerospace Medicine, Brooks AFB, Tex.  
**INTERACTIVE SCENARIO COMPUTER MODEL FOR DOSE RATES TO AIRCREWS IN FLIGHT THROUGH NUCLEAR DEBRIS CLOUDS Final Report, Dec. 1981 - Oct. 1984**

J. TABOADA, D. HEGEDUSICH, and E. L. BELL Jul. 1985 18 p  
(AD-A158741; USAFSAM-TR-85-49) Avail: NTIS HC A02/MF A01 CSCL 06R

An interactive computer model is described for the rapid calculation of gamma radiation doses to aircrews in hypothetical flights through nuclear debris clouds. The model is based on CASSANDRA, a U.S. army developed code for dust concentration calculations at loci through such a cloud. The present model computes local radiation dose integrals along a user-specified flight path. It is designed for efficient interactive operation on a Digital Equipment Corporation Model VAX 11/780 computer. GRA

**N86-13889#** Northwestern Univ., Evanston, Ill.  
**ENHANCING SENSITIVITY TO VISUAL MOTION AND ENHANCING VISUAL SENSITIVITY Interim Report, 1 Oct. 1981 - 30 Sep. 1983**

R. SEKULER 4 Jun. 1985 28 p  
(Contract AF-AFOSR-0246-80)  
(AD-A158800; AFOSR-85-0668TR) Avail: NTIS HC A03/MF A01 CSCL 06P

This report describes progress made from October 1, 1981 to September 30, 1983. During this period work proceeded on three main lines of study: (1) various aspects of visual motion perception, (2) collaborative work on contrast sensitivity and pilots' performance in aircraft simulators, and (3) individual differences in responses to temporal transients. The most extensive of the three work-units dealt with motion perception by human observers. The main findings include the following: (1) Perceived speed of a moving target varies with that target's contrast and retinal eccentricity. In particular, many targets undergo illusory slowing when they appear in the periphery in the visual field, (2) detection of a moving target is often dissociated from the ability to identify the direction in which the target moves. In particular, the accuracy with which target direction can be judged, even for highly visible targets, seems to be far less good than previously suspected, (3) relatively small amounts of training can significantly improve an observer's ability to discriminate between two highly similar directions of target motion. Moreover, this effect is well-restricted to the training direction and other, similar directions; the training effect is retained without decrement for at least two months. The results suggest that this improvement with training represents a genuine change in visual function. GRA

**N86-13890#** Air Force Human Resources Lab., Brooks AFB, Tex.

**PILOT-ORIENTED PERFORMANCE MEASUREMENT Final Report, Jan. - Dec. 1983**

J. DEMAIO, H. H. BELL, and J. BRUNDERMAN Aug. 1985 15 p  
(Contract AF PROJ. 2313)  
(AD-A158849; AFHRL-TP-85-18) Avail: NTIS HC A02/MF A01 CSCL 14B

Aircrew performance measurement is a critical problem in evaluating the quality of a visual simulation system and in determining the effectiveness of aircrew training devices. An effective performance measurement system must be able to separate performance into appropriate components and describe the relationship of these components. This paper describes a performance measurement system developed to analyze pilot performance in maintaining altitude in both straight and turning flight as a function of the object density of the simulated visual environment. The analysis indicates that pilot performance can be divided into perceptual and task difficulty factors and that the effect of the visual environment on each of these factors can be determined. A prototype performance measurement system was developed to describe pilot performance in a simulator. The pilot's task was to maintain altitude at 200 feet both in straight and in turning flight. Pilot performance was sensitive to task difficulty

and to visual scene quality. The strength of this performance measurement system was that it analyzed performance in terms of overall task performance and also specific pilot control inputs.

GRA

**N86-13891#** Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.

**HEALTH HAZARD EVALUATION OF LIQUID MONOPROPELLANTS. PHASE 5: COMPARATIVE INHALATION TOXICITIES OF LGP 1776, LGP 1845, AND HAN (HYDROXYLAMMONIUM NITRATE) Final Report**

H. L. SNODGRASS, JR. Jun. 1985 33 p  
(AD-A159090; USAEHA-75-51-0132-85) Avail: NTIS HC A03/MF A01 CSCL 06T

A comparison of the inhalation toxicities of two liquid gun propellant (LGP) formulations, LGPs 1776 and 1845, was made using rats. Also assessed was the major chemical component of each, hydroxylammonium nitrate (HAN). Rats exposed to saturated vapors of the two LGPs for 8 hours were unaffected. Following single acute aerosol exposures, LGP 1845 was more toxic, with deaths occurring at concentrations of 1350 to 1603 mg/cu m. After 5 or 10 daily aerosol exposures to the three formulations, comparable dose-dependent effects were noted. These included hematological, organ-to-body weight ratio, and pathological changes, generally at the highest exposure level of 600 mg/cu m. It is concluded that acute exposures to LGP vapors should not be hazardous to man. Also inferred is that the effects of repeated, sublethal exposures to LGPs 1776 and 1845 are quantitatively similar to those observed with HAN, the major chemical component. GRA

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### BEHAVIORAL SCIENCES

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

**A86-13569**

**MOURNING AND TRAUMATIC NEUROSES - CLINICAL ASPECTS AND AERONAUTICAL INCIDENTS FOR ONE HELICOPTER PILOT [DEUIL ET NEVROSE TRAUMATIQUE - ASPECTS CLINIQUES ET INCIDENCES AERONAUTIQUES CHEZ UN PILOTE D'HELICOPTERE]**

J. C. DUBOIS-BONNEFOND (Armee de l'Air, Centre Medical de Psychologie Clinique, Paris, France) *Medecine Aeronautique et Spatiale*, vol. 24, 3rd Quarter, 1985, p. 155-158. In French. refs

The case history of the onset, progression, diagnosis and analysis of the traumatic neuroses which rendered a military helicopter pilot unable to continue flying are summarized in terms of general principles. The trauma was initiated by the deaths of several other pilots in the same squadron due to air accidents. The pilot eventually could not handle his own aircraft, had continuous nightmares about death and helicopters, and began expressing guilt for his friends' deaths. He became aggressive toward superiors and was relieved of flight duty, after which the anguish-driven behavior patterns diminished, followed by depression. The application of a number of personality profile tests supported previous speculation that a pilot's professional attitude and ignorance of death actually suppresses a continuous awareness of death. Life events, on or off duty, which expose the pilot to the reality of death remove the psychic barriers to the continuous perception of terminal hazards faced by pilots. The pilot may then need to be retrained for some other task. M.S.K.

A86-13943#

**PSYCHOLOGICAL STATES OF STUDENT PILOTS IN FLIGHT TRAINING**

M. OKAUE and Z. TAKASHIMA Japan Air Self Defence Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 26, June 1985, p. 67-79. In Japanese, with abstract in English. refs

Questionnaire responses from 83 Japanese flight students were analyzed in order to evaluate the psychological state of the inexperienced pilot in flight. The distribution of flight experience in the class was: 33 primary level students; 26 students in the middle grades; and 24 advanced students. The effect of classroom performance on the prevalence of anxiety among the students is discussed. Attention is given to some of the psychological pressures contributing to pilot errors, including missed approaches; spin; and off runway landings. I.H.

A86-13944#

**CHANGES OF FLYING SKILLS DURING NON-FLIGHT PERIODS**

Z. KATOH, A. KADOO, Y. NAGASAWA, T. OBATA, and N. IGUCHI Japan Air Self Defence Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 26, June 1985, p. 81-104. In Japanese, with abstract in English. refs

Flight data from 28 training pilots were analyzed with respect to changes in flying skill during non-flight periods. On board flight data recordings and questionnaires concerning the self-estimation of pilot skill were evaluated with respect to three maneuvers: vertical S-Alpha (VSA); a steep turn (STP); and a horizontal turn (HRZ). A brief summary of the results is provided. I.H.

A86-14143

**THE PERCEPTION OF MOTION DURING COLINEAR EYE MOVEMENTS**

H. WALLACH, D. NITZBERG (Swarthmore College, PA), and R. BECKLEN (Sarah Lawrence College, Bronxville, NY) Perception and Psychophysics (ISSN 0031-5117), vol. 38, no. 1, July 1985, p. 18-22. refs

(Contract NSF BNS-83-18772)

When the eyes are engaged in pursuit movements, the image of a stationary object shifts on the retina, but such a target is either perceived as stationary or seems to move only little. This is the result of a compensation process called position constancy, which takes the eye movements into account. Becklen, Wallach, and Nitzberg (1984) reported that position constancy does not operate when the target undergoes a motion of its own, in a direction that differs from the direction of the eye movements. Other findings have indicated that position constancy has an effect when the target motion is colinear with the eye movements, but the accuracy with which it then operates has not been known. How correctly motions that were colinear with eye movements were perceived is measured and it is found that the extents of target motions were accurately perceived when they were in the same direction as the eye movement, but that position constancy showed a small, but distinct, lag when eye-movement and target motions were in opposite directions. Author

A86-14321

**PHYSIOLOGICAL REFLECTIONS OF MENTAL WORKLOAD**

P. A. HANCOCK, N. MESHKATI, and M. M. ROBERTSON (Southern California, University, Los Angeles) Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1110-1114. refs

Results of studies of the effect of mental workload on the major physiological responses (e.g., the auditory canal temperature, ACT; galvanic skin response, GSR; electrocardiogram, ECG; heart rate variability, HRV; event-related potentials, ERP; flicker and critical fusion frequencies, FFs; muscle tension, MT; respiration, R; body fluid responses, BF; etc.) are presented. The differing physiological measures were plotted in a two-dimensional space, the x-axis of which represented relevance to actual central nervous system (CNS) activity, while the y-axis, the measure, low or high of practical application (P). The measurements of HRV and ACT were the most practical parameters, whereas the ERP are rated

as the most superior indices of CNS activity. ECG, GSR and FF rated lowest on the CNS axis. ACT is discussed as a potential optimal composite measure. I.S.

A86-14575#

**A STUDY OF THE PSYCHOPHYSICAL MEASUREMENT ON FLUCTUATING SOUND BY A STOCHASTIC APPROXIMATION METHOD**

H. KADO Electrotechnical Laboratory, Researches (ISSN 0366-9106), no. 852, March 1985, 80 p. In Japanese, with abstract in English. refs

The loudness and perceived rate of fluctuating sound are studied. The psychophysical measurement of fluctuating sound is discussed, and an adaptive psychophysical measurement method is developed and evaluated theoretically. This method consists of an adaptive searching method applying stochastic approximation to obtain the response to the presented stimuli using a step-by-step procedure, and a numerical searching method in nonlinear problems to estimate unknown parameters numerically. The loudness of Gaussian fluctuating sound is measured, and the perceived rate of the fluctuating envelope is determined. The correlation of the fluctuating sound value to psychological effects is addressed. The results can be used to construct a loudness meter. C.D.

A86-15524

**THE EFFECT OF HIGH SPATIAL FREQUENCIES ON VISUAL RECOGNITION PROCESSES [VLIANIE VYSOKIKH PROSTRANSTVENNYKH CHASTOT NA PROTSSESSY ZRITEL'NOGO RASPOZNAVANIYA]**

E. D. BORISOVA and O. P. TAIROV (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 71, Sept. 1985, p. 1067-1071. In Russian. refs

The effect of optical filtering (OF) of the high-frequency component from the spatial-frequency spectra of numerical images on the probability of recognition was studied in healthy right-handed subjects. Exposition time was varied from 20 msec to 1000 msec, and recordings were made of the correctness of answers, the latency of the answer periods, and the changes in the time-amplitude characteristics of the visual evoked potential (EP) in the occipital O1 and O2 area leads. Defocussing of the images by OF led to a decrease in recognition probability and in the amplitudes of negative (N1) and positive (P2) waves of the late phases of EPs. As the extreme spatial frequency of the image increased, the spike latencies of the N1 wave increased, and those of the P2 wave decreased. It is suggested that the N1 wave reflects the activation of selectively set spatial frequency filters of the visual sensory system, while the P2 wave reflects decision-making processes in recognition. I.S.

A86-15831#

**THE VISUAL STRESS MODEL - A PSYCHO-PHYSIOLOGICAL METHOD FOR THE EVALUATION OF OPERATIONAL RELIABILITY OF PILOTS AND COSMONAUTS**

H. HAASE and H. KAMMEL (Gesellschaft fuer Weltraumforschung und Raumfahrt, Berlin, East Germany) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 23 p.

(IAF PAPER 85-326)

A psychophysiological investigative method for evaluating visual-cognitive performance preconditions and operational reliability is presented. The method applies reafferent stress which expresses typical aspects of information processing in the cockpit. Changes in operational, psychological, and physiological parameters before, during, and after the test stress are recorded simultaneously. Psychological question blanks before and after the test are used to record stress-implicated changes in the state of subjective feelings. The test results are useful for the dynamic evaluation of operational performance, the physiological reaction profile, the dimensions of the experienced stress, and the efficiency of coping with test requirements. C.D.



**N86-12968#** Air Command and Staff Coll., Maxwell AFB, Ala.  
**THE HELICOPTER TO FIXED WING CONVERSION PROGRAM:  
 A CRITICAL REVIEW**

L. T. MASSEY Apr. 1985 39 p  
 (AD-A156820; ACSC-85-1750) Avail: NTIS HC A03/MF A01  
 CSCL 05J

USAF helicopter pilots are initially trained by the U.S. Army through their undergraduate helicopter pilot training program. Four to seven years later, some of these pilots have the opportunity to convert to fixed wing aircraft via the fixed wing conversion program currently conducted by sending selected helicopter pilots through Air Force undergraduate pilot training. This study reviews these programs and assesses the impact this training philosophy has on career opportunities for helicopter pilots, both for those who convert to fixed wing systems, as well as for those who remain in helicopters. Two alternatives are presented which would resolve the problems identified. The study concludes that the USAF could provide better career opportunities for helicopter pilots, as well as improve experience levels in the helicopter force, by enacting changes to current training programs. Author (GRA)

**N86-12969#** Chicago Univ., Ill. Graduate School of Business.  
**STIMULUS STRUCTURES AND MENTAL REPRESENTATIONS  
 IN EXPERT COMPREHENSION OF COMPUTER PROGRAMS**  
**Technical Report, Sep. 1982 - Jan. 1985**

N. PENNINGTON Jan. 1985 110 p  
 (Contract N00014-82-K-0759)  
 (AD-A157520; TR-2-ONR) Avail: NTIS HC A06/MF A01 CSCL  
 05J

The difficulty of computer programming and other design tasks is a function of the multiple abstractions that combine to form a program's meaning. Thus, comprehension of the final form of a program design, the program text, involves retrieving multiple sets of relationships between parts. The research presented here addresses which, if any, abstraction is dominant psychologically in programmers' mental representation of programs, specifically whether procedural (control flow) or functional (goal hierarchy) abstractions dominate, and the relative ease or difficulty of inferring different kinds of information from the text. Eighty professional programmers were tested on comprehension and recognition of short program texts. The results, which suggest that procedural rather than functional units form the basis of expert programmers' mental representations, support work in other areas of test comprehension showing the importance of test structure knowledge in understanding. The results also raise questions concerning claims that chunking found in comprehension and memory tasks in skilled problem solving domains is due to pattern matching to schematic content knowledge rather than to knowledge of more abstract text or design structure units. GRA

**N86-12970#** California Univ., San Diego, La Jolla. Inst. for  
 Cognitive Science.

**HUMAN COGNITION AND PERFORMANCE Final Report, Apr.  
 1979 - Mar. 1985**

D. A. NORMAN, D. E. RUMELHART, and D. R. GENTNER 1  
 May 1985 101 p  
 (Contract N00014-79-C-0323)  
 (AD-A157665) Avail: NTIS HC A06/MF A01 CSCL 05J

The Cognitive Science Laboratory is a part of both the Institute for Cognitive Science and the Center for Human Information Processing at their University of California, San Diego. Work in the laboratory is aimed at developing a deeper understanding of the theory and applications of human information processing. The research aims of the laboratory are broad, but all the work follows a common theoretical view of cognition, providing a cohesion that binds the separate studies together, despite the apparent wide differences in content. All of the work can be characterized as being Studies of Human Cognition. This is the main focus of the laboratory's efforts, and over the years the work has covered in-depth problems within the areas of perception, attention, learning, memory, language, thought, and action. Special emphasis has been placed on knowledge representation, and one major contribution of the laboratory has been within the area: The representational

structure known as Active Structural Networks. Work in this general area is always in process elaborated and modulated by the results and progress of work in the speciality areas. Three speciality areas can be talked about separately. GRA

**N86-12971#** Navy Personnel Research and Development Center,  
 San Diego, Calif.

**A NEW HAZARD FUNCTION ESTIMATOR OF PERFORMANCE  
 TIME Technical Report, Oct. 1983 - Jul. 1984**

B. BLOXOM Nov. 1984 35 p  
 (AD-A157843; NPRDC-TR-85-10) Avail: NTIS HC A03/MF A01  
 CSCL 05J

The analysis of performance time is used to study a wide variety of manpower, training, and human factors problems in the Navy. The cumulative distribution of performance time provides some indication of the rate of performance, but it can lead to false conclusions as well. One method of measuring the rate of performance with a shifting residual basis of analysis, called hazard analysis, consists of estimating a hazard function, which shows the rate of performance as a function of time. Although various procedures have been developed for estimating a hazard function, none of the procedures has been shown to produce plausibly smooth and precise estimates under a variety of conditions. This research proposed a constrained quadratic spline as an estimator or the hazard function of performance time. A maximum penalized likelihood procedure was used to fit the estimator to a sample of psychological response times. The procedure was also used in a simulation study of the precision of the estimator. GRA

**N86-12972#** Illinois Univ., Urbana. Computer-based Education  
 Research Lab.

**DIAGNOSING COGNITIVE ERRORS: STATISTICAL PATTERN  
 CLASSIFICATION AND RECOGNITION APPROACH**

K. K. TATSUOKA Jan. 1985 36 p  
 (Contract N00014-82-K-0604; RR0-4204)  
 (AD-A158108; IU-CERL-RR-85-1-ONR) Avail: NTIS HC A03/MF  
 A01 CSCL 05J

This paper introduces a probabilistic model that is capable of diagnosing and classifying cognitive errors in a general problem-solving domain. The model is different from the usual deterministic strategies common in the area of artificial intelligence because the item response theory is utilized for handling the variability of response errors. As for illustrating the model, the dataset obtained from a 38-item fraction addition test is used, and the students' responses are classified into 34 groups of misconceptions. These groups are predetermined by the result of an error analysis previously done, and validated with the error diagnostic program written by a typical formal logic approach. GRA

**N86-13892\*#** National Aeronautics and Space Administration,  
 Langley Research Center, Hampton, Va.

**EFFECTS OF DIGITAL ALTIMETRY ON PILOT WORKLOAD**

R. L. HARRIS, SR. and B. J. GLOVER Nov. 1985 20 p refs  
 (NASA-TM-86424; L-15989; NAS 1.15:86424) Avail: NTIS HC  
 A02/MF A01 CSCL 05H

A series of VOR-DME instrument landing approaches was flown in the DC-9 full-workload simulator to compare pilot performance, scan behavior, and workload when using a computer-drum-pointer altimeter (CDPA) and a digital altimeter (DA). Six pilots executed two sets of instrument landing approaches, with a CDPA on one set and a DA on the other set. Pilot scanning parameters, flight performance, and subjective opinion data were evaluated. It is found that the processes of gathering information from the CDPA and the DA are different. The DA requires a higher mental workload than the CDPA for a VOR-DME type landing approach. Mental processing of altitude information after transitioning back to the attitude indicator is more evident with the DA than with the CDPA. E.A.K.

**N86-13893#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

**HYPOTHESIZING AND REFINING CAUSAL MODELS**

R. J. DOYLE Dec. 1984 109 p

(Contract N00014-80-C-0505; NR PROJ. RR0-1408)

(AD-A158165; AI-M-811) Avail: NTIS HC A06/MF A01 CSCL 06D

An important common sense competence is the ability to hypothesize causal relations. This paper presents a set of constraints which make the problem of formulating causal hypotheses about simple physical systems a tractable one. The constraints include: (1) a temporal and physical proximity requirement; (2) a set of abstract causal explanations for changes in physical systems in terms of dependences between quantities; and (3) a teleological assumption that dependences in designed physical systems are functions. These constraints were embedded in a learning system which was tested in two domains: a sink and a toaster. The learning system successfully generated and refined naive causal models of these simple physical systems. The causal models which emerge from the learning process support causal reasoning explanation, prediction, and planning. Inaccurate predictions and failed plans in turn indicate deficiencies in the causal models and the need to reypothesize. Thus, learning supports reasoning which leads to further learning. The learning system makes use of standard inductive rules of inference, as well as the constraints of casual hypotheses to generalize its casual models. Finally, a simple example involving an analogy illustrates another way to repair incomplete causal models. GRA

**N86-13894#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

**GENERATING AND GENERALIZING MODELS OF VISUAL OBJECTS Memorandum Report**

J. H. CONNELL and M. BRADY Jul. 1985 26 p

(Contract N00014-80-C-0505; N00014-77-C-0389)

(AD-A158197; AI-M-823) Avail: NTIS HC A03/MF A01 CSCL 06D

We report on initial experiments with an implemented learning system whose inputs are images of two-dimensional shapes. The system first builds semantic network descriptions of shapes based on Brady's smoothed local symmetry representation. It learns shape models from them using a substantially modified version of Winston's ANALOGY program. A generalization of Gray coding enables the representation to be extended and also allows a single operation, called ablation, to achieve the effects of many standard induction heuristics. The program can learn disjunctions, and can learn concepts using only positive examples. We discuss learnability and the pervasive importance of representational hierarchies. GRA

**N86-13895#** Washington Univ., St. Louis, Mo. Behavior Research Lab.

**A PSYCHOPHYSIOLOGICAL MAPPING OF COGNITIVE PROCESSES Annual Report, 1 Mar. 1984 - 28 Feb. 1985**

R. GOLDSTEIN, J. STERN, and L. BAUER 30 Apr. 1985 49 p

(Contract F49620-83-C-0059)

(AD-A158732; REPT-0059-85-1; AFOSR-85-0664TR; AR-2)

Avail: NTIS HC A03/MF A01 CSCL 05J

The experiment was concerned with the effects of varied cognitive and perceptual (i.e., monitoring) demands on patterns of physiological responding. Cognitive demands were varied by manipulating the number of letters (1, 3, or 5) comprising a briefly-presented set which the subject was instructed to encode, rehearse, and, 5 sec later, compare to a single test letter. Perceptual demands were varied by presenting the subject with a cue stimulus 5 sec prior to the set, informing him of the number of letters contained therein. Several physiological measures were recorded, including HR, EOG and probe evoked potentials sampled from the intervals preceding and following the letter set, and task evoked potentials and blinks elicited by the cue, letter set, and test stimuli. Performance data, i.e., RT and error rates, were also recorded. GRA

**N86-13896#** Smith-Kettlewell Inst. of Visual Sciences, San Francisco, Calif.

**THE SPATIAL AND TEMPORAL PARAMETERS OF VELOCITY DISCRIMINATION Annual Report, 1 Apr. - 30 Sep. 1984**

S. P. MCKEE 20 Dec. 1984 8 p

(Contract AF-AFOSR-0345-82)

(AD-A158735; AFOSR-85-0572TR) Avail: NTIS HC A02/MF A01 CSCL 06P

The target duration required for the precise discrimination of velocity is quite short, amounting to about 100 msec for a single moving dot or line target. While stroboscopic motion is an adequate substitute for continuous motion in velocity discrimination, optimal discrimination depends on the use of a strobe rate greater than 10 Hz. Generally, human observers have difficulty detecting acceleration in moving targets. Over small distances (0.5 to 1 deg), timing signals from adjacent targets presented in a sequence are pooled, so that information about their relative onset time is lost. For example, given three adjacent lines, separated spatially by 0.1 deg and presented in a sequence (apparent motion) observers are unable to discriminate between a sequence in which a 10 msec interval separates the second from the reverse order (30 msec followed by 10 msec). Velocity discrimination is not affected by blur. Sinusoidal grating targets of 3 cycles per degree or lower produce excellent discrimination. Sinusoidal gratings above 3 cycles per degree in spatial frequency are not adequate for fast velocities (> 1 deg/sec). GRA

**N86-13897#** Illinois Univ., Champaign. Cognitive Psychophysiology Lab.

**THE EVENT RELATED BRAIN POTENTIAL AS AN INDEX OF INFORMATION PROCESSING, COGNITIVE ACTIVITY, AND SKILL ACQUISITION: A PROGRAM OF BASIC RESEARCH Final Report, 1 Sep. 1983 - 31 Aug. 1984**

E. DONCHIN, C. WICKENS, and M. G. H. COLES 28 Feb. 1985 774 p

(Contract F49620-83-C-0144)

(AD-A159118; CPL-85-1; AFOSR-85-0662TR) Avail: NTIS HC A99/MF A02 CSCL 05J

We review a program of research designed to understand the event-related brain potential (ERP) so that it can be used as a tool in the study of cognitive function and in the assessment of man-machine systems. We have conducted a series of studies on the functional significance of ERPs and have demonstrated that the P300 component is related to memory processes. We have used measures of the same component to evaluate workload, to time mental processes, to study the reciprocity of processing resources, and to extend theories of human information processing. We have also made technical advances in the analysis of the distribution of electrical potentials across the scalp. GRA

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

**A86-13223**

**ASPECTS OF OPERATOR INTERFACE DESIGN FOR AN AUTOMATIC TRACKING ANTENNA CONTROLLER**

K. E. DEBRUNNER (Dyn-Opus, Inc., Simi Valley, CA) IN: ITC/USA/'84; Proceedings of the International Telemetry Conference, Las Vegas, NV, October 22-25, 1984. Research Triangle Park, NC, Instrument Society of America, 1984, p. 315-326.

Features of the operator interface and automation of the ACU-6 Antenna Controller are described. Consideration was given to the man-machine interface as a first step, followed by the hardwiring behind the control panel. The human-factors approach accounted

for the panel ergonomics, the antenna control requirements, and the breakdown or combination of individual information displays and control input devices. The use of color was maximized and the degree of clutter was minimized, the latter partially by grouping related functions in horizontal rows for ease of learning and use. Attention and fatigue is aided by color, flash sequences and timing and multifunction switches. The software logic interface was made error-tolerant to offset inputs which conflict with operational functions. M.S.K.

**A86-13263****HUMAN FACTORS IN AVIATION. III - SOME CONTEMPORARY ISSUES**

E. EDWARDS Aerospace (UK) (ISSN 0305-0831), vol. 12, Oct. 1985, p. 14-19. refs

The balance between human and mechanical factors in aviation is studied. On the flight deck the tasks allocated to machines include flight guidance, changes in power settings, and routine communication functions. The crew is responsible for overall system management because of the human capabilities of strategic decision making. The training of the pilots, in order for them to be able to operate the modern equipment and to have basic control of the aircraft using simple techniques, is discussed. Advanced electronic devices which display information such as CRT, EL, LED, and LCD, and the creation of alphanumeric symbols using various character fonts such as dots, 7-bar characters, and 16-segment bars are described. The importance of luminance, contrast ratio, resolution, color, viewing distance, view angle, and lighting levels in improving legibility of the displayed data is analyzed. The need for continuing the study of aviation ergonomics is discussed. I.F.

**A86-13570****INTERMEDIATE COLLIMATION: DESCRIPTION - GOALS - FIRST RESULTS [LA COLLIMATION INTERMEDIAIRE: DESCRIPTION - BUTS - PREMIERS RESULTATS]**

J.-P. MENU, J.-M. SEIGNEUR, D. BATEJAT, S. PREDELLA, and B. BARRAULT (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Laboratoire Central de Biologie Aerospatiale, Paris, France) Medecine Aeronautique et Spatiale, vol. 24, 3rd Quarter, 1985, p. 158-161. In French.

Intermediate collimation refers to placing an image between 60 cm and infinity in the field of vision. For pilots, the image is projected beyond the HUD, and thereby at a position of fixed collimation. Vision is then fixed at infinity most of the time. The adaptation times for vision between the HUD and head-down displays and between the HUD and the exterior view are then significant. Accommodation is controlled by the action of the Zinn zonules in deforming the lens of the eye to place the image on the retina. The accommodation times can only be measured indirectly in terms of reaction times after switching views. When six subjects were given tasks which depended on view changes among infinite, 4 m and 1 m foci, an interaction was detected between accommodation and convergence. However, in order to be applicable to pilots, further tests are necessary which include the symbology of displays. M.S.K.

**A86-13571****THERMAL STRESS IMPOSED ON PILOTS BY NBC PROTECTIVE CLOTHING [CONTRAINTE THERMIQUE IMPOSEE AU PERSONNEL NAVIGANT PAR LA PROTECTION N.B.C.]**

C. BOUTELIER and M. LONCLE (Centre d'Essais en Vol, Bretigny-sur-Orge, France) Medecine Aeronautique et Spatiale, vol. 24, 3rd Quarter, 1985, p. 161-168. In French. refs

The results of experimental determinations of the effects of thermal stress imposed on pilots by NBC clothing and anti-g suits are reported. The NBC cowling provides protection from chemical weapons, is made of neoprene, and has an air supply, but is water vapor resistant. Subjects donned the NBC suits and anti-g equipment and were then strapped in a helicopter seat in a controlled environment. Cutaneous temperatures and heart rates were monitored during the 1-hr sessions at temperatures from 20-40 C. Moderate heating in the chamber was sufficient to induce

severe thermal stresses on the subjects. The results imply a necessity exists for limiting flight duration in warm weather climates or seasons, particularly at low altitudes, if pilots wear the protective gear. The situation might be helped if the suits were actively cooled. M.S.K.

**A86-13942#****COLD WATER IMMERSION TEST OF PROTOTYPE ANTI-EXPOSURE SUITS FOR AIRCREWS**

K. TAGAMI (Tsukuba, University, Sakura, Japan), K. SHIMIZU, and W. OGAWA Japan Air Self Defence Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 26, June 1985, p. 49-66. In Japanese, with abstract in English. refs

Different designs of flame resistant and vapor permeable anti-exposure suits were produced and tested in cold water using five male subjects and several thermal manikins. Each human subject was immersed in cold water (about 0 C) for a period of 60 minutes and rectal and skin temperatures were measured every minute. Measurements of the heat loss in the human subjects were compared with the heat losses of the thermal manikins. It is found that; (1) the rectal temperature of the human subjects showed a very slight decrease (0.4 C maximum) during the 60-minute exposure; (2) a double layered suit design had the highest protection level and (3), the measurements of heat loss in the thermal manikins were in agreement with the heat loss measurements in the human subjects. The specific materials used in the construction of the suits are listed in a table. I.H.

**A86-14238\*#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

**NORMALIZED PREDICTIVE DECONVOLUTION - A TIME SERIES ALGORITHM FOR MODELING HUMAN OPERATOR DYNAMICS**

D. J. BIEZAD (USAF, Institute of Technology, Wright-Patterson AFB, OH) and D. K. SCHMIDT (Purdue University, West Lafayette, IN) (Guidance and Control Conference, Seattle, WA, August 20-22, 1984, Technical Papers, p. 399-414) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 8, Nov.-Dec. 1985, p. 768-776. Previously cited in issue 21, p. 3100, Accession no. A84-43446. refs (Contract NAG4-1)

**A86-14311\*** Texas Univ., Houston.

**COMPATIBLE ATMOSPHERES FOR A SPACE SUIT, SPACE STATION, AND SHUTTLE BASED ON PHYSIOLOGICAL PRINCIPLES**

B. A. HILLS (Texas, University, Houston) Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1052-1058. refs (Contract NAG9-23)

Fundamental physiological principles have been invoked to design compatible environments for a space suit, Space Station and the spacecraft used to transport the astronauts from earth. These principles include the long-term memory of tissues for a bubble-provoking decompression, the intermittent nature of blood flow in the tight connective tissue(s) responsible for the bends whose incidence in aviators has been shown to be related to bubble volume by the Weibull distribution. In the overall design an astronaut breathing a mixture of 30 percent O<sub>2</sub> in N<sub>2</sub> for 4-5 h in a spacecraft at 11.9 psia can transfer to a Space Station filled with the same mix at 8.7 psia and, after a further 4-5 h, go EVA at any time without any oxygen prebreathing at any stage. The probable incidence of decompression sickness has been estimated as less than 0.5 percent using the present suit operating at 4.3 psia but the risk could be reduced to zero if the suit pressure were increased to 6.5 psia. Author

**A86-14320****THE EFFECT OF LEAKAGE ON THE INSULATION PROVIDED BY IMMERSION-PROTECTION CLOTHING**

J. R. ALLAN, C. HIGENBOTTAM, and P. J. REDMAN (RAF, Institute of Aviation Medicine, Farnborough, England) Aviation, Space and Environmental Medicine (ISSN 0095-6562), vol. 56, Nov. 1985, p. 1107-1109. refs

A86-15817#

**HERMES ECLSS - REVIEW OF GENERAL REQUIREMENTS AND APPLICATION TO THE SPACEPLANE DEFINITION**

L. LEMAIGNEN, M. WEIBEL, C. FAGOT (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France), P. BRUDIEU (CNES, Toulouse, France), and K. THOERMER (Dornier System GmbH, Friedrichshafen, West Germany) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 13 p. refs

(Contract CNES-84-5027)

(IAF PAPER 85-304)

Attention is given to the mission requirements and performance capabilities of ESA's Hermes orbiter Environmental Control and Life Support System (ECLSS), which must furnish a 'shirtsleeve' environment for crews. System design has entailed fundamental consideration of physiological oxygen delivery requirements and CO<sub>2</sub> concentration limits, temperature and humidity tolerance, and maximum allowable concentration of contaminants. An 'open loop' system accomplishing CO<sub>2</sub> reduction in a Sabatier reactor and oxygen generation by electrolysis is presented, together with air and humidity management features, in schematic form. O.C.

A86-15819#

**BASIC CONSIDERATION ON CELSS**

K. NITTA (National Aerospace Laboratory, Tokyo, Japan), M. YAMASHITA (Tokyo University, Japan), and H. MATSUMIYA (Bio-System International, Tokyo, Japan) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 7 p.

(IAF PAPER 85-307)

The Controlled Ecological Life Support System (CELSS) is a Japanese research effort connected with the design of the NASA Space Station's Japanese Experiment Module. The definition of CELSS technology calls for interdisciplinary research embracing agricultural, chemical, and spacecraft systems engineering. A comprehensive account is presently given of the complex interactions to be found in photosynthetic processes, wet oxidation, and the relations between higher plant, algae, and animal components of the CELSS. O.C.

A86-15820#

**ARTIFICIAL CLOSED ECOSYSTEM 'MAN-PLANTS' WITH A FULL REGENERATION OF ATMOSPHERE, WATER AND RATION VEGETABLE PART**

B. G. KOVROV, I. A. TERSKOV, I. I. GITELSON, G. M. LISOVSKI, I. M. PANKOVA (AN SSSR, Institut Biofiziki, Krasnoyarsk, USSR) et al. IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 4 p.

(IAF PAPER 85-308)

A configuration and performance evaluation is made of a closed manned spacecraft ecosystem using vegetable cultivation as the basis of oxygen and pure water regeneration from the crew's waste air and water. Wheat, peas, beets, onions, cucumbers, tomatoes and potatoes are grown hydroponically on an expanded clay substrate, using round-the-clock artificial illumination. Systems of this type are intended for long duration space travel. O.C.

A86-15944#

**ENSURING SPACE STATION HUMAN PRODUCTIVITY**

K. H. MILLER (Boeing Aerospace Co., Seattle, WA) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p. refs

(IAF PAPER 85-500)

The 'human productivity' aspect of the current NASA Space Station Program is discussed. The early development of the concept is reviewed, and its implications are considered. The approach and results of a recently completed study on human productivity are addressed. The elements that affect productivity are identified, and management plans to deal with them, including crew composition and organization, individual autonomy and privacy, and physical amenities of the station, are briefly addressed. C.D.

N86-12973# Systems Research Labs., Inc., Dayton, Ohio.

**CRITERIA FOR A STATE-OF-THE-ART VISION TEST SYSTEM Final Report**

K. MOFFITT and L. V. GENCO May 1985 109 p

(Contract F33615-82-C-0511)

(AD-A157099; AFAMRL-TR-85-004) Avail: NTIS HC A06/MF

A01 CSCL 06P

Many vision test/screening devices used in the Armed Services have not changed since the 1940's. The reduction in the size of the pool of qualified aircrew candidates has caused operational Commands to question the validity of these tests. Current objectives of vision testing have evolved from a means to eliminate pilot candidates to methods of predicting aircrew performance. The Naval Aerospace Medical Research Laboratory (NAMRL) is attempting to correlate the results of several vision tests with the visual abilities of pilot trainees as demonstrated during monitored training flights. This report describes status that could be considered as useful parameters for testing in the Armed Forces vision test battery of the future. One major conclusion is that the operational visual task(s) must be suitably described in order to select appropriate clinical and laboratory test measures. Correlations and validation studies can then be performed with cooperative efforts such as those between NAMRL and AFAMRL. GRA

N86-12974# Department of the Navy, Washington, D. C.

**LOW TEMPERATURE INFLATOR APPARATUS Patent Application**

J. J. ESPOSITO, inventor (to Navy) 2 May 1985 9 p

(AD-D011810; US-PATENT-APPL-SN-729725) Avail: NTIS HC

A02/MF A01 CSCL 06G

This invention relates to inflator apparatus for inflating emergency flotation gear such as life rafts and life jackets; and more particularly to an inflator for flotation gear which may be stored at, and operated in, extremely low temperatures. Liquid CO<sub>2</sub> (carbon dioxide) cartridges have been used for many years as the main source of pressurized gas for inflating various types of inflatable life saving devices such as rafts, vests, and jackets. Emergency use of these devices by downed aircrewman has occurred mostly in temperate zones. However, these situations now occur more frequently in the arctic region where temperatures below -20 F are not uncommon. At these low temperatures, liquid CO<sub>2</sub> changes too slowly to the gaseous phase to provide immediate buoyancy. A rapid change is especially needed in a life raft to enable a downed person in frigid water to board as soon as possible. The longer he or she remains exposed to the cold water awaiting the formation of a boardable raft, the more likely hypothermia will set in. Raft inflation time in excess of five minutes has been observed when CO<sub>2</sub> cartridges were stored in an aircraft at sub-zero temperatures and then activated in water at 32 F. Consequently, lives have been needlessly lost. In lieu of liquid CO<sub>2</sub> cartridges, solid pyrotechnic inflators have been tried which generate gas from a compacted solid material, but the gas of combustion does not attain the pressure level needed for buoyancy of inflatable gear. GRA

N86-12975# Oak Ridge National Lab., Tenn.

**POWER AND SIGNAL TRANSMISSION FOR MOBILE TELEOPERATED SYSTEMS**

A. C. MORRIS, JR. and W. R. HAMEL 1985 31 p Presented

at the Japan/US Spec. Meeting on Remote Systems Technol.,

Oak Ridge, Tenn., 26 Apr. 1985

(Contract DE-AC05-84OR-21400)

(DE85-013994; CONF-8504132-1) Avail: NTIS HC A03/MF A01

Appropriate means must be furnished for supplying power and for sending controlling commands to mobile teleoperated systems. Because a sizable number of possibilities are available for such applications, methods used in designing both the power and communications systems built into mobile vehicles that serve in radiological emergencies must be carefully selected. This paper describes a number of umbilical, onboard, and wireless systems used in transmitting power that are available for mobile teleoperator services. The pros and cons of selecting appropriate methods

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from a list of possible communication systems are also examined. Moreover, hybrid systems combining wireless power transmissions with command-information signals are also possible. DOE

**N86-12976#** Oak Ridge National Lab., Tenn.

### **FUTURE DIRECTIONS IN MOBILE TELEOPERATION**

W. R. HAMEL 1985 22 p Presented at the Workshop on Requirements of Mobile Teleoperators for Radiol. Emergency Response and Recovery, Dallas, 23 Jun. 1985

(Contract DE-AC05-84OR-21400)

(DE85-014308; CONF-8506148-3) Avail: NTIS HC A02/MF A01

Mobile teleoperator systems are the subject of an increasing amount of research and development. This work is motivated by general problems of remote operations in hazardous environments, some of which are very similar to the challenges of radiological emergency response and recovery. Current work appears to fall into two broad economic classes, one in the \$100 K range and the other in the \$1000 K range. Both are believed to be important for technology development and deployment. Recent developments confirm that we are at the technical doorstep of next-generation mobile systems which integrate dexterous manipulation, high mobility, and telerobotic operation. DOE

**N86-13898\*#** Hamilton Standard, Windsor Locks, Conn.

### **DEVELOPMENT OF A CARBON FORMATION REACTOR FOR CARBON DIOXIDE REDUCTION Final Report**

G. NOYES Sep. 1985 92 p refs

(Contract NAS9-16956)

(NASA-CR-171907; NAS 1.26:171907; SVHSER-9811) Avail:

NTIS HC A05/MF A01 CSCL 06K

Applied research, engineering development, and performance evaluation were conducted on a process for formation of dense carbon by pyrolysis of methane. Experimental research showed that dense (0.7 to 1.6 g/cc bulk density and 1.6 to 2.2 g/cc solid density) carbon can be produced by methane pyrolysis in quartzwool-packed quartz tubes at temperatures of 1100 to 1300 C. This result supports the condensation theory of pyrolytic carbon formation from gaseous hydrocarbons. A full-scale Breadboard Carbon Formation Reactor (CFR) was designed, fabricated, and tested at 1100 to 1200 C with 380 to 2280 sccm input flows of methane. Single-pass conversion of methane to carbon ranged from 60 to 100 percent, with 89 percent average conversion. Performance was projected for an Advanced Carbon Reactor Subsystem (ACRS) which indicated that the ACRS is a viable option for management of metabolic carbon on long-duration space missions. Author

**N86-13899\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

### **MASS LOSS OF SHUTTLE SPACE SUIT ORTHOFABRIC UNDER SIMULATED IONOSPHERIC ATOMIC OXYGEN BOMBARDMENT**

W. L. MILLER Nov. 1985 14 p refs

(NASA-TM-87149; E-2777; NAS 1.15:87149) Avail: NTIS HC

A02/MF A01 CSCL 06K

Many polymeric materials used for thermal protection and insulation on spacecraft degrade significantly under prolonged bombardment by ionospheric atomic oxygen. The covering fabric of the multilayered shuttle space suit is composed of a loose weave of GORE, TEX fibers, Nomex and Kevlar-29, which are all polymeric materials. The complete evaluation of suit fabric degradation from ionospheric atomic oxygen is of importance in reevaluating suit lifetime and inspection procedures. The mass loss and visible physical changes of each test sample was determined. Kapton control samples and data from previous asher and flight tests were used to scale the results to reflect ionospheric conditions at about 220 km altitude. It is predicted that the orthofabric loses mass in the ionosphere at a rate of about 66% of the original orthofabric mass/yr. The outer layer of the two-layer orthofabric test samples shows few easily visible signs of degradation, even when observed at 440X. It is concluded that the orthofabric could suffer significant loss of performance after much less than a year of total exposure time, while the degradation

might be undetectable in post flight visual examinations of space suits. E.A.K.

**N86-13900\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

### **HUMAN FACTORS IN SPACE STATION ARCHITECTURE 1: SPACE STATION PROGRAM IMPLICATIONS FOR HUMAN FACTORS RESEARCH**

M. M. COHEN Oct. 1985 13 p refs

(NASA-TM-86702; REPT-85167; NAS 1.15:86702) Avail: NTIS HC A02/MF A01 CSCL 05H

The space station program is based on a set of premises on mission requirements and the operational capabilities of the space shuttle. These premises will influence the human behavioral factors and conditions on board the space station. These include: launch in the STS Orbiter payload bay, orbital characteristics, power supply, microgravity environment, autonomy from the ground, crew make-up and organization, distributed command control, safety, and logistics resupply. The most immediate design impacts of these premises will be upon the architectural organization and internal environment of the space station. E.A.K.

**N86-13901#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

### **INFORMATION REQUIREMENTS DETERMINATION: AN EMPIRICAL INVESTIGATION OF OBSTACLES WITHIN AN INDIVIDUAL Ph.D. Thesis**

J. R. VALUSEK 1985 201 p

(AD-A158025; AFIT/CI/NR-85-73D) Avail: NTIS HC A10/MF A01 CSCL 05H

This research has suggested that the requirements process be divided into two phases: IRD and IRA. There appears to be sufficient evidence to warrant additional investigation of the IRD phase using the model of inconsistency portrayed in this effort. Inconsistency appears to be a matter of perspective. From an analyst's point of view, the variation in users' needs constitutes inconsistency. From a user's point of view, the variation may be a fact of life resulting from perceptions of need that arise from a dynamic environment. This research is an initial attempt to document the requirements process from a user's perspective and to provide the user some external assistance to attempt to reduce the variation in perceptions of needs. It may be that the perceptions of needs always constitute a requirement from the individual's perspective and that the sorting of requirements from wishes must remain the responsibility of the referee. Perhaps tools oriented to both those roles: That of the user and that of the referee, are necessary. The requirements formulation scratchpad (RFS), as a prototype tool to help the user in the problem formulation phase of information requirements determination, was too complex for the research environment of this study. Based on suggestions from this initial investigation, the second generation of the RFS will be much simpler in design. GRA

**N86-13902#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.

### **STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 1, PART A: TECHNICAL RESULTS Final Report**

R. J. HAMANN, comp. and W. VANLEEUEWEN, comp. Paris ESA Feb. 1985 138 p 4 Vol.

(Contract ESA-5718/83/NL-AN(SC))

(FOK-TR-R-84-110-VOL-1-PT-A; ESA-CR(P)-2048-VOL-1) Avail: NTIS HC A07/MF A01

A space manipulator system is defined, and the kinematics and dynamics of the system are outlined. A system with seven degrees of freedom, rotating joints, electrical actuation, a toroidal work area, and planar/rotational maneuvering is advocated. Its basic application is servicing and maintenance of low Earth orbit platforms for materials processing. The fully extended arm must be able to move a 750 kg payload at 0.02 m/sec. A dedicated programming system must be defined for collision and obstacle avoidance. Author (ESA)



**N86-13903#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.  
**STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 1, PART B: TECHNICAL RESULTS Final Report**

R. J. HAMANN, comp. and W. VANLEEUEWEN, comp. Paris ESA Feb. 1985 247 p refs 4 Vol.  
 (Contract ESA-5718/83/NL-AN(SC))  
 (FOK-TR-R-84-110-VOL-1-PT-B; ESA-CR(P)-2048-VOL-2) Avail: NTIS HC A11/MF A01

Control aspects of robots for maintenance and servicing of low Earth orbit materials processing platforms were studied. Electrical architecture and software organization were analyzed. Work required to develop the robot was identified. Active force feedback control is advocated. Author (ESA)

**N86-13904#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.  
**STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 2: TECHNICAL APPENDICES Final Report**

R. J. HAMANN, comp. and W. VANLEEUEWEN, comp. Paris ESA Feb. 1985 121 p 4 Vol.  
 (Contract ESA-5718/83/NL-AN(SC))  
 (FOK-TR-R-84-110-VOL-2; ESA-CR(P)-2048-VOL-3) Avail: NTIS HC A06/MF A01

Forward and inverse kinematics of a robot manipulator system for maintenance and servicing of space platforms; software availability; robot languages; control models and plots; coupling and decoupling; and modeling errors are summarized. Author (ESA)

**N86-13905#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.  
**STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 3: EXECUTIVE SUMMARY Final Report**

R. J. HAMANN, comp. and W. VANLEEUEWEN, comp. Paris ESA Feb. 1985 44 p refs 4 Vol.  
 (Contract ESA-5718/83/NL-AN(SC))  
 (FOK-TR-R-84-110-VOL-3; ESA-CR(P)-2048-VOL-4) Avail: NTIS HC A03/MF A01

A space manipulator system is defined, and the kinematics and dynamics of the system are outlined. A system with seven degrees of freedom, rotating joints, electrical actuation, a toroidal work area, and planar/rotational maneuvering is advocated. Its basic application is servicing and maintenance of low Earth Orbit platforms for materials processing. The fully extended arm must be able to move a 750 kg payload at 0.02 m/sec. A dedicated programming system must be defined for collision and obstacle avoidance. Control aspects; electrical architecture; and software organization were analyzed. Work required to develop the robot was identified. Active force feedback control is advocated. Author (ESA)

**N86-13906#** Purdue Univ., West Lafayette, Ind.  
**ALERTED MONITORS: HUMAN OPERATORS AIDED BY AUTOMATED DETECTORS Final Report**

R. D. SORKIN and D. E. ROBINSON Dec. 1984 55 p  
 (Contract DTRS56-83-C-00047)  
 (PB85-222750; DOT/OST/P34-85/021) Avail: NTIS HC A04/MF A01 CSCL 05H

In an alerted monitor system, an automated detector assists a human operator in the detection and diagnosis of problems occurring in some monitored process. Air traffic control centers and the flight decks of commercial aircraft include many examples of such systems. This project developed a general model of the alerted-monitor system and evaluated the effects on system performance of interactions between the human operator and automated detector. One of the types of interaction evaluated (contingent criterion strategy) yields optimal performance from the combined person-machine system. Two laboratory experiments were performed to evaluate the assumptions of the model and

the interactions between the operator and automated components. GRA

**N86-14091\*#** Missouri Univ., Columbia. Dept. of Chemical Engineering.

**SOLID WASTE TREATMENT PROCESSES FOR SPACE STATION Final Report**

T. R. MARRERO *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports 55 p Sep. 1983 refs  
 Avail: NTIS HC A18/MF A01 CSCL 06K

The purpose of this study was to evaluate the state-of-the-art of solid waste(s) treatment processes applicable to a Space Station. From the review of available information a source term model for solid wastes was determined. An overall system is proposed to treat solid wastes under constraints of zero-gravity and zero-leakage. This study contains discussion of more promising potential treatment processes, including supercritical water oxidation, wet air (oxygen) oxidation, and chemical oxidation. A low pressure, batch-type treatment process is recommended. Processes needed for pretreatment and post-treatment are hardware already developed for space operations. The overall solid waste management system should minimize transfer of wastes from their collection point to treatment vessel. Author

**N86-14160#** Joint Publications Research Service, Arlington, Va.  
**BIOLOGICAL LIFE-SUPPORT SYSTEMS FOR LONG-DURATION SPACE FLIGHTS**

I. ANDREYEV and Y. Y. SHEPELEV *In its* USSR Rept.: Space (JPRS-USP-85-005) p 71-74 30 Sep. 1985 Transl. into ENGLISH from Izv. (Moscow), 11 Feb. 1985 p 3  
 Avail: NTIS HC A08

A brief overview of the necessary life support equipment requirements for long term space flights is presented. Self contained, closed, ecological systems for the generation of oxygen are presented as possibilities. G.L.C.

**N86-14161#** Joint Publications Research Service, Arlington, Va.  
**ARCHITECT DISCUSSES SPACE HABITAT DESIGNS**

S. ZIGUNENKO *In its* USSR Rept.: Space (JPRS-USP-85-005) p 75-77 30 Sep. 1985 Transl. into ENGLISH from Pravda (Moscow), 4 Dec. 1984 p 3  
 Avail: NTIS HC A08

General considerations for the interior design of spacecraft intended for long duration space flight were reviewed from a human factors engineering standpoint. It is important that those responsible for spacecraft design not allow their work to be overshadowed by their sense of gravity and the general restrictions of a terrestrial environment. G.L.C.

## 55

### PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

**A86-13974**

**THE OLDEST TRACES OF LIFE (ACCORDING TO PAPERS PRESENTED AT THE 27TH SESSION OF THE INTERNATIONAL GEOLOGICAL CONGRESS) [DREVNEISHIE SLEDY ZHIZNI /PO MATERIALAM 27-I SESSII MEZHDUNARODNOGO GEOLOGICHESKOGO KONGRESSA/]**

I. N. KRYLOV (AN SSSR, Geologicheskii Institut, Moscow, USSR) Priroda (ISSN 0032-874X), Sept. 1985, p. 68-76. In Russian. refs

A86-14114

**A POSSIBLE ENERGETIC ROLE OF MINERAL SURFACES IN CHEMICAL EVOLUTION**L. M. COYNE (San Jose State University, Moffett Field, CA) *Origins of Life* (ISSN 0302-1688), vol. 15, no. 3, 1985, p. 161-206. refs

The role of the interaction of mineral surfaces (MSs) with such sources of energy (E) as ionizing radiation and mechanical stress in chemical evolution and the origin of life is discussed. The effect of MS-E interaction in terms of spectroscopic properties of minerals, catalysis, and interactions of E with condensed phases are considered, as well as some commonly accepted and novel means by which the MS activity may be enhanced by E inputs. The contribution of natural radioactive decay and triboelectric E is assessed, and is proposed to be potentially competitive with solar energy for systems of heterogeneous reactions. Studies of clays are presented that demonstrate novel luminescence properties, indicating energy storage and transfer processes in the MSs, which are interpreted so as to provide a basis for estimating the potential significance of MS-E interactions for driving clay surface chemistry. I.S.

A86-14115

**FACT AND ASSUMPTION IN STUDIES ON THE ORIGINS OF LIFE**N. W. PIRIE *Origins of Life* (ISSN 0302-1688), vol. 15, no. 3, 1985, p. 207-212. refs

The prevailing tendency in the current theories of the origins of life to assume the absolute necessity of preexisting proteins, nucleic acids, and other biochemical molecules for the process of biopoiesis is critically assessed. It is suggested that the events which might take place in the course of few million years on moist mineral surfaces smeared with bituminous material and exposed to prebiotic physical and chemical environment should be considered for experiments on the origins of life. In such a system, transition elements, the orienting ability of silicates and other mineral crystals, the small molecules generated by light, and the reactive centers generated on sunlit oil and tar should be taken into account. I.S.

A86-14123

**SUBMARINE HYDROTHERMAL VENTS AND ASSOCIATED GRADIENT ENVIRONMENTS AS SITES FOR THE ORIGIN AND EVOLUTION OF LIFE**J. A. BAROSS (Washington, University, Seattle) and S. E. HOFFMAN (Oregon State University, Corvallis) *Origins of Life* (ISSN 0302-1688), vol. 15, no. 4, 1985, p. 327-345. refs (Contract N00014-79-C-004; NSF DEB-81-11307; NSF DPP-81-20473)

The hypothesis of the submarine hydrothermal environment providing the conditions for abiotic synthesis of organic compounds, macromolecules, and precells, leading to the evolution of living organisms is proposed. The geological, chemical, and biological changes in the Archean ocean and atmosphere are studied and compared with the characteristics of a present-day hydrothermal environment. The geological and geochemical features of the hydrothermal circulation system, which provides the energy for converting inorganic precursors to organic compounds, are discussed. The hot vents and cool Galapagos-type vents that result from large and small fractures are described. The changes which have produced differences in the Archean and present-day oceanic environments are analyzed. Examples of bacteria which support vent communities are presented. The influence of temperature and O<sub>2</sub> gradient on the evolution of the ecosystem is investigated. A comparison of present-day volcanic environments to ancient microbial habitats based on fossil records is provided. I.F.

A86-14774#

**A NOTE ON SELF-REPLICATING INFORMATION YIELDING THE CHEMICAL ORIGIN OF LIFE**J. C. PENAFORTE and B. BASEIA (Paraiba, Universidade Federal, Joao Pessoa, Brazil) *Revista Brasileira de Fisica* (ISSN 0374-4922), vol. 15, March 1985, p. 32-36. Research supported by the Coordenacao do Aperfeicoamento do Pessoal de Ensino Superior and CNPq. refs

Stabilization in the length of growing polymers, is obtained through the analogy between laser crossing threshold and critical biological phenomena. Reference is made to the theory of Tsalis and Ferreira (1983) concerning the transition from inanimate matter to life. I.H.

A86-15919\*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

**THE EVOLUTION OF COMPLEX LIFE**

J. BILLINGHAM (NASA, Ames Research Center, Moffett Field, CA) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 15 p. refs (IAF PAPER 85-465)

The emergence of complex living organisms in the context of evolutionary biology, planetary environments, and space events is investigated. The application of data on biological evolution, climatology, and the chemical and physical environments of the earth's surface, to explain the development of extraterrestrial life is described and an example is provided. The possibility of extraplanetary disturbances such as, meteorite and comet bombardments, and supernova explosions, causing the elimination of preexisting life and allowing advanced life development is analyzed. The possible existence of different life cycles (genetic and reproductive strategies) on other planets is studied. The GAIA hypothesis (Lovelock, 1979) which states living things modify the global environment to their own advantage is examined. The improved identification of habitable planetary environments and the possible existence of a form of extraterrestrial intelligent life is discussed. I.F.

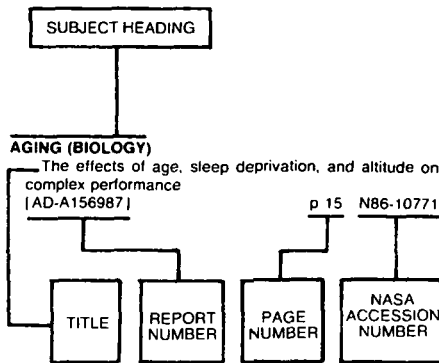
A86-15921#

**THE ANTHROPIC PRINCIPLE - PROBABILITY AND THE POSSIBILITY OF EXTRATERRESTRIAL LIFE**

P. J. HALL (Newcastle-upon-Tyne, University, England) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 6 p. refs (IAF PAPER 85-468)

The influence of the Anthropic Principle (AP) on conventional hypotheses for the existence of extraterrestrial life and on strategies in search for extraterrestrial life is discussed. Three relationships between local and general cosmological laws, the Copernican relationship, the Mach relationship, and the Anthropic relationship, are defined. Two assumptions, which are there must be absolute uniformity in the universe, and the degree of fine tuning varies from law to law and constant to constant, are analyzed in the study of the AP and the probability of the existence of extraterrestrial intelligence (ETI). The search for the existence of ETI, which is based on Anthropic and Copernican ideas, is described. It is hypothesized that electromagnetic beam signals are emitted by ETI for detection and interpretation by other ETI. The relationship between communication with electromagnetic beams and quantum mechanics and relativity is studied. I.F.

**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 the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) 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 with the AIAA accession numbers appearing first.

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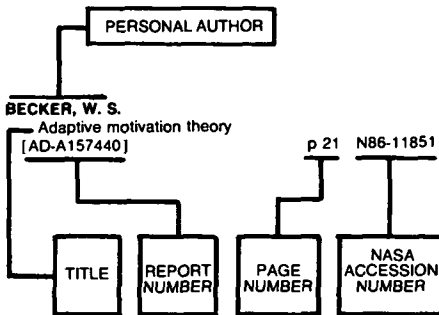
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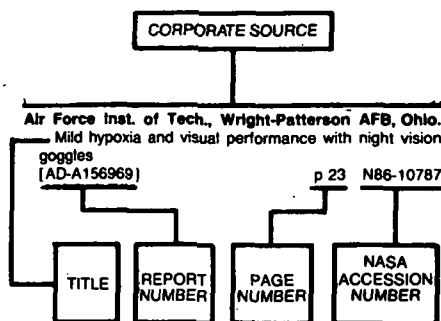
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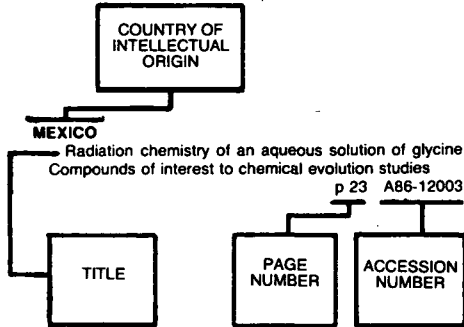
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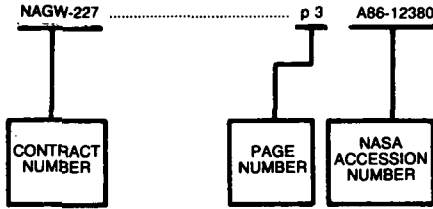
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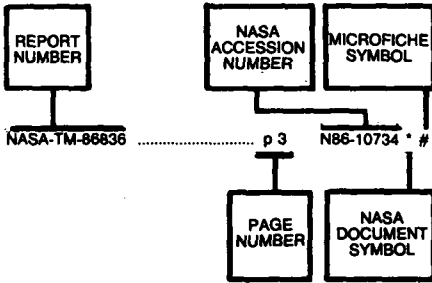
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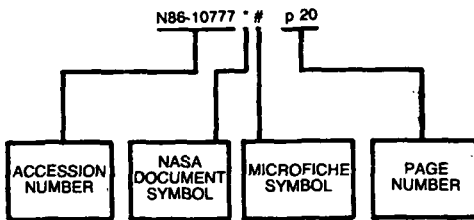
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REPORT



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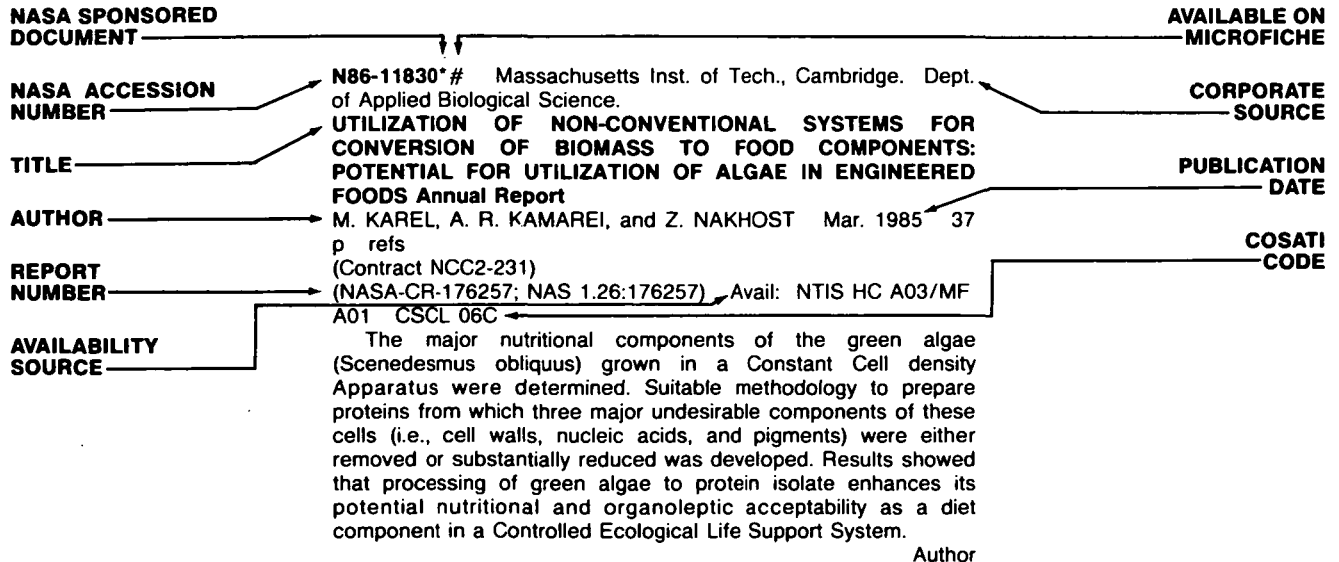
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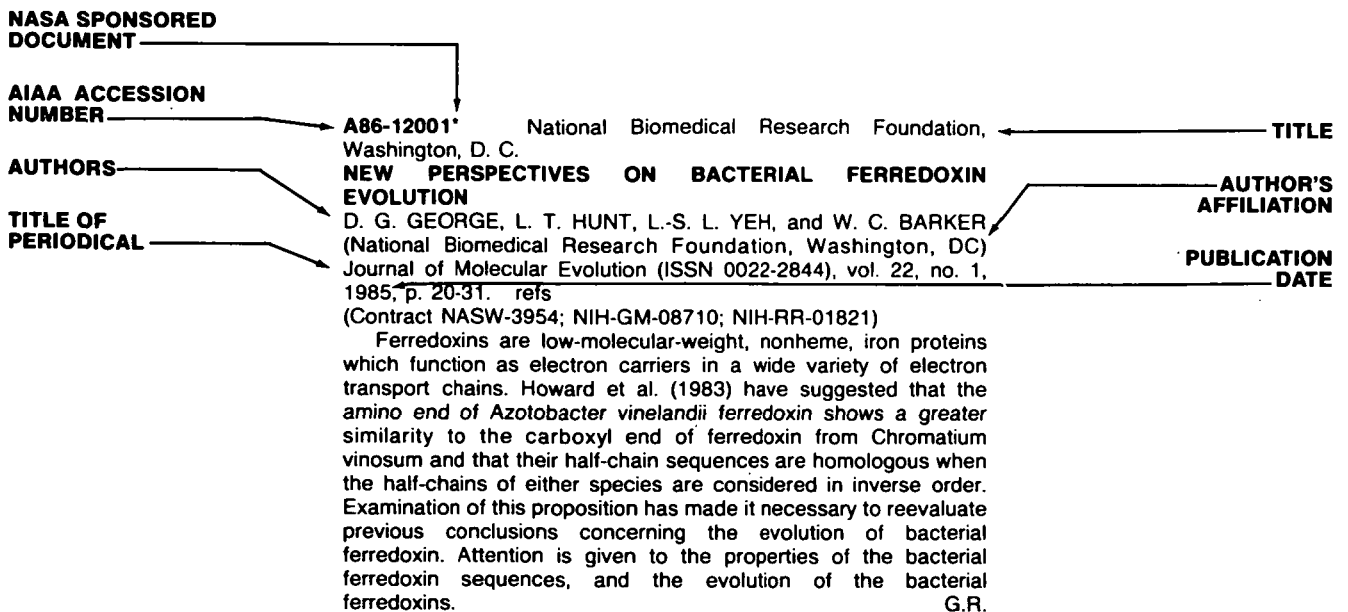
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## **INDIANA**

### **INDIANA STATE LIBRARY**

Serials Documents Section  
140 North Senate Avenue  
Indianapolis, IN 46204  
(317) 232-3686

## **IOWA**

### **UNIV. OF IOWA LIBRARIES**

Govt. Documents Department  
Iowa City, IA 52242  
(319) 353-3318

## **KANSAS**

### **UNIVERSITY OF KANSAS**

Doc. Collect.—Spencer Lib.  
Lawrence, KS 66045  
(913) 864-4662

## **KENTUCKY**

### **UNIV. OF KENTUCKY LIBRARIES**

Govt. Pub. Department  
Lexington, KY 40506  
(606) 257-3139

## **LOUISIANA**

### **LOUISIANA STATE UNIVERSITY**

Middleton Library  
Govt. Docs. Dept.  
Baton Rouge, LA 70803  
(504) 388-2570

### **LOUISIANA TECHNICAL UNIV. LIBRARY**

Documents Department  
Ruston, LA 71272  
(318) 257-4962

## **MAINE**

### **UNIVERSITY OF MAINE**

Raymond H. Fogler Library  
Tri-State Regional Documents  
Depository  
Orono, ME 04469  
(207) 581-1680

## **MARYLAND**

### **UNIVERSITY OF MARYLAND**

McKeldin Lib.—Doc. Div.  
College Park, MD 20742  
(301) 454-3034

## **MASSACHUSETTS**

### **BOSTON PUBLIC LIBRARY**

Government Docs. Dept.  
Boston, MA 02117  
(617) 536-5400 ext. 226

## **MICHIGAN**

### **DETROIT PUBLIC LIBRARY**

Sociology Department  
5201 Woodward Avenue  
Detroit, MI 48202  
(313) 833-1409

### **MICHIGAN STATE LIBRARY**

P.O. Box 30007  
Lansing, MI 48909  
(517) 373-0640

## **MINNESOTA**

### **UNIVERSITY OF MINNESOTA**

Government Pubs. Division  
409 Wilson Library  
309 19th Avenue South  
Minneapolis, MN 55455  
(612) 373-7813

## **MISSISSIPPI**

### **UNIV. OF MISSISSIPPI LIB.**

Documents Department  
University, MS 38677  
(601) 232-5857

## **MONTANA**

### **UNIV. OF MONTANA**

Mansfield Library  
Documents Division  
Missoula, MT 59812  
(406) 243-6700

## **NEBRASKA**

### **NEBRASKA LIBRARY COMM.**

Federal Documents  
1420 P Street  
Lincoln, NE 68508  
(402) 471-2045  
In cooperation with University of  
Nebraska-Lincoln

## **NEVADA**

### **UNIVERSITY OF NEVADA LIB.**

Govt. Pub. Department  
Reno, NV 89557  
(702) 784-6579

## **NEW JERSEY**

### **NEWARK PUBLIC LIBRARY**

5 Washington Street  
Newark, NJ 07101  
(201) 733-7812

## **NEW MEXICO**

### **UNIVERSITY OF NEW MEXICO**

Zimmerman Library  
Government Pub. Dept.  
Albuquerque, NM 87131  
(505) 277-5441

### **NEW MEXICO STATE LIBRARY**

Reference Department  
325 Don Gaspar Avenue  
Santa Fe, NM 87501  
(505) 827-2033, ext. 22

## **NEW YORK**

### **NEW YORK STATE LIBRARY**

Empire State Plaza  
Albany, NY 12230  
(518) 474-5563

## **NORTH CAROLINA**

### **UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL**

Wilson Library  
BA/SS Documents Division  
Chapel Hill, NC 27515  
(919) 962-1321

## **NORTH DAKOTA**

### **UNIVERSITY OF NORTH DAKOTA**

Chester Fritz Library  
Documents Department  
Grand Forks, ND 58202  
(701) 777-2617, ext. 27  
(In cooperation with North  
Dakota State Univ. Library)

## **OHIO**

### **STATE LIBRARY OF OHIO**

Documents Department  
65 South Front Street  
Columbus, OH 43215  
(614) 462-7051

## **OKLAHOMA**

### **OKLAHOMA DEPT. OF LIB.**

Government Documents  
200 NE 18th Street  
Oklahoma City, OK 73105  
(405) 521-2502

## **OKLAHOMA STATE UNIV. LIB.**

Documents Department  
Stillwater, OK 74078  
(405) 624-6546

## **OREGON**

### **PORTLAND STATE UNIV. LIB.**

Documents Department  
P.O. Box 1151  
Portland, OR 97207  
(503) 229-3673

## **PENNSYLVANIA**

### **STATE LIBRARY OF PENN.**

Government Pub. Section  
P.O. Box 1601  
Harrisburg, PA 17105  
(717) 787-3752

## **TEXAS**

### **TEXAS STATE LIBRARY**

Public Services Department  
P.O. Box 12927—Cap. Sta.  
Austin, TX 78753  
(512) 471-2996

### **TEXAS TECH UNIV. LIBRARY**

Govt. Documents Department  
Lubbock, TX 79409  
(806) 742-2268

## **UTAH**

### **UTAH STATE UNIVERSITY**

Merrill Library, U.M.C. 30  
Logan, UT 84322  
(801) 750-2682

## **VIRGINIA**

### **UNIVERSITY OF VIRGINIA**

Alderman Lib.—Public Doc.  
Charlottesville, VA 22901  
(804) 924-3133

## **WASHINGTON**

### **WASHINGTON STATE LIBRARY**

Documents Section  
Olympia, WA 98504  
(206) 753-4027

## **WEST VIRGINIA**

### **WEST VIRGINIA UNIV. LIB.**

Documents Department  
Morgantown, WV 26506  
(304) 293-3640

## **WISCONSIN**

### **MILWAUKEE PUBLIC LIBRARY**

814 West Wisconsin Avenue  
Milwaukee, WI 53233  
(414) 278-3000

### **ST. HIST LIB. OF WISCONSIN**

Government Pub. Section  
816 State Street  
Madison, WI 53706  
(608) 262-4347

## **WYOMING**

### **WYOMING STATE LIBRARY**

Supreme Ct. & Library Bld.  
Cheyenne, WY 82002  
(307) 777-6344

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