

NASA SP-7011 (355)

November 1991

# AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
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NASA SP-7011 (355)  
November 1991

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration  
Office of Management  
Scientific and Technical Information Program  
Washington, DC

1991

# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 147 reports, articles and other documents originally announced in October 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N91-27120 — N91-29138
IAA (A-10000 Series)	A91-44485 — A91-48444

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

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

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

A cumulative index for 1991 will be published in early 1992.

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

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## TYPICAL REPORT CITATION AND ABSTRACT

**NASA SPONSORED**  
ON MICROFICHE

**ACCESSION NUMBER** → **N91-10591\*#** Good Samaritan Hospital and Medical Center, ← **CORPORATE SOURCE**  
Portland, OR. Neurological Sciences Inst.

**TITLE** → **ROLE OF ORIENTATION REFERENCE SELECTION IN**  
**AUTHORS AND** **MOTION SICKNESS Semiannual Status Report**

**PUBLICATION DATE** → **ROBERT J. PETERKA and F. OWEN BLACK** Sep. 1990 37 p ← **AVAILABILITY SOURCE**  
(Contract NAG9-117)

**CONTRACT NUMBER** → (NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03 ← **PRICE CODE**

**REPORT NUMBERS** → CSCL 06E

**COSATI CODE** →

Three areas related to human orientation control are investigated:  
(1) reflexes associated with the control of eye movements and posture;  
(2) the perception of body rotation and position with respect to gravity;  
and (3) the strategies used to resolve sensory conflict situations which  
arise when different sensory systems provide orientation cues which  
are not consistent with one another or with previous experience. Of  
particular interest is the possibility that a subject may be able to  
ignore an inaccurate sensory modality in favor of one or more other  
sensory modalities which do provide accurate orientation reference  
information. This process is referred as sensory selection. This  
proposal will attempt to quantify subject's sensory selection abilities  
and determine if this ability confers some immunity to the development  
of motion sickness symptoms.

Author

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**NASA SPONSORED**

**ACCESSION NUMBER** → **A91-12594\*** National Aeronautics and Space Administration. ← **CORPORATE SOURCE**  
Ames Research Center, Moffett Field, CA.

**TITLE** → **CREW SUPPORT FOR AN INITIAL MARS EXPEDITION**

**AUTHORS** → **YVONNE A. CLEARWATER** (NASA, Ames Research Center, ← **AUTHORS' AFFILIATION**  
Moffett Field, CA) and **ALBERT A. HARRISON** (California,  
University, Davis) British Interplanetary Society, Journal (ISSN  
0007-084X), vol. 43, Nov. 1990, p. 513-518. refs ← **JOURNAL TITLE**

Copyright ← **PUBLICATION DATE**

Mars crews will undergo prolonged periods of isolation and  
confinement, travel unprecedented distances from earth and be  
subjected to formidable combinations of hardships and dangers.  
Some of the biomedical, psychological and social challenges of the  
first manned Mars expedition are reviewed and means of aligning  
humans, technology and space habitats in the interests of mission  
success are identified.

Author

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 355)*

November 1991

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## LIFE SCIENCES (GENERAL)

**A91-45225\*** Hopital Lariboisiere, Paris (France).

### **MECHANICALLY INDUCED ORIENTATION OF ADULT RAT CARDIAC MYOCYTES IN VITRO**

J.-L. SAMUEL (Hopital Lariboisiere, Paris, France) and H. H. VANDENBURGH (Brown University; Miriam Hospital, Providence, RI) *In Vitro Cellular and Developmental Biology* (ISSN 0883-8364), vol. 26, Sept. 1990, p. 905-914. refs  
(Contract NIH-AR-36266; NIH-AR-39998; NIH-RR-05818; NAG2-414)

Copyright

The present study describes the spatial orientation of a population of freshly isolated adult rat cardiac myocytes using a computerized mechanical cell stimulator device for tissue cultured cells. A continuous unidirectional stretch of the substratum at 60 to 400 microns/min for 120 to 30 min, respectively, during the cell attachment period in a serum-free medium was found to induce a significant threefold increase in the number of rod-shaped myocytes oriented parallel to the direction of movement. The myocytes orient less well with unidirectional substratum stretching after their adhesion to the substratum. Adult myocytes plated onto a substratum undergoing continuous 10-percent stretch-relaxation cycling show no significant change in the myocyte orientation or cytoskeletal organization. In addition to the type of mechanical activity, orientation of rod-shaped myocytes is dependent on the speed of the substratum, the final stretch amplitude, and the timing between initiation of substratum stretching and adhesion of myocytes to the substratum. P.D.

**A91-45446**

### **CELLULAR DIFFERENTIATION IN THE PROCESS OF GENERATION OF THE EUKARYOTIC CELL**

HAKOBU NAKAMURA (Konan University, Kobe, Japan) and ATSUSHI HASE (Osaka City Institute of Public Health and Environmental Sciences, Japan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 20, no. 6, 1990-1991, p. 499-514. refs

Copyright

Metabolic and molecular evolution is reviewed and the significance of membranous differentiation in eukaryotic cell generation is discussed. Data on the metabolic and molecular mechanisms of O<sub>2</sub> respiratory photosynthetic bacteria are presented. It is suggested that eukaryotic cells originated as a result of the cellular differentiation of highly developed prokaryotes. K.K.

**A91-46769\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

### **ULTRASTRUCTURAL AND CYTOCHEMICAL EVIDENCE FOR SINGLE IMPULSE INITIATION ZONES IN VESTIBULAR MACULAR NERVE FIBERS OF RAT**

MURIEL D. ROSS, OLIVER CHEE (NASA, Ames Research Center, Moffett Field, CA), SAMUEL BLACK (San Jose State University

Foundation, CA), and LYNN CUTLER *Annals of Otolaryngology and Rhinology* (ISSN 0003-4894), vol. 100, May 1991, p. 398-406. refs

Copyright

Cupric ion-ferricyanide labeling methods and related ferrocyanide-stained tissues were used to locate the characterize, at the ultrastructural level, presumptive impulse initiation zones in the three types of vestibular macular nerve fibers. Large-diameter, M-type vestibular nerve fibers terminate in a calyx at the heminode, and labeling is coextensive with the base of the calyx. Intermediate, M/U-type nerve fibers have short, unmyelinated preterminal segments that sometimes bifurcate intramacularly, and small-diameter, U-type nerve fibers have long, unmyelinated preterminal axons and up to three branches. Preterminals of these nerve fibers display ultrastructural heterogeneity that is correlated with labeling patterns for sodium channels and/or associated polyanionic sites. They have a nodalike ultrastructure and label heavily from near the heminode to the base of the macula. Their intramacular branches, less organized ultrastructurally, label only slightly. Results indicate that vestibular nerve fibers have one impulse initiation zone, located near the heminode, that varies in length according to nerve fiber type. Structural heterogeneity may favor impulse conduction in the central direction, and length of the impulse initiation zone could influence nerve discharge patterns. Author

### **A91-46825\*** Lockheed Missiles and Space Co., Sunnyvale, CA. **GERMINATION AND GROWTH OF WHEAT IN SIMULATED MARTIAN ATMOSPHERES**

STEVEN H. SCHWARTZKOPF (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) and ROCCO L. MANCINELLI (NASA, Ames Research Center, Moffett Field, CA) *Acta Astronautica* (ISSN 0094-5765), vol. 25, April 1991, p. 245-247. Research supported by CESCO. refs

(Contract NCC2-209; NCC2-479)

Copyright

One design for a manned Mars base incorporates a bioregenerative life support system based upon growing higher plants at a low atmospheric pressure in a greenhouse on the Martian surface. To determine the concept's feasibility, the germination and initial growth of wheat (*Triticum aestivum*) was evaluated at low atmospheric pressures in simulated Martian atmosphere (SMA) and in SMA supplemented with oxygen. Total atmospheric pressures ranged from 10 to 1013 mb. No seeds germinated in pure SMA, regardless of atmospheric pressure. In SMA plus oxygen at 60 mb total pressure, germination and growth occurred but were lower than in the earth atmosphere controls. Author

**A91-47443**

### **DYNAMICS OF INTRACRANIAL PRESSURE IN REST AND DURING CHANGES IN BODY POSITION (DINAMIKA VNUTRICHREPNOGO DAVLENIIA V POKOE I PRI PEREMENE POLOZHENIIA TELAJ)**

V. P. KROTOV, E. V. TRAMBOVETSKII, and A. N. NAZIN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 77, Jan. 1991, p. 68-75. In Russian. refs

Copyright

The relationship between epidural and subdural methods for

ABSTRACTS

registering intracranial pressure during postural changes was investigated in rabbits equipped with implanted tension sensors and subjected to changes in body position. The parameters of intracranial pressure variations were measured during rest and during functional loading periods. It is shown that there exist physiological mechanisms that are able to register different degrees of intracranial-pressure compensation during changes in body position. No significant differences were found between the results of epidural and subdural intracranial-pressure measurements.

I.S.

A91-47444

**POSTURAL CHANGES IN LUNG HEMODYNAMICS IN RATS UNDER CONDITIONS OF HIGH ALTITUDE [POSTURAL'NYE IZMENENIYA GEMODINAMIKI LEGKIKH U KRYSA V USLOVIYAKH VYSOKOGOR'IA]**

A. KH. SHANDAULOV and B. I. MAZHBICH (AMN SSSR, Institut Fiziologii, Novosibirsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 77, Jan. 1991, p. 89-96. In Russian. refs Copyright

Transbronchial electroplethysmography combined with measurements in the catheterized pulmonary artery were used to investigate changes in lung hemodynamics of rats subjected to changes in body position during their stay at 3200-m altitude for 60 and 150 days. It was found that changes in gravitational redistribution of blood volume and blood flow over various regions of lungs, induced by changes of body position, were smaller than those at sea level. This is considered to be due to a decreased compliance of pulmonary arteries and to an accompanying increase in the reactive component of hydraulic impedance.

I.S.

A91-47445

**THE EFFECT OF THE REWARMING RATE ON THE OVERALL BODY METABOLISM AND ON THE TONE OF THE CUTANEOUS BLOOD VESSELS [VLIYANIE SKOROSTI RAZOGREvaniya NA OBShCHII METABOLIZM ORGANIZMA I TONUS KOZHNYKH SOSUDOV]**

T. V. KOZYREVA and L. A. VERKHOGLIAD (AMN SSSR, Institut Fiziologii, Novosibirsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 77, Jan. 1991, p. 110-115. In Russian. refs Copyright

The effects of the local rewarming rate on the oxygen consumption and the tone of skin blood vessels were investigated in anesthetized hypothermic rats. It was found that an increase in the rewarming rate of the rat's hip skin resulted in a decrease of the temperature threshold of metabolic reactions. Results also indicated that the degree of dilation of cutaneous vessels depends on the internal temperature and on the vessel temperature.

I.S.

A91-47447

**THE INFLUENCE OF MODERATE-INTENSITY LOCOMOTION REGIMENS ON SPONTANEOUS LOCOMOTIVE ACTIVITY AND ON TOLERANCE TO ACUTE HYPOXIC HYPOXIA IN RATS [VLIYANIE DVIGATEL'NYKH REZHIMOV UMERENNOI INTENSIVNOSTI NA SPONTANNUIU DVIGATEL'NIU AKTIVNOST' I USTOICHIVOST' KRYSA K OSTROI GIPOKSICHESKOI GIPOKSII]**

V. I. KISELEV, I. V. KONEV, and V. P. KULIKOV (Altaiskii Gosudarstvennyi Meditsinskii Institut, Barnaul, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 77, Jan. 1991, p. 122-127. In Russian. refs Copyright

A91-47484

**THE STATE OF WATER-SALT METABOLISM IN GUINEA PIGS AFTER A PROLONGED STAY AT DIFFERENT TEMPERATURES OF A HYPERBARIC ENVIRONMENT [SOSTOYANIYE VODNO-SOLEVOGO OBMENA U MORSKIKH SVINOK POSLE DLITEL'NOGO PREBYVANIYA PRI RAZLICHNYKH TEMPERATURAKH GIPERBARICHESKOI SREDY]**

V. T. BAKHTEEVA and V. B. KOSTKIN (AN SSSR, Institut Evoliutsionnoi Fiziologii i Biokhimii, Leningrad, USSR)

Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 77, Feb. 1991, p. 100-105. In Russian. refs Copyright

A91-47487

**CHANGES OF RAT PERIPHERAL BLOOD NEUTROPHILS DUE TO THE COMBINED EFFECT OF A MAGNETIC FIELD, PRESSURE CHAMBER HYPOXIA, AND LOW TEMPERATURE [IZMENENIYA NEITROFILOV PERIFERICHESKOI KROVI KRYSA PRI SOCHETANNOM VOZDEISTVII MAGNITNOGO POLIA, BAROKAMERNOI GIPOKSII I NIZKIKH TEMPERATUR]**

Z. V. BABAEVA, M. Z. TSAGARELI, and K. IU. UGULAVA (AN Gruzii, Institut Eksperimental'noi Morfolologii, Tbilisi, Georgian SSR) Akademiia Nauk Gruzii, Soobshcheniia (ISSN 0132-1447), vol. 141, Feb. 1991, p. 405-408. In Russian. refs Copyright

N91-27723# Rensselaer Polytechnic Inst., Troy, NY.

**PHYLOGENETIC RELATIONSHIPS AMONG SUBSURFACE MICROORGANISMS**

S. A. NIERZWICKI-BAUER 1991 10 p

(Contract DE-FG02-90ER-60989)

(DE91-009838; DOE/ER-60989/1) Avail: NTIS HC/MF A02

This report summarizes the progress made from Jun. 1990 to Mar. 1991 toward completion of our project on phylogenetic relationships among subsurface microorganisms. The major accomplishments of the project during this period include: (1) preliminary grouping of SMCC isolates on the basis of 16S rRNA sequence data; (2) design and synthesis of 16S rRNA probes; (3) development of in situ hybridization procedures; (4) relatedness of subsurface isolates to selected phylogenetic groups; (5) RFLP analysis as an indicator of isolates to be tested with in situ hybridization; (6) detection of 16S rRNA in starved cells using SMCC isolates; and (7) preliminary experiments using microbes released from sediment samples, derived from the Hanford site, reflects its metabolic state. Cells which are starved for four days are not detectable with the homologous 16S rRNA probe. However, within 15 minutes of refeeding, detectable rRNA appeared. This suggests that organisms which are undetectable in environmental samples due to starvation may be detectable after addition of nutrients. Stepwise addition of specific nutrients could indicate which nutrients are rate limiting for growth. Preliminary experiments with soil samples from the Hanford Site indicate indigenous microorganisms can be detected by oligonucleotide probes. Further, using multiple probes based on universal sequences increases the number of organisms detected. Double label experiments, using a rhodamine-labelled oligonucleotide probe with free coumarin succinimidyl ester will allow simultaneous detection of total bacteria and specific 16S rRNA containing bacteria.

DOE

N91-27724\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**THE EVOLUTION OF ENERGY-TRANSDUCING SYSTEMS. STUDIES WITH AN EXTREMELY HALOPHILIC**

**ARCHAEBACTERIUM** Semiannual Progress Report, Feb. - Jul. 1991

HELGA STAN-LOTTER Jul. 1991 5 p

(Contract NCC2-578)

(NASA-CR-188641; NAS 1.26:188641) Avail: NTIS HC/MF A01 CSCL 06C

The halobacterial ATPase was labeled with C-14-dicyclohexylcarbodiimide and subunit 2 of the enzyme was prepared by electroelution. Subunit 2 was cleaved by several chemical and enzymatic procedures for further preparation of peptides. Immunoreactions (Western blotting) of halobacterial membranes were performed with an antiserum against subunit A of the vacuolar ATPase from *Neurospora crassa*. A 85 K band (subunit 1) from the membranes of *H. saccharovorum* and from two halobacterial isolates, which were isolated from Permian salt sediments, reacted strongly with the antiserum. The ATPase from the latter isolates resembled the ATPase from *H. saccharovorum*, but had a higher content of acidic amino acids. It can be verified that the age of the bacterial isolates is in the same

range as when deposition of salt occurred, an extremely interesting system for the study of evolutionary questions would be available, since the salt-embedded bacteria presumably did not undergo mutational and selectional events. Author

**N91-27725#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

10 Jan. 1991 32 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-003) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agricultural science, epidemiology, immunology, medicine, microbiology, pharmacology and toxicology, physiology, and public health.

Author

**N91-27726#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

7 Feb. 1991 58 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-004) Avail: NTIS HC/MF A04

Abstracts of Soviet literature are presented in the field of life sciences. The following areas are covered: aerospace medicine; agricultural science; biochemistry; biotechnology; genetics; immunology; laser bioeffects; medicine; microbiology; nonionizing radiation effects; pharmacology and toxicology; public health; and radiation biology.

**N91-27728#** Joint Publications Research Service, Arlington, VA.  
**FEATURES OF TERRESTRIAL NIGHTTIME SLEEP OF MONKEYS AND SLEEP DURING SPACE FLIGHT ABOARD COSMOS-1667 BIOSATELLITE Abstract Only**

G. G. SHLYK, V. S. ROTENBERG, M. A. SHIRVINSKAYA, V. I. KOROLKOV, and V. S. MAGEDOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 12-17 Avail: NTIS HC/MF A04

Nighttime sleep patterns were assessed in two monkeys, Vernyy and Gordyy, under terrestrial conditions and during a seven day flight aboard the Cosmos-1667 biological satellite. Comparison of the electrophysiological data derived during the night immediately before flight, during flight, and one month after the flight showed that the two primates responded differently to the experience. In the case of Vernyy, the most pronounced perturbations in the sleep pattern were noted immediately before the flight, including frequent awakenings and reduction in delta sleep and elevation of the REM/delta sleep ratio. During the first night aboard Cosmos-1667, Vernyy exhibited the recoil effect and had the longest delta sleep seen in that animal during the period of observations. Subsequently, the sleep characteristics stabilized with reduction in the REM/delta sleep ratio, a change indicative of adaptation. A month later, good tolerance of space flight and physiological recovery were evident in low REM/delta sleep ratios and high proportion of delta sleep. The changes observed in the case of Gordyy reflected less capacity for adaptation and tolerance of stress. The maximum increase in the REM/delta sleep ratio was less than 50 percent in Vernyy, but was more than twofold in Gordyy (largely the result of extremely short delta sleep). Furthermore, Gordyy also failed to exhibit the recoil phenomenon.

Author

**N91-27729#** Joint Publications Research Service, Arlington, VA.  
**STRUCTURAL CHANGES IN VESTIBULAR RECEPTORS IN RATS AFTER FLIGHT ABOARD COSMOS-1667 BIOSATELLITE Abstract Only**

D. V. LYCHAKOV, A. N. PASHCHININ, A. BYADZHIYEVA-MIKHAYLOVA, and I. KHRISTOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya

I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 17-26

Avail: NTIS HC/MF A04

Light microscopy and ultrastructural studies were conducted on the vestibular structure of 13 male rats, approximately 13 months old, after a seven-day space flight aboard the biosatellite Cosmos-1667. The study represents the first ultrastructural assessment of the utricle, saccule, and ampullae of the semicircular canals. The study revealed considerable variation in the receptor epithelium. Receptor cells in the auditory striae of the utricle and saccule and in the central apical area of the cristae were found to be surrounded by enlarged cup-like nerve endings that cover approximately 70 percent of the receptor cell surface. The enlarged nerve endings were distributed unevenly in the various vestibular formations and differed between the right and left ear. Comparison between one rat sacrificed immediately after the flight and those sacrificed later demonstrated that the changes in the nerve endings were evidently due to space flight, since they disappeared on re-adaptation to terrestrial conditions. In conjunction with previously published data, it appears that space flights of 20 days or less do not induce persistent abnormal changes in the receptor components of the vestibular apparatus. Author

**N91-27734#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

15 Mar. 1991 33 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-007) Avail: NTIS HC/MF A03

Topics addressed include: biochemistry; biotechnology; epidemiology; public health; virology; laser bioeffects; environment; radiation biology; medicine; physiology; immunology; microbiology; pharmacology; non-ionizing radiation effects; and toxicology.

B.G.

**N91-27735#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

17 Jun. 1991 77 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-013) Avail: NTIS HC/MF A05

Abstracts of Soviet research projects in the life sciences are presented. The following topics are covered: biophysics, public health, radiation biology, and biotechnology.

K.S.

**N91-27736#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

28 Jun. 1991 53 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-014) Avail: NTIS HC/MF A04

Abstracts on U.S.S.R. research in life sciences are given. Topics covered include biochemistry, biophysics, epidemiology, clinical medicine, microbiology, pharmacology, physiology, public health, psychology, radiation biology, and virology.

Author

**N91-27737#** Arizona Univ., Tucson.

**PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON BIOLOGICAL REACTIVE INTERMEDIATES: MOLECULAR AND CELLULAR EFFECTS AND THEIR IMPACT ON HUMAN HEALTH Final Report, 15 Feb. 1990 - 14 Feb. 1991**

I. G. SIPES 3 Apr. 1991 16 p Symposium held in Tucson, AZ, 14-17 Jan. 1990

(Contract AF-AFOSR-0186-90; AF PROJ. 2312)

(AD-A235518; AFOSR-91-0441TR) Avail: NTIS HC/MF A03 CSCL 15/6

The topics of each session focused on understanding new developments in the area of formation/detoxification of reactive intermediates and the consequence of their formation. The program consisted of 71 major talks, a Round Table Discussion and 108 free communications (posters). The nature of the presentations underscored the need to understand the molecular and cellular consequence of reactive intermediate formation. The final talk



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focused on new approaches and research needs in the area of reactive intermediates. The 'Future Research Needs for the Application of Mechanistic Data to Risk Assessment' talk focused on how modern molecular biology tools can be incorporated into mechanistic studies. GRA

**N91-27738#** Brown Univ., Providence, RI. Center for Neural Science.

### **SYNAPTIC PLASTICITY IN VISUAL CORTEX: COMPARISON OF THEORY WITH EXPERIMENT**

EUGENE E. CLOTHIAUX, MARK F. BEAR, and LEON N. COOPER 1990 71 p

(Contract N00014-86-K-0041; DAAL03-88-K-0116; NSF

EET-87-19102; NSF DIR-87-20084)

(AD-A236223) Avail: NTIS HC/MF A04 CSCL 20/4

Experiments performed over the last three decades indicate that the response properties of neurons in the striate cortex of the cat can be modified by manipulating the visual experience of the animal during a critical period of postnatal development. A theory that can account for these results in a precise, quantitative fashion may yield insight into the underlying molecular mechanisms as well as make possible the use of the visual cortex as a preparation for the study of the physiological basis of learning and memory storage. Such a theory has been developed in our laboratory. It allows a precise specification of theoretical equivalents of experimental situations and makes possible detailed and quantitative comparison of theory with experiment. The aim of the present effort is to provide such a comparison for what we call classical rearing conditions. These include normal rearing, monocular deprivation, reverse suture, strabismus, binocular deprivation, as well as the restoration of normal binocular vision after forms of deprivation. We find quantitative agreement of theory and experiment both for equilibrium states and the kinetics by which they are reached. GRA

**N91-27739#** California Univ., Santa Barbara. Marine Science Inst.

### **MOLECULAR BIOLOGY OF THE PHOTOREGULATION OF PHOTOSYNTHETIC LIGHT-HARVESTING COMPLEXES IN MARINE DINOFLAGELLATES Final Report, Oct. 1987 - Mar. 1991**

BARBARA B. PREZELIN and EDWARD L. TRIPLETT 4 Jun. 1991 5 p

(Contract N00014-88-K-0060; NR PROJ. RR0-4106)

(AD-A236623) Avail: NTIS HC/MF A01 CSCL 06/1

The goal is to continue to use biotechnological techniques to study the genetic bases of light- and nutrient-regulation of photosynthetic light-harvesting complexes in marine dinoflagellates. The peridinin chlorophyll a-protein (PCP) complexes of dinoflagellates was chosen as a model system for proposed genetic analyses. Since these phytoplankton are a spectral representative of the large group of marine algae whose light-harvesting components are dominated by blue-light absorbing xanthophylls, knowledge gained through study of the PCP system may also provide insights into the closely related fucoxanthin system of diatoms, chrysophytes and brown algae. GRA

**N91-28064\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

### **A COMPARATIVE STUDY OF SEMINIFEROUS TUBULAR EPITHELIUM FROM RATS FLOWN ON COSMOS 1887 AND SL3**

WALTER J. SAPP, CAROL S. WILLIAMS, K. KATO, DELBERT E. PHILPOTT, J. STEVENSON, and L. V. SEROVA (Institute of Biomedical Problems, Moscow, USSR) In Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 1-8 1989 Submitted for publication Sponsored in part by NIH

(Contract NCC2-12; NCC2-455)

Avail: NTIS HC/MF A23 CSCL 06/3

Space flight, with its unique environmental constraints such as immobilization, decreased and increased pressures, and radiation, is known to affect testicular morphology and spermatogenesis.

Among the several biological experiments and animals on board COSMOS 1887 Biosputnik flight were 10 rats, from which were collected testicular tissue. Average weights of flight tests were 6.4 pct. below that of the vivarium control when normalized for weight loss/100 grams body weight. Counts of surviving spermatogonia per tubule cross section indicated an average of 39 spermatogonia for flight animals, 40 for synchronous controls and 44 for the vivarium controls. Serum testosterone was significantly decreased when compared to basal controls but the decrease was not significant when compared in vivarium and synchronous control groups. The significant decrease in spermatogonia and the decrease in serum testosterone are similar to that in animals flown on Space Lab 3 (Challenger Shuttle).

Author

**N91-28065\*#** Tuskegee Inst., AL. Agricultural Experiment Station.

### **EFFECT OF BIWEEKLY SHOOT TIP HARVESTS ON THE GROWTH AND YIELD OF GEORGIA JET SWEET POTATO GROWN HYDROPONICALLY**

CYRIACUS R. OGBUEHI, PHIL A. LORETAN, C. K. BONSI, WALTER A. HILL, CARLTON E. MORRIS, P. K. BISWAS, and DESMOND G. MORTLEY In Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 9-14 1989 Sponsored in part by Department of Agriculture (Contract NAG10-24)

Avail: NTIS HC/MF A23 CSCL 06/3

Sweet potato shoot tips have been shown to be a nutritious green vegetable. A study was conducted to determine the effect of biweekly shoot tip harvests on the growth and yield of Georgia Jet sweet potato grown in the greenhouse using the nutrient film technique (NFT). The nutrient solution consisted of a modified half Hoagland solution. Biweekly shoot tip harvests, beginning 42 days after planting, provided substantial amounts of vegetable greens and did not affect the fresh and dry foliage weights or the storage root number and fresh and dry storage root weights at final harvest. The rates of anion and cation uptake were not affected by tip harvests. Author

**N91-28066\*#** Tuskegee Inst., AL. Agricultural Experiment Station.

### **EFFECT OF CHANNEL SIZE ON SWEET POTATO STORAGE ROOT ENLARGEMENT IN THE TUSKEGEE UNIVERSITY HYDROPONIC NUTRIENT FILM SYSTEM**

CARLTON E. MORRIS, EDWIN MARTINEZ, C. K. BONSI, DESMOND G. MORTLEY, WALTER A. HILL, CYRIACUS R. OGBUEHI, and PHIL A. LORETAN In Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 15-19 1989 Sponsored in part by Department of Agriculture (Contract NAG10-24)

Avail: NTIS HC/MF A23 CSCL 06/3

The potential of the sweet potato as a food source for future long term manned space missions is being evaluated for NASA's Controlled Ecological Life Support Systems (CELSS) program. Sweet potatoes have been successfully grown in a specially designed Tuskegee University nutrient film technique (TU NFT) system. This hydroponic system yielded storage roots as high as 1790 g/plant fresh weight. In order to determine the effect of channel size on the yield of sweet potatoes, the width and depth of the growing channels were varied in two separate experiments. Widths were studied using the rectangular TU NFT channels with widths of 15 cm (6 in), 30 cm (12 in) and 45 cm (18 in). Channel depths of 5 cm (2 in), 10 cm (4 in), and 15 cm (6 in) were studied using a standard NASA fan shaped Biomass Production Chamber (BPC) channel. A comparison of preliminary results indicated that, except for storage root number, the growth and yield of sweet potatoes were not affected by channel width. Storage root yield was affected by channel depth although storage root number and foliage growth were not. Both experiments are being repeated. Author

**N91-28069\*** # Alcorn State Univ., Lorman, MS. Dept. of Biological Sciences.

**IN VITRO REGENERATION OF BASELLA ALBA L**

NORRIS ALLEN EDNEY, MUHAMMAD A. RIZVI, and NARJIS F. RIZVI /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 33-39 1989  
 Avail: NTIS HC/MF A23 CSCL 06/3

Basella alba L. is a tropical vine used as a vegetable in some Asian and African countries. It has potential as a nontraditional crop for small family farms. A short day plant, it blooms during the fall, provided the temperatures are mild. In the southeastern U.S., the short days of fall are associated with subfreezing temperatures, and plants are killed before blooming. Attempts were made to regenerate the plant using tissue culture techniques. Several trials were conducted with different media, hormones, and explants. It was found that nodal segments on Gamborg medium regenerated shoots. Interaction studies of auxins and cytokinins indicated that its endogenous auxin content might be high because callus proliferated in almost all treatments and roots initiated even when the medium was not supplemented with an auxin. Author

**N91-28070\*** # Alabama A & M Univ., Normal. Dept. of Biology.

**MANIPULATING CYANOBACTERIA: SPIRULINA FOR POTENTIAL CELSS DIET**

MAHASIN G. TADROS, WOODROW SMITH, PETER MBUTHIA, and BEVERLY JOSEPH /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 40-44 1989

(Contract NCC2-501)

Avail: NTIS HC/MF A23 CSCL 06/3

Spirulina sp. as a bioregenerative photosynthetic and an edible alga for spacecraft crew in a CELSS, was characterized for the biomass yield in batch cultures, under various environmental conditions. The partitioning of the assimilatory products (proteins, carbohydrates, lipids) were manipulated by varying the environmental growth conditions. Experiments with Spirulina have shown that under stress conditions (i.e., high light 160  $\mu\text{E}/\text{sq m/s}$ , temperature 38 C, nitrogen or phosphate limitation; 0.1 M sodium chloride) carbohydrates increased at the expense of proteins. In other experiments, where the growth media were sufficient in nutrients and incubated under optimum growth conditions, the total of the algal could be manipulated by growth conditions. These results support the feasibility of considering Spirulina as a subsystem in CELSS because of the ease with which its nutrient content can be manipulated. Author

**N91-28712#** Lawrence Livermore National Lab., CA.

**THE USE OF AMS TO THE BIOMEDICAL SCIENCES**

J. S. VOGEL Apr. 1991 17 p Presented at the Environment Canada Workshop on Canadian Requirements for The Center for Accelerator Mass Spectrometry (AMS), Burlington, Ontario (Canada), 15-16 Apr. 1991

(Contract W-7405-ENG-48)

(DE91-012037; UCRL-JC-107116; CONF-9104245-1) Avail: NTIS HC/MF A03

The Center for Accelerator Mass Spectroscopy (AMS) began making AMS measurements in 1989. Biomedical experiments were originally limited by sample preparation techniques, but we expect the number of biomedical samples to increase five-fold. While many of the detailed techniques for making biomedical measurements resemble those used in other fields, biological tracer experiments differ substantially from the observational approaches of earth science investigators. The role of xenobiotics in initiating mutations in cells is of particular interest. One measure of the damage caused to the genetic material is obtained by counting the number of adducts formed by a chemical agent at a given dose. AMS allows direct measurement of the number of adducts through stoichiometric quantification of the C-14 label attached to the DNA after exposure to a labelled carcinogen. Other isotopes of interest include tritium, Cl-36, Se-79, Ca-41, Al-26, and I-129. Our experiments with low dose environmental carcinogens reflect the protocols which will become a common part of biomedical AMS. In biomedical experiments, the researcher defines the carbon

to be analyzed through dissection and/or chemical purification; thus the sample is merely combusted and graphitized at the AMS facility. However, since biomedical samples can have a C-14 range of five orders of magnitude, preparation of graphite required construction of a special manifold to prevent cross-contamination. Additionally, a strain of C-14-depleted C57BL/6 mice is being developed to further reduce background in biomedical experiments. AMS has a bright and diverse future in radioisotope tracing. Such work requires a dedicated amalgamation of AMS scientists and biomedical researchers who will redesign experimental protocols to maximize the AMS technique and minimize the danger of catastrophic contamination. DOE

**N91-28713#** Purdue Univ., West Lafayette, IN. Dept. of Biological Sciences.

**REGULATION OF PHOTOSYNTHETIC MEMBRANE COMPONENTS IN CYANOBACTERIA**

L. A. SHERMAN 1991 11 p

(Contract DE-FG02-89ER-14028)

(DE91-012713; DOE/ER-14028/2) Avail: NTIS HC/MF A03

The major objectives are to analyze gene regulation under different environmental conditions and to determine the role of the psbO protein (MSP, the manganese stabilizing protein, the 33 kDa protein) in O<sub>2</sub>-evolution. These objectives are studied in the transformable cyanobacteria *Synechococcus* sp. PCC7942 and *Synechocystis* sp. PCC6803, respectively. A deletion strain ( $\Delta$ psbO) was used in *Synechocystis* that completely lacks the gene or the gene product, and which can grow photosynthetically at about 2/3 the normal rate. This deletion strain was used to construct site directed mutations at specific, externally located, charged residues. In particular, residues and domains that enable MSP to interact with the PSII reaction center components were analyzed. The gene which codes for the novel chlorophyll protein complex which is synthesized during iron deficiency was identified and cloned. The apoprotein, isiA, has an amino acid sequence very similar to that of the gene product of psbC (CP43) except for the lack of most of the large luminal loop E. It was found that an insertion mutant in isiA can grow normally in regular iron sufficient medium and in partially iron deficient cultures. A putative candidate for irpR was identified, the iron regulated DNA binding protein that is used to control gene expression based on iron concentrations. DOE

**N91-28714#** Los Alamos National Lab., NM.

**SPONTANEOUS EMERGENCE OF A METABOLISM**

R. J. BAGLEY and J. D. FARMER (Los Alamos National Lab., NM.) 1990 51 p Presented at the Artificial Life Conference, Santa Fe, Feb. 1990

(Contract W-7405-ENG-36)

(DE91-013684; LA-UR-91-1707; CONF-9002163-2) Avail: NTIS HC/MF A04

Networks of catalyzed reactions with nonlinear feedback have been proposed to play an important role in the origin of life. We investigate this possibility in a polymer chemistry with catalyzed cleavage and condensation reactions. We study the properties of a well-stirred reactor driven away from equilibrium by the flow of mass. Under appropriate non-equilibrium conditions, the nonlinear feedback of the reaction network focuses the material of the system into a few specific polymer species. The network of catalytic reactions digests the material of its environment, incorporating it into its own form. We call the result an autocatalytic metabolism. Under some variations it persists almost unchanged, while in other cases it dies. We argue that the dynamical stability of autocatalytic metabolisms gives them regenerative properties that allow them to repair themselves and to propagate through time. DOE

**N91-28715#** Pacific Northwest Lab., Richland, WA.

**MICROBEAM STUDIES OF THE SENSITIVITY OF STRUCTURES WITHIN LIVING CELLS**

L. A. BRABY May 1991 32 p Presented at the Scanning Microscopy Meeting, Bethesda, 3-9 May 1991

(Contract DE-AC06-76RL-01830)

(DE91-012927; PNL-SA-19443; CONF-9105197-1) Avail: NTIS HC/MF A03

Determining the biological effects of low doses of high LET radiation is complicated by the stochastic nature of charged-particle interactions. Populations of cells exposed to very low doses contain a few cells which have been hit by a charged particle, while the majority of the cells receive no radiation damage. At somewhat higher doses, a few cells receive two or more events. We have developed a special irradiation facility at PNL to control the actual number of charged-particle tracks that pass through cell nuclei. This approach can be used to investigate the effects of the interaction between irradiated and unirradiated cells in an organized system, as well as to study the effects of spatial and temporal distribution of radiation damage within single cells. We expect that this approach will lead to a better understanding of the mechanisms of high LET radiation effects. DOE

**N91-28716#** Columbia Univ., New York, NY. Center for Radiological Research.

**RADIATION PHYSICS, BIOPHYSICS, AND RADIATION BIOLOGY**

E. J. HALL and M. ZAIDER May 1991 100 p  
(Contract DE-FG02-88ER-60631)

(DE91-012883; DOE/ER-60631/7) Avail: NTIS HC/MF A05

Research is a blend of physics, chemistry, and biology, involving research at the basic level with the admixture of a small proportion of pragmatic or applied research in support of radiation protection and/or radiotherapy. Current research topics include: oncogenic transformation assays, mutation studies involving interactions between radiation and environmental contaminants, isolation, characterization and sequencing of a human repair gene, characterization of a dominant transforming gene found in C3H 10T1/2 cells, characterize ab initio the interaction of DNA and radiation, refine estimates of the radiation quality factor Q, a new mechanistic model of oncogenesis showing the role of long term low dose medium LET radiation, and time dependent modeling of radiation induced chromosome damage and subsequent repair or misrepair. DOE

**N91-28717#** California Inst. of Biological Research, La Jolla.  
**NOVEL METHODS FOR PHYSICAL MAPPING OF THE HUMAN GENOME APPLIED TO THE LONG ARM OF CHROMOSOME 5**  
M. MCCLELLAND Jan. 1991 17 p

(Contract DE-FG03-89ER-60913)

(DE91-012894; DOE/ER-60913/T1) Avail: NTIS HC/MF A03

The objective was to develop novel methods for mapping of the human genome. The techniques to be assessed were: (1) three methods for the production of unique sequence clones from the region of interest; (2) novel methods for the production and separation of multi-megabase DNA fragments; (3) methods for the production of physical linking clones that contain rare restriction sites; (4) application of these methods and available resources to map the region of interest. Rare-cleavage tools were developed based on restriction enzymes and methylases. The effect of methylation on enzymes used for genome mapping was studied. Characterization was made of two new isoschizomers. A reliable way to produce partial digests of DNA in agarose was developed and applied to the human genome. And a method was applied to double the apparent specificity of rare-cutter endonucleases. DOE

**N91-28718#** Oak Ridge National Lab., TN.

**PHOTOBIOLOGY: ALGAL HYDROGEN PRODUCTION AND PHOTOCONDUCTIVITY OF METALIZED CHLOROPLASTS**

E. GREENBAUM 1991 7 p Presented at the International Symposium on New Biomaterials and Global Ecology, Tokyo (Japan), 25-27 Jun. 1991

(Contract DE-AC05-84OR-21400)

(DE91-013232; CONF-9106192-1) Avail: NTIS HC/MF A02

Sustained hydrogen photoevolution from *Chlamydomonas reinhardtii* and *C. Moewusii* was measured under an anoxic, CO<sub>2</sub> containing atmosphere. It has been discovered that light intensity and temperature influence the partitioning of reductant between

the hydrogen photoevolution pathway and the Calvin cycle. Under low incident light intensity (1-3 W m<sup>2</sup> minus 2)) or low temperature (approx. 0 C), the flow of photosynthetic reductant to the Calvin cycle was reduced, and reductant was partitioned to the hydrogen pathway as evidenced by sustained H<sub>2</sub> photoevolution. Under saturating light (25 W m<sup>2</sup> minus 2)) and moderate temperature 20 plus minus 5 C, the Calvin cycle became the absolute sink for reductant with the exception of a burst of H<sub>2</sub> occurring at light on. A novel photobiophysical phenomenon was observed in isolated spinach chloroplasts that were metalized by precipitating colloidal platinum onto the surface of the thylakoid membranes. A two-point irradiation and detection system was constructed in which a continuous beam helium-neon laser (lambda) = 632.8 nm) was used to irradiate the platinized chloroplasts at varying perpendicular distances from a single linear platinum electrode in pressure contact with the platinized chloroplasts. No external voltage bias was applied to the system. The key objective of the experiments reported in this report was to measure the relative photoconductivity of the chloroplast-metal composite matrix. DOE

**N91-28719#** Oak Ridge National Lab., TN.

**BIOMARKER-BASED BIOMONITORING FOR EVALUATING HEALTH AND ECOLOGICAL EFFECTS ON ENVIRONMENTAL CONTAMINATION**

J. F. MCCARTHY, L. R. SHUGART, and B. D. JIMENEZ 1991 43 p Presented at the Hazardous Waste Site Investigations: Toward Better Decisions, Gatlinburg, 21-24 May 1990

(Contract DE-AC05-84OR-21400)

(DE91-013729; CONF-900556-2) Avail: NTIS HC/MF A03

A research approach is described for assessing the biological and ecological significance of contaminants present in the environment. The approach uses wild animals and introduced caged animals near hazardous waste sites as (1) sentinels of bioavailable contaminants, (2) predictors of adverse ecological effects, and (3) surrogates to estimate the potential exposure and risks to humans living near these sites. Evidence of exposure in animals on the site provides a temporally-integrated measure of bioavailable contaminant levels and is therefore much more relevant to the potential risk to humans than is the analytically measurable concentration of contaminants in the soil, water, or air. The research approach utilizes biomarkers (biochemical, molecular and cellular indicators of exposure) and measures of body burden of persistent compounds (such as polychlorinated biphenyls; PCBs) in wild animals captured on a hazardous waste disposal site and in adjacent uncontaminated reference areas to identify and quantify the potential for exposure to bioavailable contaminants. Unexposed animals confined at sites confirm the potential for environmental exposure. Relationships between biomarker response and adverse ecological effects are determined from measures of animal health and population structure. The potential risk to humans is extrapolated from the animal exposure data using pharmacodynamic models. DOE

**N91-28720#** California Univ., Berkeley. Lawrence Berkeley Lab.

**CHROMOSOMAL CHANGES IN CULTURED HUMAN EPITHELIAL CELLS TRANSFORMED BY LOW- AND HIGH-LET RADIATION**

TRACY CHUI-HSU YANG, L. M. CRAISE, J. C. PRIOLEAU, M. R. STAMPFER, and J. S. RHIM Nov. 1990 13 p Presented at the COSPAR Plenary Conference, The Hague, Netherlands, 25 Jun. - 6 Jul. 1990

(Contract DE-AC03-76SF-00098)

(DE91-013772; LBL-30024; CONF-9006220-9) Avail: NTIS HC/MF A03

For a better assessment of radiation risk in space, an understanding of the responses of human cells, especially the epithelial cells, to low- and high-LET radiation is essential. In our laboratory, we have successfully developed techniques to study the neoplastic transformation of two human epithelial cell systems by ionizing radiation. These cell systems are human mammary epithelial cells (H184B5) and human epidermal keratinocytes (HEK).

Both cell lines are immortal, anchorage dependent for growth, and nontumorigenic in athymic nude mice. Neoplastic transformation was achieved by irradiation cells successively. Our results showed that radiogenic cell transformation is a multistep process and that a single exposure of ionizing radiation can cause only one step of transformation. It requires, therefore, multihits to make human epithelial cells fully tumorigenic. Using a simple karyotyping method, we did chromosome analysis with cells cloned at various stages of transformation. We found no consistent large terminal deletion of chromosomes in radiation-induced transformants. Some changes of total number of chromosomes, however, were observed in the transformed cells. These transformants provide an unique opportunity for further genetic studies at a molecular level. DOE

**N91-28721#** California Univ., Berkeley. Lawrence Berkeley Lab.

**GENETIC CHANGES IN MAMMALIAN CELLS TRANSFORMED BY HELIUM CELLS**

M. DURANTE, G. GROSSI (Naples Univ., Italy), T. C. YANG, and R. ROOTS Nov. 1990 12 p Presented at the COSPAR Plenary Conference, The Hague, Netherlands, 25 Jun. - 6 Jul. 1990

(Contract DE-AC03-76SF-00098)

(DE91-013778; LBL-30025; CONF-9006220-10) Avail: NTIS HC/MF A03

Midterm Syrian Hamster embryo (SHE) cells were employed to study high LET-radiation induced tumorigenesis. Normal SHE cells (secondary passage) were irradiated with accelerated helium ions at an incident energy of 22 MeV/u (9 to 10 keV/micron). Transformed clones were isolated after growth in soft agar of cells obtained from the foci of the initial monolayer plated postirradiation. To study the progression process of malignant transformation, the transformed clones were followed by monolayer subculturing for prolonged periods of time. Subsequently, neoplasia tests in nude mice were done. In this work, however, we have focused on karyotypic changes in the banding patterns of the chromosomes during the early part of the progressive process of cell transformation for helium ion-induced transformed cells.

DOE

**N91-28722#** California Univ., Berkeley. Lawrence Berkeley Lab.

**PROTEIN-DIRECTED MODULATION OF HIGH-LET HYPERTHERMIC RADIOSENSITIZATION Ph.D. Thesis**

P. CHANG Apr. 1991 100 p

(Contract DE-AC03-76SF-00098)

(DE91-013783; LBL-30680) Avail: NTIS HC/MF A05

The importance of protein synthesis (PS) in development of thermotolerance was studied in CHO-SC1 cells and its mutant CHO-tsH1. SC1 cells show classic biphasic survival curves after continuous heating (greater than 41 C); tsH1 cells do not. tsH1 cells do show thermotolerance similar to SC1 cells when incubated at 35 C, but survival at the nonpermissive temperature 40 C was greatly reduced in the absence of PS. We believe PS is not required for the initial onset of thermotolerance, but is required for sustaining it. The combined effects of heat and high-LET radiation were studied. SC1 cells show different survival curves depending on the order of treatment; tsH1 cells have the same response in either case. Increased radiosensitivity in SC1 cells depends on PS following irradiation and is LET-dependent. These results suggest that high-LET radiation induced cellular damage can be potentiated with heat-induced PS during post-irradiation heat treatment.

DOE

**N91-28723#** Arizona State Univ., Tempe.

**ANTENNA ORGANIZATION IN GREEN PHOTOSYNTHETIC BACTERIA**

R. E. BLANKENSHIP 1990 23 p

(Contract DE-FG02-85ER-13388)

(DE91-014814; DOE/ER-13388/5) Avail: NTIS HC/MF A03

Chlorosomes are bag-like structures attached to the cytoplasmic side of the inner cell membrane, and transfer energy into the membrane where long-term energy storage is carried out

by the photochemical reaction center. Evidence is now overwhelming that the chlorosome represents a very different type of antenna from that found in any other system yet studied. The idea that the pigments in chlorosomes are organized into molecular aggregates by direct pigment-pigment interactions has now gained essentially universal acceptance among the workers in the field of photosynthesis, largely due to the work from our laboratory. The challenge is now to understand at a molecular level how the pigment oligomers are packaged into the chlorosome and how they function to make an efficient antenna system. The role of proteins in the chlorosome is now very unclear, and some workers believe they play essentially no role. Several lines of current and planned experiments are directed at understanding these questions. A major conceptual breakthrough was the discovery of a previously unrecognized control system that serves to regulate the flux of energy through the system in response to the redox potential of the cell. Each of these areas is described. DOE

**N91-28724#** Alabama Univ., University. Dept. of Chemistry. **MAGNETIC RESONANCE AND OPTICAL SPECTROSCOPIC STUDIES OF CAROTENOIDS**

L. D. KISPERT May 1991 14 p

(Contract DE-FG05-86ER-13465)

(DE91-014361; DOE/ER-13465/6) Avail: NTIS HC/MF A03

The role was studied of a host lattice in the formation of radicals and excited singlet and triplet states that are relevant to photosynthesis. Particular emphasis is being placed on determining what is special about carotenoids that natural photosynthetic systems require them as antennae as well as for protection. The host matrix is manipulated so as to understand the carotenoid function (protection, quenching, energy transfer and antenna) and the structure of carotenoid cations. To characterize their properties, EPR, ENDOR, optical, molecular orbital and electrochemical studies were performed of carotenoids and carotenoid cations produced chemically, electrochemically, radiolytically (x ray irradiated from matrices) and photolytically (solution photolysis by excimer radiation) as a function of the host matrix. DOE

**N91-28725#** Los Alamos National Lab., NM.

**PLANT GROWTH IS INFLUENCED BY GLUTAMINE SYNTHETASE-CATALYZED NITROGEN METABOLISM**

P. J. LANGSTON-UNKEFER 11 Jun. 1991 20 p Presented at the DOE Workshop on Marker-Aided Selection, Gatlinburg, 13-14 Jun. 1991

(Contract W-7405-ENG-36)

(DE91-014592; LA-UR-91-2100; CONF-9106225-1) Avail: NTIS HC/MF A03

Ammonia assimilation has been implicated as participating in regulation of nitrogen fixation in free-living bacteria. In fact, these simple organisms utilize an integrated regulation of carbon and nitrogen metabolism; we expect to observe an integration of nitrogen and carbon fixation in plants; how could these complex systems grow efficiently and compete in the ecosystem without coordinating these two crucial activities? We have been investigating the role of ammonia assimilation regulating the complex symbiotic nitrogen fixation of legumes. Just as is observed in the simple bacterial systems, perturbation of ammonia assimilation in legumes results in increased overall nitrogen fixation. The perturbed plants have increased growth and total nitrogen fixation capability. Because we have targeted the first enzyme in ammonia assimilation, glutamine synthetase, this provides a marker that could be used to assist selection or screening for increased biomass yield. DOE

## AEROSPACE MEDICINE

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

**A91-45645#****CIRCULATORY BIOMECHANICS - ACCELERATION EFFECTS [BIOMECHANIQUE CIRCULATOIRE - EFFETS DES ACCELERATIONS]**

D. GAFFIE (ONERA, Chatillon, France), P. QUANDIEU (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Bretigny-sur-Orge, France), PH. LIEBAERT (DRET, Service des Recherches, Paris, France), D. COHEN-ZARDY, T. DAUMAS (Ecole Polytechnique, Palaiseau, France) et al. (NATO, AGARD, Symposium on High Altitude and High Acceleration Protection for Military Aircrew, Pensacola, FL, Apr. 29, 30, 1991) ONERA, TP no. 1991-67, 1991, 17 p. In French. DRET-supported research. refs

(ONERA, TP NO. 1991-67)

A general physical model of blood-flow behavior in vessels is presented with the aim of elucidating the mechanisms of acceleration-related loss of consciousness (LOC) in fighter-aircraft pilots. Calculation results show that, under certain conditions, a blood flow rate limitation is observed which is associated with a modification of the flow regime. This leads to the hypothesis that, under the application of a very rapid loading factor, the onset of LOC is associated with a hypoxia connected with intracranial hypertension. L.M.

**A91-45867****PARABOLIC FLIGHT AS A TOOL TO MEASURE OCULAR COUNTERROTATION IN A REDUCED FORCE ENVIRONMENT**

JOACHIM WETZIG, KLARISSA HOFSTETTER-DEGEN (Mainz, Universitaet, Federal Republic of Germany), J. R. KASS (OH System GmbH, Bremen, Federal Republic of Germany), and M. REISER (Kaiserslautern City Hospital, Federal Republic of Germany) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, June 1991, p. 39-44. DLR-supported research. refs

(Contract BMFT-01-QV-2239)

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Five unmedicated subjects were flown in parabolic flight. The aircraft, a Caravelle, performed single parabolas every 2 to 4 minutes. This resulted in alternating phases of normal, hyper, hypo and again hypergravity. Subjects sat yoga-fashion upright facing the aircraft cockpit. Head and/or trunk was deflected 30 deg from the upright, stimulating otolith and/or neck receptors. During each pullup, low-g phase, and pullout of the parabolas, a picture of the left eye was recorded on video tape. On-the-ground ocular roll (OCR) was determined from these video recordings. OCR ranged from 0.9 to 6.9 deg in low-g and from 1 to 7.2 deg under high-g, depending on head and trunk position. Neck receptor contribution was found to induce OCR of 0.2 deg to 2.1 deg in two subjects. Author

**A91-45868****SUBJECTIVE LUMINOUS LINE PERCEPTION UNDER CHANGING G-LOAD AND BODY-POSITIONS IN PARABOLIC FLIGHT**

KLARISSA HOFSTETTER-DEGEN, JOACHIM WETZIG (Mainz, Universitaet, Federal Republic of Germany), J. R. KASS (OH System GmbH, Bremen, Federal Republic of Germany), and M. REISER (Kaiserslautern City Hospital, Federal Republic of Germany) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, June 1991, p. 45-47. refs

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Five healthy subjects were subjected to parabolic flight with laterally tilted head, trunk, or body position. A vertical luminous line was viewed by the subjects in a head-fixed goggle device.

During normal, hyper- and hypogravity phases, subjective luminous line orientation was measured. The data imply that stimulation of the neck position receptors markedly influences the perception of the subjective vertical as well as mechanisms of convergence of otolithic signals and visual information within the brain. Author

**A91-45869****TEST OF EXERCISE EXPERIMENTS PROPOSED FOR THE MIR '92 MISSION**

DIETER ESSFELD, KLAUS BAUM, and UWE HOFFMANN (Koeln, Deutsche Sporthochschule, Cologne, Federal Republic of Germany) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, June 1991, p. 48-51. refs

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During exercise, heart rate and blood pressure drives can be elicited by receptors situated in the interstitial space of the muscle. It was recently shown that these receptors are sensitive to the local state of hydration. Weightlessness could affect these receptor mechanisms through the redistribution of body fluids and through secondary changes in the interstitial structure. To investigate such effects, an experiment was carried out to determine heart rate and blood pressure responses to light isometric calf exercise at different calf volumes during the Mir '92 mission (experiment ISX). The First North Sea Parabolic Flight campaign provided an opportunity to test the setup and some operational aspects of this experiment. The experience of this campaign led to some modifications of the original setup. Author

**A91-46770\*** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

**INTERPLANETARY CREW EXPOSURE ESTIMATES FOR THE AUGUST 1972 AND OCTOBER 1989 SOLAR PARTICLE EVENTS**

LAWRENCE W. TOWNSEND, JUDY L. SHINN, and JOHN W. WILSON (NASA, Langley Research Center, Hampton, VA) Radiation Research (ISSN 0033-7587), vol. 126, 1991, p. 108-110. refs

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Detailed exposure estimates for the bone marrow, ocular lens, and skin of astronauts on manned missions beyond the earth's magnetosphere have been made for the large solar particle events (SPE) of August 1972 and October 1989. The estimates were made using the coupled neutron-proton space radiation transport computer code BRYNTRN and the CAM model for the human body. It is found that at least 10 g/sq cm aluminum shielding is needed to keep estimated dose equivalent values below current space radiation exposure guidelines recommended for LEO missions. Space suits currently being designed will not provide adequate crew protection and may not even ensure crew survival in the event of exposure to a large SPE during extravehicular activity. O.G.

**A91-46772** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**ENERGY DEPOSITION AT THE BONE-TISSUE INTERFACE FROM NUCLEAR FRAGMENTS PRODUCED BY HIGH-ENERGY NUCLEONS**

FRANCIS A. CUCINOTTA (NASA, Johnson Space Center; Rockwell International Corp., Houston, TX), FERENC HAJNAL (DOE, Environmental Measurements Laboratory, New York), and JOHN W. WILSON (NASA, Langley Research Center, Hampton, VA) Health Physics (ISSN 0017-9078), vol. 59, Dec. 1990, p. 819-825. refs

Copyright

The transport of nuclear fragmentation recoils produced by high-energy nucleons in the region of the bone-tissue interface is considered. Results for the different flux and absorbed dose for recoils produced by 1 GeV protons are presented in a bidirectional transport model. The energy deposition in marrow cavities is seen to be enhanced by recoils produced in bone. Approximate analytic formulae for absorbed dose near the interface region are also presented for a simplified range-energy model. Author

A91-46830

**PLASMA CHANGES IN BETA-ENDORPHIN TO ACUTE HYPOBARIC HYPOXIA AND HIGH INTENSITY EXERCISE**

WILLIAM J. KRAEMER, SCOTT E. GORDON (Pennsylvania State University, University Park), ALLAN J. HAMILTON (Arizona, University, Tucson), LAURIE A. TRAD (U.S. Army, Research Institute of Environmental Medicine, Natick, MA), JOHN T. REEVES (Colorado, University, Medical Center, Denver) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 754-758. refs  
Copyright

A91-46831

**ALTERATIONS IN HUMAN UPPER EXTREMITY MOTOR FUNCTION DURING ACUTE EXPOSURE TO SIMULATED ALTITUDE**

ALLAN J. HAMILTON (U.S. Army, Research Institute of Environmental Medicine, Natick; Massachusetts General Hospital; Harvard University, Boston), LAURIE A. TRAD, and ALLEN CYMERMAN (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 759-764. refs  
Copyright

The hypothesis that mild motor dysfunction is associated with acute mountain sickness (AMS) is verified using a computerized upper extremity movement analyzer (UEMA). Arm movement characteristics were measured in 14 subjects at sea level and at the end of a 30-h simulated altitude exposure (4,600 m). The mean values for all the speed-related parameters measured at the end of the 30-h exposure declined by 20 to 32 percent, as compared with sea-level values. The declines in the speed-related parameters are found to be significantly correlated with the severity of AMS symptoms as measured by the Environmental Symptoms Questionnaire ( $R = 0.82$ ). It is concluded that the results of the study support the hypothesis that subclinical alterations in upper extremity speed are associated with mild, reversible AMS and provide evidence that hypoxia may produce supraspinal inhibition of motor pathways. O.G.

A91-46832\* Brandeis Univ., Waltham, MA.

**ALTERED SENSORIMOTOR CONTROL OF THE BODY AS AN ETIOLOGICAL FACTOR IN SPACE MOTION SICKNESS**

JAMES R. LACKNER, ASHTON GRAYBIEL, and PAUL A. DIZIO (Brandeis University, Waltham, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 765-771. refs  
(Contract NAG9-295)  
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Exposure to nonterrestrial force levels affects the activity of gravito-inertial force sensitive receptors of the body, both of labyrinthine and nonlabyrinthine origin. It also disrupts the normal patterning of motor control of body orientation and movement. The patterns and levels of muscle innervation necessary to achieve particular body configurations and to bring about particular body movements are greatly affected by background force level and body orientation relative to the force vector. The present studies demonstrate that such altered sensorimotor control of head and body posture along with altered vestibulomotor control are evocative of motion sickness. This observation has explanatory significance both for space motion sickness and the re-entry disturbances that occur after prolonged spaceflight. Author

A91-46833

**A DOUBLE-BLIND PLACEBO CONTROLLED EVALUATION OF ACUPRESSURE IN THE TREATMENT OF MOTION SICKNESS**

L. A. WARWICK-EVANS, I. J. MASTERS, and S. B. REDSTONE (Southampton, University, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 776-778. refs  
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A double-blind placebo controlled experiment was used to evaluate the effectiveness of acupressure as a prophylaxis against motion sickness. There were two independent variables with two

levels each: acupressure vs placebo, and motion sickness high vs low susceptible subjects. The provocative stimulus was rotation about two orthogonal axes. Signs and symptoms of motion sickness were scored both by the subject and the observer. In spite of previous reports to the contrary, acupressure provided no protection against motion sickness for either high or low susceptible subjects. Author

A91-46834

**RAPID ONSET OF SEVERE HEAT ILLNESS - A CASE REPORT**

GLENN W. MITCHELL (Aeromedical Consultation Service, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 779-782. refs  
Copyright

The physiological responses of an aviator who had been flying a UH-1H helicopter up to 6 h/d clothed in full IPE on 6 consecutive days prior to the sudden onset of heat illness. His performance during the study was normal, and no clear physiological derangements were noted prior to his symptoms. The rapid evolution of his symptoms after voicing no complaints provides a graphic illustration of the difficult predictability and initial central nervous system effects of this condition. Author

A91-46836

**MORTALITY AND CANCER MORBIDITY AFTER EXPOSURE TO MILITARY AIRCRAFT FUEL**

ANDERS SELDEN and GUNNAR AHLBORG, JR. (Orebro Medical Center Hospital, Sweden) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 789-794. Research supported by Swedish Armed Forces and Swedish Work Environment Fund. refs  
Copyright

In order to elucidate a possible excess risk of lymphatic malignancies due to aircraft fuel exposure in the Swedish Armed Forces (SAF), a historical prospective cohort study was conducted. During a nine-year follow-up period, three cases of malignant lymphoma were detected versus 3.21 expected tumors of the lymphatic system. In conclusion, no evidence was found for an association between military aircraft fuel and the occurrence of malignant lymphomas or other malignancies among exposed men in the SAF. Author

A91-47101

**A NYSTAGMUS STRATEGY TO LINEARIZE THE VESTIBULO-OCULAR REFLEX**

HENRIETTA L. GALIANA (McGill University, Montreal, Canada) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 38, June 1991, p. 532-543. Research supported by NSERC. refs  
Copyright

Two important aspects of the vestibulo-ocular reflex (VOR) are addressed. First, the linear range of ocular responses is much more extensive than expected from the characteristics of central pathways (CNS), and this is shown to result directly from early convergence of fast and slow premotor signals in the central processes, associated with significant and intermittent changes in functional connectivity (effective structural modulation). Second, the presence of such structural modulation implies that responses must be analyzed using transient analysis techniques, rather than previous steady state approaches, in order to properly evaluate reflex dynamics. Simulation results with a recent model of the VOR are used to illustrate the arguments. Relying on known interconnections between saccadic burst circuits in the brainstem, and the ocular premotor areas of the vestibular nuclei, a viable strategy for the timing of nystagmus events is proposed. The strategy easily reproduces the characteristic changes in vestibular nystagmus with the amplitude of head velocities, and with the frequency of passive head oscillation. I.E.

A91-47102\* Massachusetts Inst. of Tech., Cambridge.

**A SIMPLE ELECTRICAL-MECHANICAL MODEL OF THE HEART APPLIED TO THE STUDY OF ELECTRICAL-MECHANICAL ALTERNANS**



EDWARD A. CLANCY (MIT, Cambridge, MA), JOSEPH M. SMITH, and RICHARD J. COHEN (Harvard University; MIT, Cambridge, MA) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 38, June 1991, p. 551-560. Research supported by Whitaker Foundation. refs  
(Contract NAGW-988; NIH-1-R01-HL-39291; N00014-80-C-0520; N00014-79-C-0168)  
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Recent evidence has shown that a subtle alternation in the surface ECG (electrical alternans) may be correlated with the susceptibility to ventricular fibrillation. In the present work, the author presents evidence that a mechanical alternation in the heartbeat (mechanical alternans) generally accompanies electrical alternans. A simple finite-element computer model which emulates both the electrical and the mechanical activity of the heart is presented. A pilot animal study is also reported. The computer model and the animal study both found that (1) there exists a regime of combined electrical-mechanical alternans during the transition from a normal rhythm towards a fibrillatory rhythm, (2) the detected degree of alternation is correlated with the relative instability of the rhythm, and (3) the electrical and mechanical alternans may result from a dispersion in local electrical properties leading to a spatial-temporal alternation in the electrical conduction process. I.E.

#### A91-47446

#### PERCEPTION OF TEMPERATURE RISE BY HUMANS DURING SEASONAL HEAT ADAPTATION [VOSPRIIATIE POVYSHENIIA TEMPERATURY PRI SEZONNOI TEPLOVOI ADAPTATsii CHELOVEKA]

M. D. KHUDAIBERDIEV, F. F. SULTANOV, and L. M. POKORMIAKHA (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 77, Jan. 1991, p. 116-121. In Russian. refs  
Copyright

The functional activity of the temperature analyzer in humans during adaptation to hot temperatures was examined by the psychophysical temperature scaling method, using the Stevens and Stevens (1963) formula to quantify temperature perception. It was found that human subjects placed into chambers at 20, 28, and 40 C temperatures during the hot summer period (in Ashkhabad, USSR) exhibited greater levels of the scaled-temperature perception index (1.66, 1.32, and 1.50, respectively) than the same subjects examined in the winter time (1.40, 1.08, and 0.84). This indicates that these subjects, after adaptation to high summer temperatures, were more sensitive to small increases in temperature in the summer than they were in the winter. These results are evidence of changes taking place in the hot environment in the functional activity of the temperature analyzer. I.S.

#### N91-27727# Joint Publications Research Service, Arlington, VA. PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF SENSORIMOTOR ACTIVITY OF OPERATORS AFTER SHORT-TERM SIMULATED WEIGHTLESSNESS Abstract Only

V. A. PONOMARENKO, V. V. LAPA, and I. S. NIKITIN In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 9-12  
Avail: NTIS HC/MF A04

Psychophysiological tests were conducted on operators to assess the effects of weightlessness on sensorimotor efficiency and operational task performance. Weightlessness was simulated by a -10 degree orthostatic position for 6 days, with a pressure suit applying excess pressure of 60 mm Hg to the lower half of the body, and one-day immersion in water. The results demonstrated that after a period of weightlessness, fine motor coordination and performance suffer in the immediate post weightlessness period, which may be a critical factor upon entering the earth's atmosphere after space flight. The deterioration in performance was described as deautomation of learned habits as a result of changes in the

functional status of the motor analyzer and proprioception. Deterioration was evident in loss of strength and endurance, as well as in over-estimation of effort required for task completion. In practical terms, these observations indicate that upon re-entering the earth's gravitational field, the pilot's motor activity will be regulated essentially by the second signal level. Accordingly, performance under these conditions may be predicted from evaluation of differential thresholds of proprioceptive sensitivity, and training of space crews should encompass conditions involving distorted proprioception. Author

#### N91-27730# Joint Publications Research Service, Arlington, VA. MINERAL DENSITY OF BONES OF HUMAN SKELETON IN SIMULATED REDUCED GRAVITY Abstract Only

V. S. OGANOV, A. S. RAKHMANOV, S. K. TERNOVOY, V. YE. NOVIKOV, and S. L. DUBONOS In its JPRS Report: Science and Technology. USSR: Life Sciences p 2 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 43-47  
Avail: NTIS HC/MF A04

Changes in bone density in response to a 370 day regimen of antiorthostatic (-5 degree) hypokinesia were studied in nine men, 27 to 41 years old, four of whom (Group A) engaged in physical exercise throughout the experiment, and five of whom (Group B) were started on physical exercise beginning with day 120. Data derived from a variety of noninvasive techniques demonstrated to a decrease in density of lumbar vertebrae, diaphyses of the femur, tibia, and forearm bones in most of the subjects with considerable individual variability. The changes, however, were less pronounced in the initial stages in subjects on continuous training. Furthermore, calcium losses from the diaphyses were rather limited and were usually less than 1 percent per month. The most pronounced changes were in the density of the femoral neck, which may be used as an indicator of calcium loss under these conditions. Initiation of physical exercise at day 120 prevented further calcium loss from the femoral neck in Group B, but did not lead to reversal. Author

#### N91-27731# Joint Publications Research Service, Arlington, VA. BLOOD SERUM PROTEIN COMPOSITION AND NITROGEN METABOLISM METABOLISM IN INDIVIDUALS EXPOSED TO LENGTHY HYPOKINESIA Abstract Only

L. B. ZAYTSEVA, O. N. LARINA, and I. A. POPOVA In its JPRS Report: Science and Technology. USSR: Life Sciences p 2 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 50-54  
Avail: NTIS HC/MF A04

In order to obtain a better understanding of factors affecting human physiology under space flight conditions, nine men 27 to 42 years old were subjected to 370 days of orthostatic hypokinesia at an angle of -5 degrees. Physical exercise and chemotherapeutic measures intended to mitigate the adverse effects of hypokinesia were implemented in one group (Group A) of four men on day 25, and in the remaining five subjects on day 120 (Group B). The monitoring of serum protein patterns and urea, uric acid, and creatinine levels, in conjunction with urine levels of uric acid and creatinine, demonstrated, for the most part, little deviation from control values. However, urine creatinine levels revealed predominance of catabolic processes in the muscle tissues, and depression of serum alpha(sub 2)-globulins reflected depression of hepatic biosynthetic potential. Elevation of beta-globulins in both groups indicated an increase in serum concentration of low-density lipoproteins. The urinary creatinine levels in Group A individuals remained normal for approximately 170 days, but thereafter rose to the unfavorable high level seen in Group B subjects. Author

#### N91-27732# Joint Publications Research Service, Arlington, VA. FUNCTIONAL TESTING DURING YEARLONG ANTIORTHOSTATIC HYPOKINESIA Abstract Only

V. M. MIKHAYLOV, G. V. MACHINSKIY, V. P. BUZULINA, V. S. GEORGIYEVSKIY, E. N. NECHAYEVA, and S. G. KRYUTCHENKO In its JPRS Report: Science and Technology.

USSR: Life Sciences p 2 7 Feb. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 54-56  
 Avail: NTIS HC/MF A04

Cardiorespiratory functional testing and work performance were assessed in nine men subjected to 370 days of antiorthostatic (-4.5 degree) hypokinesia. The study was designed to monitor the efficacy of countermeasures employed against weightlessness aboard the Mir Space Station. The results demonstrated that the adverse effects of weightlessness were subject to mitigation by a regular schedule of physical exercise similar, in effect, to that on the Mir Space Station. The beneficial effects were particularly pronounced in the four subjects who were on the exercise regimen throughout the period of simulated weightlessness; they were less so in the five subjects whose exercise program was delayed for 120 days. The former group, for example, remained free of syncopal episodes while the latter group did not. Author

**N91-27733#** Joint Publications Research Service, Arlington, VA.  
**REASONS FOR INFLIGHT DETERIORATION OF STATE OF HEALTH IN PILOTS. REPORT 2 Abstract Only**  
 V. YE. YASTREBOV and V. V. SHCHERBINSKIY In its JPRS Report: Science and Technology. USSR: Life Sciences p 3 7 Feb. 1991 Transl. into ENGLISH from Voenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 10, Oct. 1989, p 43-45  
 Avail: NTIS HC/MF A04

The second part of a report is presented on factors underlying inflight deterioration of health in pilots, usually described in the literature as fatigue related to mental and physical stress. Current findings indicate that the physiological changes implicated in this condition are vagotonia, spasmophilia, and functional hypoglycemia. Equally significant is the fact that psychological factors are involved in 55 to 85 percent of the cases, in conjunction with physical stress factors. Although greater insight was obtained into the pathogenetic mechanisms underlying inflight deterioration of physical and mental faculties, prevention and treatment modalities will have to be placed on a firmer ground through further research to ensure greater flight safety. Author

**N91-27740#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**  
 13 Nov. 1990 63 p Transl. into ENGLISH from various Russian articles  
 (JPRS-ULS-90-019) Avail: NTIS HC/MF A04

This is a compilation of translated Russian articles from various publications. They are grouped into the following subject areas: Aerospace medicine; Agricultural science; Biochemistry; Biophysics; Biotechnology; Epidemiology; Genetics; Laser bioeffects; Microbiology; Military medicine; Nonionizing radiation effects; and Public health. Two abstracts are presented elsewhere: Effect of Job Load on Functional State of Naval Flight Personnel and Pathogenesis and Prevention of Pain Syndrome in Pilots on Long Flights.

**N91-27741#** Joint Publications Research Service, Arlington, VA.  
**EFFECT OF JOB LOAD ON FUNCTIONAL STATE OF NAVAL FLIGHT PERSONNEL Abstract Only**  
 S. G. MELNIK, A. V. SHAKULA, and F. D. GLADKIKH In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 13 Nov. 1990 Transl. into ENGLISH from Voenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 7, Jul. 1989 p 54-57  
 Avail: NTIS HC/MF A04

Comparative studies were conducted on the cardiovascular and respiratory effects that low and high latitude flights have on naval helicopter crews. Data derived for 26 crew members showed that at low latitudes, because of high temperatures and other climatic factors, 2 to 3.5 hours of flight activity were much more stressful than at higher latitudes. Whereas at higher latitudes recovery of normal cardiovascular and respiratory status required about 16 hours, at low latitudes recovery continued for more than 58 hours. As expected, the adverse effects of a 3.5 hour flight were more pronounced than those of a 2 hour flight. These findings indicate

that flight time should be limited to 2.5 to 3 hours, with no more than 2 to 3 flights per day. In addition, sea duty should be limited to a maximum of two tours of three months each. Author

**N91-27742#** Joint Publications Research Service, Arlington, VA.  
**PATHOGENESIS AND PREVENTION OF PAIN SYNDROME IN PILOTS ON LONG FLIGHTS Abstract Only**  
 V. A. VARFOLOMEYEV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 13 Nov. 1990 Transl. into ENGLISH from Voenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 8, Aug. 1989 p 46-48  
 Avail: NTIS HC/MF A04

An analysis was conducted on the pain syndrome that afflicts flight crews during long flights and on the means that may be used to prevent or minimize the discomfort. Basically, the syndrome consists of pain commencing in the lumbar region and after 5 hours, spreading to the back and then, after 10 to 13 hours, affecting the neck, shoulders, feet, and all the major muscle groups. Key factors leading to the development of in-flight pain on prolonged flights are tissue compression, hypodynamic tone, body position, mental and muscle fatigue, and static stress on muscles. Mitigation of the pain syndrome involves physical conditioning as well as physical exercise and various forms of massage, hydrotherapy, and so forth. In-flight measures involve physical activity which, in addition to toning the body, also has the beneficial effect of maintaining wakefulness and alertness: Author

**N91-27743#** AScl Corp., McLean, VA.  
**TOTAL HUMAN EXPOSURE AND INDOOR AIR QUALITY: AN AUTOMATED BIBLIOGRAPHY (BLIS) WITH SUMMARY ABSTRACTS, VOLUME 2 Final Report, Jan. 1987 - Dec. 1989**  
 M. DELLARCO and W. OTT Oct. 1990 139 p  
 (Contract EPA-68-D9-0094)  
 (PB91-137281) Avail: NTIS HC/MF A07 CSCL 06/16

The Bibliographical Literature Information System (BLIS) is a computer data base that provides a comprehensive review of available literature on total human exposure to environmental pollution. Brief abstracts (often condensed versions of the original abstracts) are included; if the original document had no abstract, one was prepared. Unpublished draft reports are listed, as well as final reports of the U.S. Government and other countries, reports by governmental research contractors, journal articles, and other publications on exposure models field data, and newly emerging research methodologies. Emphasis on those field studies measuring all the concentrations to which people may be exposed, including indoors, outdoors, and in-transit. Author

**N91-27744#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**  
 9 Jan. 1991 84 p Transl. into ENGLISH from various Russian articles  
 (JPRS-ULS-91-002) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agriculture, aerospace medicine, biochemistry, biotechnology, epidemiology, genetics, immunology, laser biological effects, medical science, microbiology, molecular biology, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, and virology.

**N91-27745#** Joint Publications Research Service, Arlington, VA.  
**THE 370-DAY ANTIORTHOSTATIC HYPOKINESIA: GOALS AND PROTOCOLS**  
 A. I. GRIGORYEV and B. V. MORUKOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-3 9 Jan. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 5, Sep.-Oct. 1989 p 47-50  
 Avail: NTIS HC/MF A05

The purpose of research on 370-day antiorthostatic hypokinesia was to improve the complex of preventive measures that are designed for use during long space flights. The main objectives



were: (1) to improve the physical conditioning system; (2) to study the effectiveness of pharmaceutical preparations that avert metabolic changes in tissues of the locomotor system, to study metabolism, and to ensure an adequate level of energetic and plastic processes during times of intensive physical conditioning; and (3) to assess the effectiveness of means for day-to-day correction for hemodynamic shifts and hydro-ionic homeostasis.

Author

**N91-27746#** Joint Publications Research Service, Arlington, VA.  
**ORTHOSTATIC STABILITY OF DEHYDRATED HEALTHY MEN**  
**Abstract Only**

V. B. NOSKOV, A. N. KOTOV, M. YU. VOLKOV, O. N. RUSTAMYAN, YU. V. SUKHANOV, and K. S. YUROVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 48 9 Jan. 1991 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 112-117  
Avail: NTIS HC/MF A05

An analysis was conducted on the impact of dehydration induced by 80 mg of furosemide on orthostatic stability and reactivity of cardiopulmonary and endocrine systems. The standard 20 min orthostatic test was performed on ten men. Hemodynamic monitoring, blood chemistries and urinalysis demonstrated that the response of the cardiopulmonary system was dependent on the degree of hypovolemia as well as individual neuroendocrine reactivity. The results demonstrated that a 7 to 20 percent hypovolemia was tolerable without onset of orthostatic instability due to adequate mobilization of neuroendocrine reserves. The response of the renin-angiotensin-aldosterone axis with that degree of hypovolemia ensured sufficient vascular tone to preclude postural instability.

Author

**N91-27747#** Joint Publications Research Service, Arlington, VA.  
**PHYSIOLOGICAL SEQUELAE OF VOLUNTARY BREATH**  
**HOLDING Abstract Only**

V. B. MALKIN and YE. P. GORA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 48 9 Jan. 1991 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 118-126  
Avail: NTIS HC/MF A05

In view of the importance of breath holding tests in assessing occupational stability of cosmonauts, pilots and underwater divers, an analysis was conducted on individual responsiveness of the cardiopulmonary system, oxygen saturation of the blood and the CNS to voluntary inspirational and expirational breath holding. Phase studies demonstrated that individual variability in the time required for incoordination of the respiratory musculature.

Author

**N91-27748#** Joint Publications Research Service, Arlington, VA.  
**ACID-BASE BALANCE IN MEN BREATHING AIR WITH**  
**RAISED CO<sub>2</sub> Abstract Only**

I. A. SAPOV, V. I. KULESHOV, I. V. LEVSHIN, and YU. YU. KEYERIG *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 48 9 Jan. 1991 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 127-132  
Avail: NTIS HC/MF A05

The effects of different levels of CO<sub>2</sub> in inspired air on acid-base balance were studied in 34 men, subjected to 3.5, 4.5 or 5.5 percent CO<sub>2</sub> for 72, 42 or 22 h, respectively. Oxygen was maintained at 17 to 18 percent. Hypercapnia was most pronounced in the 5.5 percent CO<sub>2</sub> group, with the arterial pH falling to 7.322 and venous pH to 7.252 and the corresponding pCO<sub>2</sub> values raising to 6.7 and 8.41 kPa, respectively. Accordingly, this group was felt to be most at risk of hemic hypoxia and metabolic acidosis, indicating that exposure to 5.5 percent CO<sub>2</sub> for 22 h represents a critical situation in closed systems, such as prevails in space ships.

Author

**N91-27749#** Joint Publications Research Service, Arlington, VA.  
**EFFECTS OF WORK AND RAISED CO<sub>2</sub> COMBINATION ON**  
**RESPIRATION AND THERMOREGULATION Abstract Only**  
S. V. LEVINSKIY and I. I. MALKIMAN *In its* JPRS Report: Science

and Technology. USSR: Life Sciences p 48-49 9 Jan. 1991 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 133-140  
Avail: NTIS HC/MF A05

An assessment was conducted on the effects of physical exertion (57 W for 20 min) and raised ambient CO<sub>2</sub> (5-6 percent) on respiration and thermoregulation. The study encompassed 8 men, subjected to 5-6 percent CO<sub>2</sub> for 4 h/day for three days with and without physical work. Quantitative information was derived from pulmonary function studies and measurement of rectal temperature. The results led to classification of the subjects into three types: (1) individuals exhibited considerable tolerance of oxygen debt and maintained or actually increased body temperature on exertion; (2) subjects were characterized by inadequate adaptation to elevated CO<sub>2</sub> and inability to maintain body temperature at a normal level; and subjects showed the greatest fall in body temperature and, obviously, were least tolerant of raised CO<sub>2</sub>.

Author

**N91-27750#** Joint Publications Research Service, Arlington, VA.  
**EFFECT OF AMINAZINE ON FUNCTIONAL STATE OF**  
**CARDIOVASCULAR SYSTEM DURING HYPERTHERMIA**  
**Abstract Only**

V. A. TASHLIYEV, K. A. AMANNEPESOV, A. O. KAFUROV, and A. N. ULITIN *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 51 9 Jan. 1991 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenkoy SSR: Seriya Biologicheskikh Nauk, Ashkhabad (USSR), no. 5, Sep.-Oct. 1989 p 59-65

Avail: NTIS HC/MF A05

Examination of effector manifestations of the cardiovascular system during hyperthermic stress and observation of their changes after the use of aminazine and a comparison and analysis of hemodynamic, thermometric, and chronometric data included 2 series of experiments on unanesthetized rats. Both series (experimental and control) involved measurement of rheographic parameters, arterial pressure, rectal temperature, and determination of length of survival after hyperthermia. Recording of these indicators for 60-70 min at 10-min intervals at normal temperatures preceded a temperature increase to 45 C and subcutaneous injection of aminazine at a rate of 125 mg to 100 g of weight of the animal.

Author

**N91-27752#** David Sarnoff Research Center, Princeton, NJ.  
**EXPERIMENTAL SYSTEM FOR THE NONINVASIVE**  
**DETECTION OF AIR BUBBLES IN TISSUES Final Report, Mar.**  
**1987 - Dec. 1988**

ROBERT W. PAGLIONE Dec. 1990 11 p  
(Contract F33615-87-C-0608)  
(AD-A235458; USAFSAM-TP-90-18) Avail: NTIS HC/MF A03  
CSCS 06/10

The air-bubble detection system was designed to detect the changes in the microwave absorption properties of tissues. These changes could be caused by the introduction of air bubbles due to exposure to high altitudes. The system basically transmits a low-level modulated microwave signal through the tissue and monitors the changes in the amplitude of the received signal. The output signal from the detection circuitry can be monitored using an oscilloscope or strip-chart recorder. The system is powered by + or - 8V and +12V DC. The DC voltages are generated from the AC line using a standard AC/DC supply and post-regulators. This assembly is housed in a separate enclosure that is electrically isolated from the microwave enclosure.

GRA

**N91-27753#** Chicago Univ., IL. Dept. of Medicine.  
**PHASE-SHIFTING EFFECT OF LIGHT AND ACTIVITY ON THE**  
**HUMAN CIRCADIAN CLOCK Annual Technical Report, 1 Mar.**  
**1990 - 28 Feb. 1991**

EVE VANCAUTER 1 Apr. 1991 17 p  
(Contract AF-AFOSR-0222-90; DA PROJ. 2312)  
(AD-A235615) Avail: NTIS HC/MF A03 CSCS 06/5

To determine whether single presentation of light or physical activity can phase shift the human circadian clock, 8 young male

subjects were subjected to the following experimental protocol. Following entrainment to a fixed sleep wake and light-dark cycle for one week, each subject underwent 3 separate studies: one baseline study in which measurements of circadian phase positions were performed under 'constant routine' conditions (i.e., constant wakefulness in recumbent position under constant dim light with constant caloric intake for 42 hrs), and two studies in which each subject was exposed to a 3-h session of either bright light (5000 Lux) or physical activity (exercise on a stationary arm-and-leg exerciser) during the 'constant routine' regimen. In order to estimate accurately circadian phase positions, 8 overt rhythms were monitored in each subject: plasma cortisol, plasma TSH, plasma melatonin, plasma glucose, plasma C-peptide, core temperature, total activity and mental performance. The immediate phase shifting effects of bright light or exercise were measured on the monitored rhythms on the first day following stimulus presentation. Preliminary analysis of currently available data indicate that both light and exercise resulted in a phase advance of approximately one hour.

GRA

**N91-27754#** University of South Alabama, Mobile.  
**SUPERCOMPUTING AND THE PROCESSING OF ACOUSTIC TRANSIENTS BY BIOLOGICAL SYSTEMS AND MACHINES**  
**Final Report**

CHARLES H. BROWN 29 Sep. 1990 18 p  
 (Contract AF-AFOSR-0265-89; AF PROJ. 3842)  
 (AD-A235759; AFOSR-91-0476TR) Avail: NTIS HC/MF A03  
 CSCL 20/1

Funds were received for the acquisition of scientific instrumentation chosen to strengthen the auditory research program in the Comparative Hearing Laboratory directed. Funds were used to purchase two commercial, research grade, sound booths, and for a computer network based on the 80486 microprocessor. This equipment is dedicated (1) to the laboratory control of psychoacoustical experiments, (2) to the efficient conduction of signal processing analyses suitable for processing on microcomputers, and (3) to serving as a high-speed file server and terminal for the conduction of large-scale signal processing analyses executed on the Alabama Supercomputer Network (Cray XMP-24).

GRA

**N91-27755#** Naval Medical Research Inst., Bethesda, MD.  
**COMPUTER-BASED TECHNIQUES FOR COLLECTION OF PULMONARY FUNCTION VARIABLES DURING REST AND EXERCISE** Technical Report, Jan. - Dec. 1990

NIGEL A. TAYLOR and JOHN R. CLARKE Mar. 1991 77 p  
 (Contract NMRI PROJ. M00-99)  
 (AD-A236482; NMRI-91-26) Avail: NTIS HC/MF A05 CSCL  
 06/5

Pulmonary function tests are routinely included as part of the experimental protocol for both immersion and barophysiology experiments. Typically, these tests are performed using standard spirometry, and as such suffer from time consuming data analysis and experimental error associated with such analysis. In many cases the combined effects of these limitations has meant that some valuable data often fails to come out in the analysis. One solution to this situation is to transfer these tasks to the computer. A computer based system was developed for both data collection and analysis, which is faster, more sensitive to minor physiological perturbations, and more precise than standard spirometry. The apparatus and programming algorithms for this system are presented so that other laboratories might be able to similarly improve the methods for collection of pulmonary function data.

GRA

**N91-27756\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 351)**

Jul. 1991 92 p  
 (NASA-SP-7011(351); NAS 1.21:7011(351)) Avail: NTIS HC A03;  
 NTIS standing order as PB89-912300, \$10.50 domestic, \$21.00  
 foreign CSCL 06/5

This bibliography lists 255 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Jun. 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance.

Author

**N91-27757#** National Inst. of Standards and Technology, Gaithersburg, MD. Office Systems Engineering Group.

**GOVERNMENT DOCUMENT PROCESSING REQUIREMENTS REPORT**

R. F. SIES Apr. 1991 16 p  
 (PB91-187773; NISTIR-4560) Avail: NTIS HC/MF A03 CSCL  
 05/2

Several activities are described of the Office Systems Engineering Group in the area of electronic publishing standards. An account is given of the July 30, 1990 workshop on Electronic Information Exchange Standards Used in Document Processing Applications and the list of User Requirements that came out of that workshop. Other efforts are reported which were made to help bring about the harmonization of electronic publishing standards.

Author

**N91-28067\*#** Morgan State Univ., Baltimore, MD. Dept. of Physics.

**EXCIMER LASER INTERACTION WITH DENTIN OF THE HUMAN TOOTH**

ERNEST C. HAMMOND, JR., RUTH L. GILLIAM, and GEORGE R. BAKER (Xavier Univ. of Louisiana, New Orleans.) /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 21-25 1989  
 Avail: NTIS HC/MF A23 CSCL 06/16

The use of an excimer laser produced many unusual conical structures within the dentin of the inner part of the human tooth. By varying the frequency of the laser one can disperse the energy and cause more bleeding in laser surgery, but not destroy the cells associated with the incision. Therefore, the healing process will virtually be without scarring. Whereas, using the infrared laser the blood loss would be less, but the healing process would tend to be longer because cells are being destroyed due to the cauterization effect of the laser. The question is, are these structures produced as an interaction with the laser or are they an intrinsic part of the structure. The effects of the laser interaction upon dentin was studied, and in using electron microscopy the interaction of the excimer laser upon the tooth dentin and other various biological tissue is more clearly understood.

Author

**N91-28072\*#** Alabama A & M Univ., Normal. Dept. of Biology.  
**X RAY SENSITIVITY OF DIPLOID SKIN FIBROBLASTS FROM PATIENTS WITH FANCONI'S ANEMIA Abstract Only**

RANJINI KALE /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 46 1989

Avail: NTIS HC/MF A23 CSCL 06/16

Experiments were performed on Fanconi's anemia and normal human fibroblast cell lines growing in culture in an attempt to correlate cell cycle kinetics with genomic damage and determine their bearing on the mechanism of chromosome aberration induction. FA fibroblasts showed a significantly increased susceptibility to chromosomal breakage by x rays in the G2 phase of the cell cycle. No such response was observed in fibroblasts irradiated in the G0 phase. The observed increases in achromatic lesions and in chromatid deletions in FA cells as compared with normal cells appear to indicate that FA cells are deficient in strand break repair and also possibly in base damage excision repair. Experiments are now in progress to further elucidate the mechanisms involved.

Author

**N91-28083\*#** Miles Coll., Birmingham, AL.  
**THE 3-(BROMOACETAMIDO)-PROPYLAMINE HYDROCHLORIDE: A NOVEL SULFHYDRYL REAGENT AND ITS FUTURE POTENTIAL IN THE CONFIGURATIONAL STUDY OF S1-MYOSIN**

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PRASANTA SHARMA and HERBERT C. CHEUNG (Alabama Univ., Birmingham.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 127-133 1989

(Contract NIH-AR-31239)

Avail: NTIS HC/MF A23 CSCL 06/16

Configurational study of S1-Myosin is an important step towards understanding force generation in muscle contraction. Previously reported NMR studies were corroborated. A new compound was synthesized, 3-(Bromoacetamido)-propylamine hydrochloride. Its potential as a sulfhydryl reagent provides an indirect but elegant approach towards future structural elucidation of S1-Myosin. The preliminary investigation has shown that this compound, BAAP, reacted with S1 in the absence of MgADP. The modified enzyme had a 2-fold increase in CaATPase activity and no detectable K-EDTA ATPase activity. Reaction of BAAP with S1 in the presence of MgADP resulted in a modified enzyme which retained a Ca-ATPase activity that was about 60 percent of the unmodified S1 and had essentially zero K-EDTA ATPase activity. Sulfhydryl titration indicated that about 1.5 and 3.5 SH groups per S1 molecule were blocked by BAAP in the absence and presence of MgADP, respectively. When coupled to a carboxyl group of EDTA, the resulting reagent could become a useful SH reagent in which chelated paramagnetic or luminescent lanthanide ions can be exploited to probe S1 conformation. Author

**N91-28726\*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

### **DIRECTION DISCRIMINATING HEARING AID Patent Application**

M. JHABVALA, inventor (to NASA) and H. C. LIN, inventor (to NASA) (Maryland Univ., College Park.) 9 Jun. 1989 22 p (NASA-CASE-GSC-13027-1; NAS 1.71:GSC-13027-1; US-PATENT-APPL-SN-363807) Avail: NTIS HC/MF A03 CSCL 06/12

It is an object of this invention to provide an improvement in hearing aids. It is another object of this invention to provide a hearing aid which is directionally sensitive. It is a further object of this invention to provide an improvement in hearing aids which are able to detect not only the direction from which the sound originates, but also to provide a visual indication of both the direction and intensity of the sounds. It is still another object of this invention to provide a directional hearing aid comprised of integrated circuits in order to minimize size and power dissipation. The foregoing and other objects of the invention are achieved by a multi-channel hearing aid device which is able to signal to the wearer in a binaural or a quadraphonic configuration whether sound is coming from the left or right, front or back, or both. For each channel, which operate in pairs, the sound is picked up by a respective microphone amplified and rectified into a DC voltage. The DC voltage is next fed to a three bit analog to digital converter comprised of seven parallel comparators and eight by three encoder. The three bit binary codes from the encoder are coupled into a logic circuit where the three bit binary codes are decoded to seven output levels which are used to drive an indicator which provides a visual indication of the sound level received. The three bit binary codes for each pair of channels are also fed into a digital comparator. The output of the two channels is such that if, for example, the signal coming from the right is louder than that coming from the left, the outputs of the logic unit of the right channel will be enabled and the corresponding indicator activated, indicating the direction of the sound source. Also an indication of the loudness is provided for that channel. The preferred embodiment only gives an indication for the stronger channel because it is deemed that a multiple channel indication, with relative volumes being indicated, would lead to confusion. NASA

**N91-28727\*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

### **DEVICE FOR REMOVING FOREIGN OBJECTS FROM ANATOMIC ORGANS Patent Application**

EARL D. ANGULO, inventor (to NASA) 19 Mar. 1991 18 p

(NASA-CASE-GSC-13306-1; NAS 1.71:GSC-13306-1; US-PATENT-APPL-SN-674828) Avail: NTIS HC/MF A03 CSCL 06/11

A device is disclosed for removing foreign objects from anatomic organs such as the ear canal or throat. It has a housing shaped like a flashlight, an electrical power source such as a battery or AC power from a wall socket, and a tip extending from the housing. The tip has at least one wire loop made from a shape-memory-effect alloy such as Nitinol switchably connected to the electrical power source such that when electric current flows through the wire loop the wire loop heats up and returns to a previously programmed shape such as a curet or tweezers so as to facilitate removal of the foreign object. NASA

### **N91-28728# Michigan Univ., Ann Arbor. School of Medicine. NEW TECHNIQUES FOR POSITRON EMISSION TOMOGRAPHY IN THE STUDY OF HUMAN NEUROLOGICAL DISORDERS**

D. E. KUHL 1991 7 p

(Contract DE-FG02-87ER-60561)

(DE91-013855; DOE/ER-60561/5) Avail: NTIS HC/MF A02

We continue our focus to develop more cost effective and efficient means for producing new functionally specific tracers and more simple, less expensive, means for acquiring and interpreting quantitative data. These improved processes are required for the future growth of positron emission tomography (PET) and for the transfer of this technology to clinical use. Our approach concentrates on two separate yet related areas, radiosynthesis and data analysis. The program is divided into four subprojects, the first pair related to radiosynthesis, and the second pair related to data analysis. Progress during the past project year has been excellent in both accomplishment and publication record. DOE

**N91-28729\*** National Aeronautics and Space Administration, Washington, DC.

### **AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 352)**

Aug. 1991 61 p

(NASA-SP-7011(352); NAS 1.21:7011(352)) Avail: NTIS HC A04; NTIS standing order as PB89-912300, \$10.50 domestic, \$21.00 foreign CSCL 06/5

This bibliography lists 147 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during July 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

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## BEHAVIORAL SCIENCES

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

### **A91-46622#**

### **DEVELOPMENT OF SUBJECTIVE MEASURES OF WORKLOAD. I - APPROPRIATENESS OF FORMS OF SCALES AND DIMENSIONS FOR RATING**

MIYAKO OKAUE, ZOUJIROU KATOH, ATUSHI KADOO, and S. NISHI Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 31, Sept. 1990, p. 41-51. In Japanese. refs

A subjective rating sheet for workload was developed by using results of evaluations given for four types of trial forms (A1, A2, B1, and B2) by nine subjects who were trained to operate a research flight simulator. The rating items of A1 and A2 were in the form of words (such as 'difficulty'), while those of B1 and B2 were in form of sentences (such as 'I experienced difficulty'). The forms for marking the workload were also different, ranging from a single 100-mm line to graded-line format. It was found that

ratings expressed in the word form were superior to those in the sentence form, in terms of readability. As for the format for rating, the graded-line form seemed to be the best among the four kinds of forms used, since it enabled the subjects to mark their intended values more precisely than did the single long lines or the 3-step and 5-step grades. I.S.

**A91-46623#**

**A STUDY ON PILOT WORKLOAD. I - THE STUDY OF PILOTING PERFORMANCE MEASUREMENT**

S. NISHI, ATSUSHI KADOO, KIYOSHI MIZUMOTO, and ZOJIRO KATOH Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 31, Sept. 1990, p. 53-64. In Japanese. refs

The relationship between the subjective rating score of the maneuver difficulty and the flight variables was investigated using a research simulator of the Aeromedical Laboratory and analyzing the results by the multiple regression analysis of the forward stepping method. Six maneuvers (take-off, level flight, loop, steep turn, barrel roll, and lazy8) were evaluated, along with eight flight variables (altitude, air speed, heading, bank angle, pitch angle, yaw angle, angle of attack, and vertical velocity), evaluated every second during each maneuver. It was found that the subjective rating score should be separate in two types of maneuvers: the score for maintaining the flight variable and the score for changing the flight variable during the maneuver. It is shown that the subjective rating score of the maneuver difficulty was related to the main flight variables of each maneuver. I.S.

**A91-46827**

**STEREOTYPES OF PILOTS AND APPREHENSION ABOUT FLYING WITH THEM - A STUDY OF COMMERCIAL AVIATION SCENARIOS**

RICHARD L. DUKES, RUTH HULBERT-JOHNSON, HARVEY NEWTON, and SHARON OVERSTREET (Colorado, University, Colorado Springs) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 722-726. refs Copyright

This study explored the effects of gender, experience, and performance of a commercial aviation pilot on concern of passengers about flying with him or her. It used scenarios that represented two aspects of pilot behavior: skill and judgment. Adult subjects in the role of passengers read vignettes that described their captain and the flight in a 2 x 2 x 2 factorial design (male or female, newly promoted or veteran captain, strong or weak performance). Results showed that of the three manipulated variables, only pilot performance had a statistically significant main effect upon apprehension about making a continuation flight with the pilot. Statistical interactions showed that the level of passenger concern was not based entirely on pilot performance. For instance, on the skill scenario, when a female pilot performed well, her rating was higher than that of an equally performing male, but when she performed poorly, her rating was lower than his. Author

**A91-46828**

**EFFECTS OF DEXAMETHASONE AND HIGH TERRESTRIAL ALTITUDE ON COGNITIVE PERFORMANCE AND AFFECT**

JARED B. JOBE (National Center for Health Statistics, Hyattsville, MD), BARBARA SHUKITT-HALE, LOUIS E. BANDERET, and PAUL B. ROCK (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 727-732. refs Copyright

This study examined the effects of dexamethasone and exposure to high terrestrial altitude on cognitive performance, affect, and personality. Cognitive performance was evaluated by five cognitive tasks, affect was evaluated by the Clyde Mood Scale and the Multiple Affect Adjective Clerk List, and personality was examined using the Minnesota Multiphasic Personality Inventory. Sixteen healthy young men received either dexamethasone (4 mg every 6 h) (n = 7) or placebo (n = 9) for 34 h prior to and 52 h after ascent to 4300 m. Subjects treated with dexamethasone

correctly performed more computer interaction and addition problems than did placebo-treated subjects. They also were less sleepy, dizzy, depressed, and anxious than placebo-treated subjects at altitude. No adverse effects on cognitive performance, affect, or personality were noted after dexamethasone was discontinued on the third day at altitude. Results indicate that dexamethasone at the present dose positively influences cognitive performance and mood states at altitudes, but has no residual effect on personality. Author

**A91-46835**

**TESTING THE TESTS - AN EMPIRICAL EVALUATION OF SCREENING TESTS FOR THE DETECTION OF COGNITIVE IMPAIRMENT IN AVIATORS**

ALAN F. STOKES (Illinois, University, Savoy), MARIE T. BANICH, and VALORIE C. ELLEDGE (Illinois, University, Champaign) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 783-788. refs (Contract DTF A02-87-068) Copyright

Consideration is given to research involving the empirical evaluation of two 'mini-mental exams', two paper-and-pencil test batteries, and a prototype version of an automated screening battery. The subjects of the study were 54 pilots and 62 individuals from a heterogeneous clinical population. Sensitivity, specificity, and positive predictive value were calculated for each sub-task. The 'mini-mental' exams are considered to be poor candidates for a screening test. The best discrimination performance was demonstrated by the automated battery, due to the incorporation of dual-task tests of divided attention performance. These tests were found to be particularly sensitive to otherwise difficult-to-detect cognitive impairments of a mild or subtle nature. It is concluded that the practical success of a screening program is heavily dependent upon the actual prevalence of cognitive impairment in the medical applicant population. O.G.

**N91-27751# Joint Publications Research Service, Arlington, VA. BIOLOGICAL EXPERIMENTS ON KOSMOS-1887 BIOSATELLITE**

A. M. ALPATOV, YE. A. ILIN, V. V. ANTIPOV, and M. G. TAIRBEKOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 68-72 9 Jan. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 5, Sep.-Oct. 1989 p 26-32 Avail: NTIS HC/MF A05

The Kosmos-1887 satellite is a specialized biosatellite, designed to accommodate biomedical research conducted during the flight. Diverse organisms were on board: bacteria, protozoans, plants, worms, insects, fish, and amphibians. The research on those biological subjects was geared toward further study of the biological effects of weightlessness, evaluation of the fundamental consequences of the loss of gravity, and the refinement of the ideas on the biological role of gravity. The program of biological experiments included a number of traditional areas: cell biology, genetics, and biological development. A new area was also added - biorhythmology. A brief, general survey of the basic results of those experiments is presented. Author

**N91-27758# University of Central Florida, Orlando.**

**TAXONOMIC TRANSFORMATIONS OF VISUAL MEDIA SELECTIONS INTO DISPLAY SPECIFICATION Final Report, Apr. 1989 - Jan. 1990**

RICHARD D. GILSON and HARLEY R. MYLER Mar. 1991 74 p (Contract N61339-89-C-0042) (AD-A235596; ARI-RN-91-36) Avail: NTIS HC/MF A04 CSCL 12/6

This research examined relationships between characteristics of visual stimuli and learning as a first step in developing decision support systems to help estimate visual fidelity requirements for device based training. On the basis of reviews of psychophysical and other literature, it was concluded that little is known about the relationships between characteristics of visual stimuli and

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learning. An experimental decision support system was nevertheless developed, with critical gaps in essential data as noted. Information herein may be helpful in estimating visual display parameters. Examining the quality of the estimates will require validation research that, because of the time and cost constraints in training device development, is unlikely to be feasible. GRA

**N91-27759#** Naval Research Lab., Washington, DC.  
**USER'S GUIDE FOR SAMUEL, VERSION 1.3 Memorandum Report**

JOHN J. GREFENSTETTE and HELEN G. COBB 6 May 1991  
95 p  
(AD-A235611; NRL-MR-6820) Avail: NTIS HC/MF A05 CSDL  
12/5

The strategy acquisition method using empirical learning (SAMUEL) is a machine learning system designed to actively explore alternative behavior in a simulated environment, and to construct high performance rules from this experience. The learning method relies on the notion of competition and employs genetic algorithms to search the space of decision policies. The rule language in SAMUEL also makes it easier to incorporate existing knowledge, whether acquired from experts or by symbolic learning programs. The system includes a competition based production system interpreter, incremental strength updating procedures to measure the utility of rules, and genetic algorithms to modify strategies based on past performance. The current version includes a more convenient language for the expression of tactical control rules, better interfaces, and a number of new heuristics for rule modification. We have experimented with SAMUEL on a task involving learning control rules that enable a simulated robotic aircraft to evade an approaching missile. The SAMUEL has been able to learn high performance strategies for this task. This manual should help the user to experiment with SAMUEL on other problems. GRA

**N91-27760#** Human Engineering Labs., Aberdeen Proving Ground, MD.

**THE EFFECTS OF DISPLAY FAILURES, POLARITY, AND CLUTTER ON VISUAL SEARCH FOR SYMBOLS ON CARTOGRAPHIC IMAGES Final Report**

CRAIG J. DYE and HARRY L. SYNDER Apr. 1991 49 p  
(Contract DA PROJ. 1L1-62716-AH-70)  
(AD-A235703; HEL-TM-9-91) Avail: NTIS HC/MF A03 CSDL  
12/6

Little research has been conducted about human performance in symbol search of cartographic images on matrix-addressable displays. Alphanumeric studies have researched failures and polarity on such displays but not using cartographic images. Two studies were conducted which required subjects to search for symbols on cartographic images under various conditions of failure, polarity, and background clutter. Response time and accuracy were measured. Generally, high clutter impeded performance more than low clutter, and negative contrast produced slightly better performance than positive contrast. Horizontal line failures affected search ability more than vertical line or cell failures did, particularly when the failures were in the on mode rather than the off mode. Further, it was discovered that while previous alphanumeric studies found effects at 3 percent failures or greater, effects were observed for the present studies at 2 percent or greater, apparently because of the presence of map information on the display. Recommendations for cartographic display design and future research are discussed. GRA

**N91-27761#** Georgia Inst. of Tech., Atlanta. School of Psychology.

**AUTOMATIC INFORMATION PROCESSING AND HIGH-PERFORMANCE SKILLS: PRINCIPLES OF CONSISTENCY, PART-TASK TRAINING, CONTEXT, RETENTION, AND COMPLEX TASK PERFORMANCE Interim Report, Nov. 1989 - Dec. 1990**

ARTHUR D. FISK, WENDY A. ROGERS, MARK D. LEE, KEVIN A. HODGE, and CHRISTOPHER J. WHALEY Apr. 1991 289 p

(Contract F33615-88-C-0015)

(AD-A235944; AFHRL-TR-90-84) Avail: NTIS HC/MF A13  
CSDL 05/8

Six series of experiments (11 individual experiments) were conducted to further extend automatic/controlled processing research to command and control mission-specific training. The issues examined in these experiments were related to retention of task-component skills; amount of practice; component training for memory-search-dependent tasks; and effects of degree of consistency, context, and task performance dependent on interactions of memory scanning, visual search, rule-based processing and acquisition of procedural knowledge. A final section of the document outlines how the present data provide processing principles which augment previous human performance guidelines that have been shown to be important for high-performance-skills training. GRA

**N91-27762#** Human Engineering Labs., Aberdeen Proving Ground, MD.

**THE EFFECTS OF LINE AND CELL FAILURES ON READING AND SEARCH PERFORMANCE USING**

**MATRIX-ADDRESSABLE DISPLAYS Final Report**

CHARLES J. LLOYD, JENNIE J. DECKER, and HARRY L. SNYDER Apr. 1991 56 p  
(Contract DA PROJ. 1L1-62716-AH-70)  
(AD-A235947; HEL-TM-7-91) Avail: NTIS HC/MF A04 CSDL  
12/6

Reading and visual search speed and accuracy were used to evaluate the effects of simulated line and cell failures on a visual display. Five experimental variables (failure type cell, vertical line and horizontal line), percent failure 0, 4, 8, or 12 percent cells failed, display polarity light characters on dark background or dark characters on light background, mode of failure failures match the symbols or failures match the background, and matrix size 7 x 9, 9 x 11, or 11 x 15 dots) significantly affected performance of both the reading and search tasks. Additionally, many of the interactions among these variables were significant. The experimental results indicate that as the percentage of failures increased, performance systematically decreased. For failure levels of less than 4 percent, little effect on performance was found. Performance increased as the size of characters increased. A 30 percent improvement in search time and a 7 percent improvement in reading time was obtained by using dot-matrix sizes larger than 7 x 9 pixels. In general, dark symbols presented on a light background (negative contrast) were read and searched for more quickly than light symbols presented on a dark background (positive contrast). GRA

**N91-27763\*#** Old Dominion Univ., Norfolk, VA. Dept. of Psychology.

**OPERATOR STRATEGIES UNDER VARYING CONDITIONS OF WORKLOAD**

RUTH J. ARNEGARD Washington Jul. 1991 225 p  
(Contract NGT-504-05)  
(NASA-CR-4385; NAS 1.26:4385) Avail: NTIS HC/MF A10  
CSDL 05/8

An attempt was made to operationally define and measure strategic behavior in a complex multiple task environment. The Multi-Attribute Task battery was developed to simulate various aspects of flight and consisted of an auditory communication task, monitoring tasks, a tracking tasks, a resource management task which allowed a wide range of responding patterns, and a scheduling window which allowed operators to predict changes in workload. This battery was validated for its sensitivity to strategic behavior, and baseline measures for each individual task were collected. Twenty-four undergraduate and graduate students then performed the battery for four 64 minute sessions which took place over a period of 2 days. Each subject performed the task battery under four levels of workload, which were presented for equal lengths of time during all four sessions. Results indicated that in general, performance improves as a function of experience with the battery, but that performance decreased as workload level increased. The data also showed that subjects developed

strategies for responding to the resource management task which allowed them to manage the high workload levels more efficiently. This particular strategy developed over time but was also associated with errors of complacency. These results are presented along with implications for the aviation field and areas of future research. Author

**N91-27764\*#** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

**OBSERVER PROPERTIES FOR UNDERSTANDING DYNAMICAL DISPLAYS: CAPACITIES, LIMITATIONS, AND DEFAULTS**

DENNIS R. PROFFITT (Virginia Univ., Charlottesville.) and MARY K. KAISER Feb. 1991 15 p (NASA-TM-102812; A-90136; NAS 1.15:102812) Avail: NTIS HC/MF A03 CSCL 05/9

People's ability to extract relevant information while viewing ongoing events is discussed in terms of human capabilities, limitations, and defaults. A taxonomy of event complexity is developed which predicts which dynamical events people can and cannot construe. This taxonomy is related to the distinction drawn in classical mechanics between particle and extended body motions. People's commonsense understandings of simple mechanical systems are impacted little by formal training, but rather reflect heuristical simplifications that focus on a single dimension of perceived dynamical relevance. Author

**N91-28730\*#** National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

**AN ACCELERATED TRAINING METHOD FOR BACK PROPAGATION NETWORKS Patent Application**

ROBERT O. SHELTON, inventor (to NASA) 17 Jun. 1991 42 p (NASA-CASE-MSC-21625-1; NAS 1.71:MSC-21625-1; US-PATENT-APPL-SN-716182) Avail: NTIS HC/MF A03 CSCL 05/9

The principal objective is to provide a training procedure for a feed forward, back propagation neural network which greatly accelerates the training process. A set of orthogonal singular vectors are determined from the input matrix such that the standard deviations of the projections of the input vectors along these singular vectors, as a set, are substantially maximized, thus providing an optimal means of presenting the input data. Novelty exists in the method of extracting from the set of input data, a set of features which can serve to represent the input data in a simplified manner, thus greatly reducing the time/expense to training the system. NASA

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### MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

**A91-44862**

**DESIGN OF A SPATIAL-CHROMATIC HUMAN VISION MODEL FOR EVALUATING FULL-COLOR DISPLAY SYSTEMS**

CHARLES J. C. LLOYD and ROBERT J. BEATON (Virginia Polytechnic Institute and State University, Blacksburg) IN: Human vision and electronic imaging: Models, methods, and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 23-37. refs Copyright

A model of human spatial-chromatic vision and a corresponding procedure for employing the model to evaluate color systems are described. The procedure and model together constitute a color image quality metric that is responsive to the modulation transfer

and noise generating characteristics of a display system. This human vision model uses processing stages which simulate blurring by the optics of the eye, linear spectral absorption by three classes of cone, addition of internal noise, derivation of opponent-color images, nonlinear transduction by retinal mechanisms, and calculation of the responses of linear spatial mechanisms with finite spatial frequency and orientation bandwidth. A summary of the modulation detection, discrimination, and suprathreshold contrast perception performance of the model is given, and a comparison is made with human performance data from the visual science literature. R.E.P.

**A91-44867**

**DETERMINATION OF THE OPTIMUM GRAY-SCALE LUMINANCE RAMP FUNCTION FOR ANTI-ALIASING**

ALAN R. JACOBSEN (Boeing Commercial Airplanes, Seattle, WA) IN: Human vision and electronic imaging: Models, methods, and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 202-213. refs Copyright

An investigation is carried out on the effect of various luminance ramps on the image quality of gray-scale antialiased color matrix display images. The basic algorithm uses a preprocess line filter having a Gaussian luminance distribution. In addition to the luminance ramp, the number of gray levels, type of pixel configuration, and line color were also varied. It is shown that the effect of the luminance ramp function is quite noticeable, and that the linear ramp yields consistently better image quality in antialiased lines. R.E.P.

**A91-44868**

**ASSESSING VISUAL GREY SCALE SENSITIVITY ON A CRT**

GERALD MURCH and NOVIA WEIMAN (Tektronix Laboratories, Beaverton, OR) IN: Human vision and electronic imaging: Models, methods, and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 214-223. refs Copyright

Necessary measurements of the CRT imaging capability to properly use the CRT as an imaging device are described. The overall goal is to provide the systems designer with data that permit the systems imaging capability to match the human visual capacity. While the calculation of human contrast sensitivity function data is used to illustrate the problem of characterization of a CRT device, the results of such a device characterization also provide some information on the initial question of the number of gray scale levels required for maximizing information detectability on a CRT. R.E.P.

**A91-45400#**

**HUMAN FACTOR IMPLICATIONS OF THE AEROSPATIALE AS332L SUPER PUMA COCKPIT**

R. R. PADFIELD (Helikopter Service A/S, Oslo, Norway) European Rotorcraft Forum, 15th, Amsterdam, Netherlands, Sept. 12-15, 1989, Paper. 20 p. refs

Human-factor problems that might occur in modern civilian helicopters are analyzed by examining human-factor implications of the cockpit design of the Aerospatiale AS332L Super Puma cockpit. Attention is focused on hardware, software, environment, and 'liveware' factors (the latter includes leadership, communications, crew coordination, personal relations, and discipline). Engine malfunction warnings, autopilot system, navigation equipment, landing lights, and intercom switching are discussed as well as the main-gear-box lubrication-system warning light, hydraulic panel, fuel-flow control levers, autopilot panel, rotor-brake system, and heater distributor valve control. Emphasis is placed on the participation of line pilots and instructors in the cockpit design of any aircraft. V.T.

**A91-45403#**

**THE INVOLUNTARY PARTICIPATION OF A HUMAN PILOT IN A HELICOPTER COLLECTIVE CONTROL LOOP**

JOHN R. MAYO (Sikorsky Aircraft, Stratford, CT) European Rotorcraft Forum, 15th, Amsterdam, Netherlands, Sept. 12-15, 1989, Paper. 13 p. refs

The purpose of the study is to investigate the vibration interference for a pilot in a collective-loop closure, arising from helicopter's unique vertical degree of freedom. Bioresponse data for a pilot at the collective control of a helicopter is analyzed in the 1-5 Hz frequency range, then the collective axis pilot transfer function is coupled with a high-order linear helicopter model including rigid-body, flexible-fuselage, rotor flapping and lagging, inflow, and external-load dynamics. In the final phase of study, a low-pass filter design is implemented in the collective-control axis of the linear model in order to attenuate passive pilot feedthrough. A reduction of the pilot/vehicle interactions and, therefore, an increase in vehicle stability margins as a result of this step are observed. V.T.

## A91-45734 TRUSSARM - A VARIABLE-GEOMETRY-TRUSS MANIPULATOR

P. C. HUGHES (Toronto, University, Downsview, Canada), W. G. SINCARSIN, and K. A. CARROLL (Dynacon Enterprises, Ltd., Downsview, Canada) (U.S.-Japan Joint Conference on Adaptive Structures, 1st, Maui, HI, Nov. 13-15, 1990) Journal of Intelligent Material Systems and Structures (ISSN 1045-389X), vol. 2, April 1991, p. 148-160. NSERC-supported research. refs  
Copyright

An overview is given of recent work done in Canada on 'trussarms' - truss structures of high aspect ratio and variable geometry, suitable for use as manipulator arms. Four possible truss topologies are compared, and the 'standard' octahedral topology is shown to be superior, largely on the basis of simplified hinge design. A preliminary comparison is also made between the Canadarm (the current Shuttle manipulator arm) and two trussarms. Some of the key issues in the kinematics, dynamics and control of truss-arms are discussed, and the paper closes with a brief description of laboratory trussarm models currently under development. Author

## A91-45875 FUTURE SPACE SUIT DESIGN CONSIDERATIONS

Aerospace Engineering (ISSN 0736-2536), vol. 11, July 1991, p. 13-16.  
Copyright

This paper examines the space suit design requirements dictated by the environmental factors to be encountered during manned expeditions to the moon and to Mars. To meet the environmental challenges, engineers are studying both lightweight structural materials for use in space suit system assemblies and the incorporation of dust-proof protective measures. Consideration is given to the comparative values of extravehicular mobility unit system weights, habitat pressure versus suit pressure, and commonly used metals for space suit structural components. Techniques being considered for bearing dust protection include separate environmental protective seals, labyrinth seals, and lubricant-impregnated felt seals, or combinations of these. R.E.P.

## A91-46601# SPACE SUITS - STATE OF THE ART AND FUTURE PROSPECTS

SEISHIRO KIBE and KEIJI NITTA Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 38, no. 443, 1990, p. 627-634. In Japanese. refs

Space-suit technology is reviewed, with emphasis on equipment for EVA activities. Particular attention is given to the zero prebreathing suit, the manned maneuvering unit, and the crew equipment translation aid. B.J.

## A91-46826 VISUAL ACUITY OF THE U.S. NAVY JET PILOT AND THE USE OF THE HELMET SUN VISOR

AILENE MORRIS, LEONARD A. TEMME, and PAUL V. HAMILTON

(U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 715-721. Research supported by U.S. Navy. refs  
Copyright

The findings of two studies are reported. The first study, conducted with U.S. Navy jet pilots as subjects at 343 cd/sq m, revealed a decrease in low-contrast visual acuity attributable to helmet sun visor use in the presence of a glare source. Low-contrast acuity, spot detection, and contrast sensitivity were measured in the second study, conducted on student naval aviators at an illumination typically encountered during daytime flight (6870 cd/sq m). Results indicate that the filter density and the illuminance reaching the eyes could be varied over a wide range, without critically affecting these visual functions. It is concluded that to select sun visors or sunglasses it is necessary to take into account prevailing environmental illuminance. O.G.

## A91-46829 BIODYNAMIC SIMULATIONS OF THE EFFECT OF A NECK-MOUNTED AIR BAG ON THE HEAD/NECK RESPONSE DURING HIGH G ACCELERATION

CHANG M. LEE (Korea Air Force Academy, Seoul, Republic of Korea), ANDRIS FREIVALDS (Pennsylvania State University, University Park), and SOON Y. LEE (Korea University, Seoul, Republic of Korea) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Aug. 1991, p. 747-753. refs  
Copyright

New helmet-mounted devices have created new safety hazards for pilots during ejection or high G maneuvering. In order to prevent the resulting head/neck injuries, this study extends the air-bag protection system developed for ground vehicles to a neck mounted system for aircrew personnel. Results, carried out by computer biodynamic simulations using the Articulated Total Body Model (ATB), showed that: (1) helmet weight had little effect on head/neck torque, contact force and flexion angle; (2) initial head/neck position and center of gravity offsets of the helmet-mounted devices had significant effects on head/neck torques, contact forces, and neck flexion angles; and (3) the neck mounted air bag significantly reduced neck torques, contact forces, and neck flexion angles. It is concluded that the neck-mounted air bag system could significantly reduce the severity of head/neck injuries to pilots during ejection or high G maneuvering. Author

## A91-47518 A METHOD FOR ANALYZING THE OPERATIONAL RELIABILITY OF A CREW/FLIGHT VEHICLE SYSTEM WHEN SOLVING A COMPLEX-TRACKING PROBLEM [OB ODNOI METODE OTSENKI NADEZHNOI FUNKTSIONIROVANIIA SISTEMY EKIPAZH-LETATEL'NYI APPARAT PRI RESHENII ZADACHI KOMPENSATORNOGO SLEZHENIIA]

V. A. KONDRATENKOV and G. A. TERESHKIN (Kievskoe Vysshie Voennoe Aviatzionnoe Inzhenernoe Uchilishche, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 17-21. In Russian. refs  
Copyright

A mathematical model of a crew/flight vehicle system is developed on the basis of the theory of Markov processes. This model can be used to assess the reliability of a crew that is executing a compensatory tracking task. The proposed approach makes it possible to define the analytical dependence of the probability of task execution on the parameters characterizing the system in time. L.M.

A91-47519  
SYNTHESIS OF SUBOPTIMAL SIMULATION CONTROL IN NOISE CONDITIONS [SINTEZ SUBOPTIMAL'NOGO IMITATSIONNOGO UPRAVLENIIA V USLOVIAKH POMEKH]  
V. I. VASIL'EV, I. I. GORELOV, and Z. D. USMANOV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 28-34. In Russian. refs  
Copyright



The paper examines the possibility of using methods of optimal simulation control synthesis under conditions of constantly acting noncontrollable external inputs. It is shown that these methods make it possible to construct a good-quality control which leads the object to the goal by narrowing the attainability regions. In the case where the state of the object cannot belong to these narrowings, two control modes are substantiated: active noise suppression and dual control. L.M.

A91-47520

**ON THE QUESTION OF HUMAN-OPERATOR ACTIVITY IN CERTAIN AUTOMATIC CONTROL SYSTEMS [K VOPROSU DEIATEL'NOSTI CHELOVEKA-OPERATORA V NEKOTORYKH ASU]**

A. M. MELESHEV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 36-38. In Russian. refs

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A particular type of operator activity is examined, i.e., the mental rotation of visually presented images typical for certain automatic control systems. It is shown that, in the man-machine system considered, operating with time deficit, it is necessary to take into account time expenditures on the mental rotation of the images. In the case of complex configurations of the initial positions the time expenditures may be impermissible from the point of view of preserving the operational integrity of the system. L.M.

A91-47521

**SYMBOLIC-ALGEBRAIC METHODS FOR THE ANALYSIS OF NONLINEAR AND BILINEAR MODELS OF MAN-MACHINE CONTROL SYSTEMS [SIMVOL'NO-ALGEBRAICHESKIE METODY ANALIZA NELINEIYKH I BILINEIYKH MODELEI ERGATICHESKIKH SISTEM UPRAVLENIIA]**

V. A. IATSENKO (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 39-43. In Russian. refs

Copyright

The feasibility of using symbolic-analytical computations to analyze nonlinear two-dimensional models of man-machine systems is examined. It is shown that symbolic computations can be used to classify linear-analytical man-machine systems, to evaluate state or feedback linearization properties, to determine the controllability index, and to analyze the matrices related to the properties of the input-output mapping of nonlinear man-machine systems. L.M.

A91-47522

**ON HUMAN-OPERATOR ADAPTATION [OB ADAPTATSII CHELOVEKA-OPERATORA]**

A. E. RADIEVSKII (Kievskii Institut Avtomatiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 43-46. In Russian. refs

Copyright

Issues connected with the adaptation of a human operator in a compensatory-tracking system are examined. In addition, methodological principles for designing the learning process on a special-purpose training simulator are presented. L.M.

A91-47523

**SYNTHESIS OF MAN-MACHINE CONTROL SYSTEMS [SINTEZ ERGATICHESKIKH SISTEM UPRAVLENIIA]**

V. V. PAVLOV and O. S. IAKOVLEV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 57-62. In Russian. refs

Copyright

The effect of the feedback parameters on the quality of transient processes in multidimensional nonlinear control systems is assessed. Methods for the distribution of functions between the human operator and the system devices during the quality control of transient processes are presented. L.M.

A91-47525

**THE INFLUENCE OF ERRORS COMMITTED BY AIR FLIGHT CREWS ON FLIGHT SAFETY [VLIIANIE OSHIBOK AVIATSIONNOGO PERSONALA NA BEZOPASNOST' POLETOV]**

V. N. GOLEGO (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 68-73. In Russian. refs

Copyright

Statistical data on the contribution of flight-crew errors to aviation incidents and accidents are examined. It is found that there exists a group of errors whose influence on flight safety tends to remain constant or even to increase despite numerous measures undertaken to enhance safety. This phenomenon is explained from the standpoint of man-machine system theory. L.M.

A91-47526

**REFLEXIVE CHOICE OF CONFLICT-RESOLUTION STRATEGIES IN MAN-MACHINE SYSTEMS [REFLEKSIVNYI VYBOR STRATEGII RAZRESHENIIA KONFLIKTOV V ERGATICHESKIKH SISTEMAKH]**

N. I. SEN'SHIN (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 88, 1990, p. 82-86. In Russian. refs

Copyright

The paper examines issues connected with the choice of conflict-resolution strategies in a system modeled by a positional nonantagonistic game of several persons. An algorithm for choosing the preferred position with allowance for forbidden situations is proposed. A theorem regarding the structure of a suboptimal strategy guaranteeing conflict resolution with an arbitrary representative of the conflict class is formulated and proved. L.M.

A91-47809#

**SIMULATOR-BASED INTELLIGENT TUTORING SYSTEM FOR NASA'S ROBOTIC ARM**

THOMAS T. CHEN and DIANN BARBEE (Global Information Systems Technology, Inc., Savoy, IL) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 72-76. refs (AIAA PAPER 91-2921) Copyright

An intelligent tutoring system to be used with simulators of the Shuttle's robotic arm is described. The overall goal of this project is to enhance the benefit and instructional utility of simulators, supported by reducing training costs and increasing training efficiency through automatic generation of new scenarios based on student performance. It is shown that existing simulators can be modified to support very efficient training and the work can inform the design of new simulators, which rarely have built-in diagnostics, automatic scenario generation, or student models that guide the follow-on training. R.E.P.

A91-47814#

**EFFECTS OF TIME DELAYS ON HEAD TRACKING PERFORMANCE AND THE BENEFITS OF LAG COMPENSATION BY IMAGE DEFLECTION**

RICHARD H. Y. SO and MICHAEL J. GRIFFIN (Southampton, University, England) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 124-130. Research supported by USAF. refs

(AIAA PAPER 91-2926) Copyright

Images on head-coupled systems delayed by latencies in measuring head position and generating computer graphics are examined. This study focuses on: (1) investigation of the effects of time delays on head tracking performance, (2) evaluation of an image deflection method to reduce deleterious effects of delayed images, and (3) examining the application of a head position prediction algorithm to improve the benefits of image deflection.



## 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Significant decreases resulted in head tracking performance when lags of 40ms or more were added to a system with an inherent 40ms lag. Lag compensation by image deflection significantly enhanced tracking performance with lags up to 380ms. R.E.P.

### A91-47815#

#### UNUSUAL ATTITUDE RECOVERIES USING A PATHWAY IN THE SKY

JOHN REISING, KRISTEN BARTHELEMY (USAF, Cockpit Integration Directorate, Wright-Patterson AFB, OH), and DAVID HARTSOCK (Midwest Systems Research, Dayton, OH) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 131-138. refs (AIAA PAPER 91-2927)

Three different Head Up Display (HUD) formats were tested to see which would provide the pilot with the most effective means of recovering from unusual attitudes. Two of the formats were variations of conventional HUD formats, while the third utilized a Pathway-in-the-sky to guide the pilot back to the horizon. The conclusion was that, with adequate training, the Path performed as well as the more conventional HUDs, and provided the pilot with situational awareness by showing him the way to recover.

Author

### A91-47836#

#### INVESTIGATION OF VISUAL INTERFACE ISSUES IN SPACE TELEOPERATION USING A VIRTUAL TELEOPERATOR

M. A. MACHLIS and H. L. ALEXANDER (MIT, Cambridge, MA) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 330-336. refs (AIAA PAPER 91-2950) Copyright

A simulator has been developed to examine human factors issues in teleoperation. A graphic workstation simulates the visual feedback which would be provided to an operator by vehicle-mounted video cameras on an actual teleoperator. The software design allows easy modification of vehicle dynamics and content of the simulated environment. Command input is via a combination of hand- and foot-controllers, and visual feedback is provided by a CRT monitor or a VPL Eyephones stereoscopic head-mounted display. A mechanical-linkage head tracker allows transformation of views based on operator head orientation. Using the head-mounted display with head-slaved views was found to provide a strong sense of telepresence. A representation of the body of the teleoperator was added to the visual scenes. It was expected that, when using the head-mounted display with head-slaved views, this would reduce operator disorientation by providing precise visual cues to gaze direction. Preliminary results indicate that including a vehicle body does reduce disorientation and increases performance on some tasks.

Author

### A91-47844#

#### THE EFFECTS OF SIMULATOR TRANSPORT DELAY ON PERFORMANCE, WORKLOAD, AND CONTROL ACTIVITY DURING LOW-LEVEL FLIGHT

MATTHEW S. MIDDENDORF, ANNETTE I. FIORITA (Logicon Technical Services, Inc., Dayton, OH), and GRANT R. MCMILLAN (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 412-426. refs (AIAA PAPER 91-2965) Copyright

The effect of a transport delay of 90, 200, or 300 msec on the performance of test subjects in a low-level flight task is evaluated experimentally using a fixed-base F-16-type aircraft simulator in four different protocols. The equipment and procedures are described, and the results are presented in extensive tables and graphs and characterized in detail. Significant effects on overall performance, workload, and control activity are found at 300 msec and sometimes at 200 msec. It is concluded that a total transport

delay of 200 msec is acceptable in this type of simulation, but that any other simulation delay must be subtracted from this budget. D.G.

### A91-47845#

#### ISSUES CONCERNING CUE CORRELATION AND SYNCHRONIZATION OF NETWORKED SIMULATORS

ROBERT J. SAWLER and RON MATUSOF (CAE-Link Corp., Binghamton, NY) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 427-435. refs (AIAA PAPER 91-2967) Copyright

The problem of correlating cues in a single flight simulator is reviewed, and the more complex task of correlating cues on networked simulators is examined. Instrument, motion, visual, navigational, and audio correlation are described; 'wall-clock' synchronization methods are outlined; and particular attention is given to network cue latency due to control-loading, data-sampling, data-transfer, processing, visual-system, and motion-system delays. Also considered are delay dispersion (the unpredictable variation among individual signal delays), fidelity differential, static correlation, and the additional delays encountered in wide-area (rather than local-area) networks. D.G.

### A91-47846#

#### AN ASSESSMENT OF THE IMPORTANCE OF MOTION CUEING BASED ON THE RELATIONSHIP BETWEEN SIMULATED AIRCRAFT DYNAMICS AND PILOT PERFORMANCE - A REVIEW OF THE LITERATURE

FRANK M. CARDULLO (New York, State University, Binghamton) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 436-447. refs (AIAA PAPER 91-2980) Copyright

This paper reviews a method of assessing the need for motion cueing based on the simulated aircraft flight dynamics environment. The flight environment is reduced into four categories; maneuvers which are largely open loop and low gain, high gain closed loop with good visual, high gain closed loop with poor visual and aircraft which are unstable; and assesses motion cueing requirements on that basis. Also reviewed is the motion cueing literature including both the results of performance studies and transfer of training studies with the intent of establishing a determination of the relationship between the necessity of motion cueing and the task performed in the simulator. Author

### A91-47850\*#

#### RECENT PROCEEDINGS OF THE NASA STEERING COMMITTEE ON SIMULATOR INDUCED SICKNESS

MICHAEL E. MCCAULEY (Monterey Technologies, Inc., Carmel, CA), ANTHONY M. COOK (NASA, Ames Research Center, Moffett Field, CA), and JAMES W. VOORHEES (U.S. Army, Crew Station Research and Development Branch, Moffett Field, CA) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 478-488. refs (AIAA PAPER 91-2973) Copyright

The reports, research updates, and discussion topics presented at the third (1990) and fourth (1991) meetings of the Committee, comprising experts from the U.S., the U.K., and Canada, are briefly summarized. A number of interim solutions to the problem of simulator-induced sickness are suggested, including reducing global visual flow, shortening simulation duration, reducing the amount of maneuvering, repeating sessions to allow pilot adaptation, and eliminating spatial and temporal distortions. D.G.

### A91-47851#

#### WHAT NEEDS DOING ABOUT SIMULATOR SICKNESS?

ROBERT S. KENNEDY, JENNIFER E. FOWLKES (Essex Corp., Orlando, FL), and MICHAEL G. LILIENTHAL (U.S. Navy, Naval Air Systems Command, Washington, DC) IN: AIAA Flight

Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 489-495. refs (AIAA PAPER 91-2974) Copyright

The problem of simulator-induced sickness is discussed, and results from a statistical study of 3600 exposures to two training simulators, based on an especially designed sickness questionnaire, are summarized in graphs. Groups of symptoms (neurovegetative, oculomotor, and vestibular) are identified, and an adaptation process occurring in 'hops' is noted, which can be promoted by spacing sessions at 2-5-day intervals. Extensive field tests using the questionnaire to establish a data base are suggested. D.G.

**A91-47852\*# Monterey Technologies, Inc., Carmel, CA.  
THE EFFECT OF GLOBAL VISUAL FLOW ON SIMULATOR SICKNESS**

THOMAS J. SHARKEY and MICHAEL E. MCCAULEY (Monterey Technologies, Inc., Carmel, CA) IN: AIAA Flight Simulation Technologies Conference, New Orleans, LA, Aug. 12-14, 1991, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 496-504. refs (Contract NAS2-12927) (AIAA PAPER 91-2975) Copyright

Simulator-induced sickness is investigated in experiments performed at the NASA Ames Army Crew Station Research Facility using the fixed-base helmet-mounted-display flight simulator described by Lypaczewski et al. (1986). The focus of the tests was on the possible roles of (1) global visual flow, as defined by Warren et al. (1982), and (2) maneuvering intensity (in the conflict hypothesis of Reason and Brand, 1975). The results, based on subjective evaluations, physiological measurements, and physical tests on 19 Army helicopter pilots performing a 40-min river-valley following task, are presented in extensive tables and graphs and discussed. The data are found to be in agreement with (1) and inconsistent with (2), indicating more sickness at lower altitude instead of with increased maneuvering. Shorter simulator sessions and postponement of low-altitude work until later in the training period are recommended. D.G.

**A91-48196  
INCORPORATING THE EFFECTS OF TIME ESTIMATION INTO HUMAN-RELIABILITY ANALYSIS FOR HIGH-RISK SITUATIONS**

JOSEPH SHARIT (New York, State University, Buffalo) and DAVID M. MALON (Argonne National Laboratory, IL) IEEE Transactions on Reliability (ISSN 0018-9529), vol. 40, June 1991, p. 247-254. refs Copyright

A modeling framework for predicting the effects of discrepancies between subjective and objective measures of elapsed time on performance of human-machine interaction tasks in high-risk situations is presented. Following a review of the major theories and experimental research findings in time estimation, the importance of time estimation in terms of its potential for affecting human performance in critical human-machine system operations is discussed. This approach for dealing with time-related task demands is to describe the ongoing dynamic processes during task performance that are associated with temporal estimation, and to assess their effects on human reliability. This is accomplished through a conceptual framework that is depicted and discussed in terms of several task features and information-processing mechanisms, and that implicitly recognizes the experimental evidence concerning human time-estimation performance. I.E.

**N91-27765\*# Alabama Univ., Huntsville.  
ECLSS ADVANCED AUTOMATION PRELIMINARY REQUIREMENTS Final Report**

BRENDA D. LUKEFAHR, DANIEL M. ROCHOWIAK, BRIAN L. BENSON, JOHN S. ROGERS, and JAMES W. MCKEE Nov. 1989 168 p

(Contract NAS8-36955)

(NASA-CR-186115; NAS 1.26:186115; UAH-RR-823) Copyright Avail: NTIS HC/MF A08 CSCL 06/11

A description of the total Environmental Control and Life Support System (ECLSS) is presented. The description of the hardware is given in a top down format, the lowest level of which is a functional description of each candidate implementation. For each candidate implementation, both its advantages and disadvantages are presented. From this knowledge, it was suggested where expert systems could be used in the diagnosis and control of specific portions of the ECLSS. A process to determine if expert systems are applicable and how to select the expert system is also presented. The consideration of possible problems or inconsistencies in the knowledge or workings in the subsystems is described. Author

**N91-27766\*# Alabama Univ., Huntsville.  
A DIAGNOSTIC PROTOTYPE OF THE POTABLE WATER SUBSYSTEM OF THE SPACE STATION FREEDOM ECLSS Final Report**

BRENDA D. LUKEFAHR, DANIEL M. ROCHOWIAK, BRIAN L. BENSON, JOHN S. ROGERS, and JAMES W. MCKEE Nov. 1989 49 p

(Contract NAS8-36955)

(NASA-CR-186111; NAS 1.26:186111; UAH-RR-824) Copyright Avail: NTIS HC/MF A03 CSCL 06/11

In analyzing the baseline Environmental Control and Life Support System (ECLSS) command and control architecture, various processes are found which would be enhanced by the use of knowledge based system methods of implementation. The most suitable process for prototyping using rule based methods are documented, while domain knowledge resources and other practical considerations are examined. Requirements for a prototype rule based software system are documented. These requirements reflect Space Station Freedom ECLSS software and hardware development efforts, and knowledge based system requirements. A quick prototype knowledge based system environment is researched and developed. Author

**N91-27767# Technical Research Centre of Finland, Espoo.  
LVI-Tekniikan Laboratorio.**

**THE EFFECTS OF AIR TEMPERATURE AND OTHER INDOOR CLIMATE FACTORS ON WORK PRODUCTIVITY**

E. TAMMELA (Työterveyslaitos, Helsinki, Finland) 1990 54 p In FINNISH; ENGLISH summary (DE91-771954; VTT/LVIS2000-2) Avail: NTIS HC/MF A04

The aim was to review the effects of air temperature and other indoor climate factors on work productivity and to find out whether a wider experimental study is necessary in Finland. The effects of hot conditions on human performance have been widely investigated in laboratories. Generally the aim has been to find the exposure limits in which people can work without harm to their health and to determine the mechanism on which the performance loss is based. According to these studies the performance in mentally demanding and also in very simple tasks deteriorates at a temperature above 33 C. The results are partly contradictory, which is due to numerous confusing factors related to the studies and to many other factors affecting performance, e.g., thermal characteristics, time of exposure, type of task, level of arousal, skill and motivation of the worker. Most of the studies near the range of comfort have dealt with the effects of air temperature on learning. These studies have been conducted in schools, in observation classrooms and in laboratories. Performance began to deteriorate at an air temperature of 27 C or more. There are only a few studies concerning the effects of thermal conditions on productivity in office work. In some studies mild thermal stress has resulted in a lowered performance and in others no differences have been found. Well motivated persons may be quite unaffected by mild thermal stress. Mild heat stress increases the degree of experienced symptoms and fatigue and decreases work satisfaction. There is no evidence suggesting that a temperature other than that found comfortable by the majority will produce more work output. DOE

## **N91-27768#** Joint Publications Research Service, Arlington, VA. **JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

20 Mar. 1991 52 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-006) Avail: NTIS HC/MF A04

Abstracts of Soviet research projects in the area of the life sciences is presented. The following topics are covered: biochemistry, biotechnology, molecular biology, physiology, public health, and virology. One particular abstract is presented in the field of aerospace medicine on the subject of habitability and biological life support systems.

## **N91-27769#** Joint Publications Research Service, Arlington, VA. **HABITABILITY AND BIOLOGICAL LIFE SUPPORT SYSTEMS**

O. G. GAZENKO, A. I. GRIGORYEV, G. I. MELESHKO, and YE. YA. SHEPELEV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-6 20 Mar. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 3, May-Jun. 1990 p 12-17

Avail: NTIS HC/MF A04

Problems about man's attitude toward biological life support systems (BLSS's) are discussed. Man's understanding of the purpose and role of BLSS's in the future of cosmonautics depends on an understanding of the problem of habitability. If the concept of habitability is based on the satisfaction of a familiar list of individual physiological and hygiene requirements, then the task of life support systems (LSS's) can be understood purely from the viewpoint of a consumer: as one of ensuring the parameters required of the environment and the amount of its required components (oxygen, water, and food). If the problem is based on the ecological concept of the habitat in the broad sense, then ecological, not consumer, requirements must be imposed on the LSS as a system for total development of a biologically complete habitat adequate for man's biological needs and meeting, in principle, the basic criteria of the natural environment on Earth. This is the reason for the different approaches to evaluating the prospects of BLSS's used by designers on the one hand and doctors studying human living conditions in space facilities on the other. The importance of defining relations between the concept of habitability and the role of the means that ensure it are discussed.

Author

## **N91-27770#** Navy Clothing and Textile Research Facility, Natick, MA.

### **PHYSIOLOGICAL ACCEPTANCE CRITERIA FOR COLD WEATHER CLOTHING Final Report, Oct. 1988 - Dec. 1989**

NANCY A. PIMENTAL Apr. 1991 22 p

(Contract NAVY PROJ. TM331311)

(AD-A235670; NCTRF-185) Avail: NTIS HC/MF A03 CSCL 15/5

The purpose of the present investigation was to develop physiological limit criteria for cold weather clothing items which meet the limits for protection against development of a cold injury, and which are also associated with an increased level of subjective comfort and acceptance. The literature on physiological responses to cold was reviewed. The relationships of responses such as body core temperature, skin temperatures and shivering to subjective feelings of thermal comfort and temperature sensation were examined. Under many conditions that Navy cold weather clothing items are worn, it is not practical to expect that the optimal level of thermal comfort can be obtained. Allowing for a moderate level of cold sensation and thermal discomfort, the following physiological criteria for acceptance of cold weather clothing items were developed: (1) a mean weighted skin temperature is greater than or equal to 28 C (82 F), (2) local skin temperature at any site is greater than or equal to 18 C (64 F), (3) a metabolic rate due to shivering is less than twice the normal resting rate (metabolic rate is greater than or equal to approximately 180 kcal/hr). All three criteria must be met. Application of these criteria will enable better evaluation of and comparison to cold weather clothing items.

GRA

## **N91-27771#** Naval Ocean Systems Center, San Diego, CA. **AEGIS STATUS-DISPLAY FORMATS: TRADEOFF STUDIES**

JAMES W. BROYLE May 1991 5 p

(AD-A236969) Avail: NTIS HC/MF A01 CSCL 12/6

An experiment was designed to collect human performance data on current and experimental status display formats for a Navy Workstation (i.e., Aegis Combat System). Current information display methods do not take advantage of human processing capabilities of using graphics (e.g., icons, bar-graphs, or color) and integrating the information on the display to fit the operator's task. The focus of the experiment was to provide human performance data to support the trade-off analyses of display formats and to investigate the feasibility of applying these techniques to future control/display upgrades. Eleven subjects (6 Navy personnel with Aegis combat system experience and 5 Navy researchers) viewed different display formats of the Guided Missile Launcher System Character Read-out (CRO). The subjects answered 16 questions about system status on each of the display layouts. The experiment compared operator accuracy and response times when reading information across the displays. We found that operator performance may differ as a function of layout of information on a CRO and the cognitive processes required to execute the task. Other design improvements for future studies will be discussed.

GRA

## **N91-27772#** Naval Ocean Systems Center, San Diego, CA.

### **SOME PRAGMATIC ISSUES OF MEASUREMENT**

T. P. ENDERWICK May 1991 8 p

(AD-A236992) Avail: NTIS HC/MF A02 CSCL 14/2

Measurement is the cornerstone of Human Factors (HF) research and testing. To facilitate discussions HF testing will be treated as a special case of HF research in that testing uses many of the same methods and measurements. HF research is applied research which means the results are always expected to have a use. This does not mean that the results are necessarily unrelated to theory evaluation. This simply means that the sponsor and user have the right to know what the utility and limitations of the results are in relation to the specific problems or questions posed prior to the research. This, in turn, determines the selection and/or development of measures to be used in research and testing. This gives rise to a number of pragmatic issues for research in general and measurement in particular. The topics in this paper are somewhat diversified. First, some of the potential users will be identified along with their needs in respect to HF research and testing. This will be followed by a discussion of some pragmatic issues and end with a suggested approach for evaluating crew's contribution to system performance.

GRA

## **N91-28068\*#** Texas Southern Univ., Houston. Dept. of Home Economics.

### **INTERNATIONAL FOOD PATTERNS FOR SPACE FOOD**

SELINA AHMED, AMANDA COX, and PAULINE V. CORNISH In Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 26-32 1989

Avail: NTIS HC/MF A23 CSCL 06/8

The purpose of this research was to obtain basic data on ethnic foods by studying dietary patterns and multicultural foods, and to determine nutritional status of multicultural space explorers by evaluating dietary, clinical, biochemical, and socioeconomic factors. The study will plan a significant role in providing nutritional research for space explorers of different ethnic backgrounds. It will provide scientific background information by bringing together cross cultural dietary and nutritional from different ethnic groups. Results will also help the health care personnel including physicians, dietitians, and nutritionists to better understand and assist patients from other cultures illness. Also, the results will provide data which will help in the development of future food plans for long duration flights involving manned exploration to Mars and lunar base colonies.

Author

**N91-28109\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.  
**END-EFFECTOR-JOINT CONJUGATES FOR ROBOTIC ASSEMBLY OF LARGE TRUSS STRUCTURES IN SPACE: A SECOND GENERATION**

WILLIAM V. BREWER /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 336-342 1989 Prepared in cooperation with Jacksonville State Univ., AL  
 Avail: NTIS HC/MF A23 CSCL 06/11

Attachment of strut to node can be accomplished with a variety of mechanisms. All require extensive standoff elements (called scars) added to the nodes. These increase packaging volume for the nodes by as much as 300 percent. First generation designs also tend to be either heavy or expensive due to complex parts. Screws thread mechanisms are discussed simplest and most easily manufactured of alternatives. Torque and rotational motion must be transmitted across the strut to end-effector interface accomplishing the joining process and establishing a specific preload. Four drive mechanisms are considered: worm, helical, bevel, and differential gears. Author

**N91-28110\*#** Prairie View Agricultural and Mechanical Coll., TX. Dept. of Electrical Engineering.

**MARS SURFACE BASED FACTORY. PHASE 2, TASK 1C: COMPUTER CONTROL OF A WATER TREATMENT SYSTEM TO SUPPORT A SPACE COLONY ON MARS**

JOHN FULLER, WARSAME ALI, and DANETTE WILLIS /in Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings p 343-348 1989  
 Avail: NTIS HC/MF A23 CSCL 06/11

In a continued effort to design a surface based factory on Mars for the production of oxygen and water, a preliminary study was made of the surface and atmospheric composition on Mars and determined the mass densities of the various gases in the Martian atmosphere. Based on the initial studies, oxygen and water were determined to be the two products that could be produced economically under the Martian conditions. Studies were also made on present production techniques to obtain water and oxygen. Analyses were made to evaluate the current methods of production that were adaptable to the Martian conditions. Even though the initial effort was the production of oxygen and water, it was found necessary to produce some diluted gases that can be mixed with the oxygen produced to constitute 'breathable' air. The conceptual design of a breathable air manufacturing system, a means of drilling for underground water, and storage of water for future use were completed. The design objective was the conceptual design of an integrated system for the supply of quality water for biological consumption, farming, residential and industrial use. Author

**N91-28731#** Navy Clothing and Textile Research Facility, Natick, MA.

**THE CHEMICAL RESISTANCE OF PROTECTIVE HANDWEAR AVAILABLE THROUGH THE NAVY'S SUPPLY SYSTEM Final Report, Oct. 1989 - Sep. 1990**

ANDRA KIRSTEINS Apr. 1991 30 p  
 (AD-A235874; NCTRF-184) Avail: NTIS HC/MF A03 CSCL 06/12

The Navy Clothing and Textile Research Facility (NCTRF) evaluated seven types of chemical protective gloves, available through the Navy's supply system, for their chemical resistance against a selected list of 10 hazardous chemicals found aboard ship. The purpose of this study was to generate information that could be used in the development of a material for multi-purpose hazardous-chemical protective handwear. Such a glove would eliminate the need for a variety of gloves in the supply system that are procured for a specific use. It should be noted that these gloves were not tested for their intended uses, since this was not the scope of the study. The study revealed that none of the current gloves protects against all of the tested chemicals. Results from this study further justify the need for the development of a multi-purpose hazardous-chemical protective glove material.

GRA

**N91-28732#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.

**USING HSYS IN THE ANALYSIS OF HUMAN-SYSTEM INTERACTIONS: EXAMPLES FROM THE OFFSHORE PETROLEUM INDUSTRY**

J. L. HARBOUR and S. G. HILL 1990 5 p Presented at the Human Factors Society Conference, Orlando, 8-12 Oct. 1990 (Contract DE-AC07-76ID-01570)  
 (DE91-013218; EGG-M-90269; CONF-9010155-5) Avail: NTIS HC/MF A01

In an attempt to better understand the interactional relationship between humans and operational systems, HSYS was developed. The HSYS methodology provides a systematic process for analyzing Human-SYSTEM interactions in complex operational settings. HSYS focuses on system interactions from the human's perspective and is built around a linear model of human performance, termed the Input-Action model. According to the model, all human actions involve, to varying degrees, five sequential steps: Input Detection, Input Understanding, Action Selection, Action Planning, and Action Execution. Based on the Input-Action model, a series of flowcharts, supported by detailed topical modules, have been developed to analyze each of the five main components in depth. During initial validation efforts, the HSYS methodology was used to analyze 28 accidents which occurred in the offshore petroleum industry from 1980 to 1989. Although numerous factors contributed to the various accident sequences examined, one frequently identified problem was a lack of situational awareness by crew members either immediately preceding the accident or during the actual accident sequence itself. A major contributor to this lack of awareness was inadequate input detection, caused by either inadequate input recognition, inadequate input discrimination, or inadequate attention. In most instances, the root causes for these inabilities were associated with inadequate sensor/display arrays and/or poor human-machine interface design and engineering. DOE

**N91-28733** Tel-Aviv Univ. (Israel). Dept. of Interdisciplinary Studies.

**HUMAN BODY PROTECTION IN A DYNAMIC ENVIRONMENT. CUSHIONING MECHANICS M.S. Thesis**

ISRAEL ZANGER Jul. 1989 101 p In HEBREW; ENGLISH summary  
 (ITN-91-85149) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

The principles of cushioning mechanics were defined and the transfer of vibration to a sitting human body in a dynamic environment was analyzed. The vibration damping properties of potential cushioning materials were classified. A mathematical approximation was established, which relates the damping efficiency of cushioning materials to the contact pressure. Several cushioning mechanics principles were formulated: An optimal domain for each material contact pressure; quasi-uniformity of contact pressure distribution; directional damping properties; and optimal damping of wide-spectrum vibration. Attention to these principles can lead to the design of cushions with optimal damping efficiencies. A test stand was assembled on which a series of transducers measured the acceleration transmitted through a cushioned chair into a sitting human body. The measured filtering efficiencies agreed well with predictions made according to the above principles. The principles were used to develop a methodology for the design of protective dynamic cushions, which can be applied to protection of instruments and delicate structures as well as to human protection. The methodology was applied to the design of cushions for a helicopter seat and for a combat vehicle seat; both proved superior to the articles in current use.

ISA

## SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A91-45444

# SYNTHESIS OF BIOMOLECULES FROM N<sub>2</sub>, CO, AND H<sub>2</sub>O BY ELECTRIC DISCHARGE

Y. HIROSE, K. OHMURO, M. SAIGO, T. NAKAYAMA, and Y. YAMAGATA (Kanazawa University, Japan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 20, no. 6, 1990-1991, p. 471-481. refs

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A model primitive gas containing a mixture of N<sub>2</sub>, CO and water vapor over a water pool was subjected to electric discharges. The discharge vessel was equipped with a CO<sub>2</sub> absorber, thus simulating possible absorption of CO<sub>2</sub> in the primitive ocean. The vessel also has a cold trap, which protects the primary products against the further decomposition in the discharge phase by enabling these products to adhere to the trap. The solution was analyzed at regular intervals for HCN, HCHO and urea, and maximum concentrations of about 50, 2, and 140 mM were observed. The discharge phase was continued for 6 months. In the solution, glycine, glycyglycine, orotic acid and small amounts of the other amino acids were found. Author

A91-45445

# MECHANISMS OF AMINO ACID POLYCONDENSATION ON SILICA AND ALUMINA SURFACES

VLADIMIR A. BASIUK, TARAS IU. GROMOVOI, VITALII G. GOLOVATYI, and ALEKSANDR M. GLUKHOI (AN USSR, Institut Fizicheskoi Khimii, Kiev, Ukrainian SSR) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 20, no. 6, 1990-1991, p. 483-498. refs

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Infrared spectroscopy is used to study the chemisorption products of bifunctional amino acid vapors on the surface of silica and alumina. Two mechanisms of peptide chain growth were easily detected on the silica surface. It is found that condensation of amino acids into linear peptides on the silica surface can take place only in the presence of water. Detectable amounts of linear peptides are formed on the alumina surface in the absence of water. K.K.

A91-45447

# SPONTANEOUS BREAKING OF THE L, D SYMMETRY IN PHOTOLYTIC PRODUCTION AND DEGRADATION OF AMINO ACIDS

K. TENNAKONE (Institute of Fundamental Studies, Kandy; Ruhuna, University, Matara, Sri Lanka) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 20, no. 6, 1990-1991, p. 515-519. refs

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The radiolysis experiments of amino acids have revealed the presence of bimolecular interaction between like enantiomers which suppress their photodegradation and between opposite enantiomers that enhance the photodegradation. Based on a mathematical model, it is suggested that this phenomenon could have given rise to chiral stereoselection in biochemical evolution. Author

A91-45771

# HANDEDNESS, ORIGIN OF LIFE AND EVOLUTION

VLADIK A. AVETISOV, VITALII I. GOLDANSKII, and VLADIMIR V. KUZ'MIN (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) *Physics Today* (ISSN 0031-9228), vol. 44, July 1991, p. 33-41. refs

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Physical approaches to the problem of the origin of life are presented. Attention is given to two properties of living systems that are unique from the physical standpoint: self-replication and

homochirality. The authors suggest that the existence of these two properties predetermines the path of prebiological evolution in that life, based on self-replication of organic homochiral polymers, could have originated only if the prebiotic organic medium was capable of a bifurcation-type transition to the chirally pure state. K.K.

A91-48417

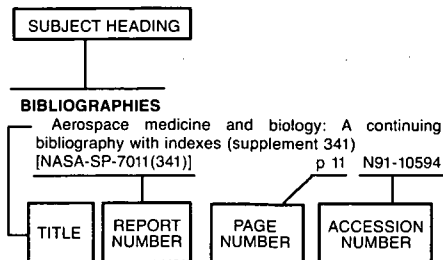
# VOLCANIC PRODUCTION OF POLYPHOSPHATES AND ITS RELEVANCE TO PREBIOTIC EVOLUTION

Y. YAMAGATA, H. WATANABE, M. SAITO, and T. NAMBA (Kanazawa University, Japan) *Nature* (ISSN 0028-0836), vol. 352, Aug. 8, 1991, p. 516-519. refs

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Most of the phosphorus on the early earth would have been in the form of water-insoluble apatite, and the origin of the water-soluble polyphosphates required for prebiotic evolution has therefore been a mystery. It is shown here, both from experiments that simulate magmatic conditions and from analysis of volatile condensates in volcanic gas, that volcanic activity can produce water-soluble polyphosphates through partial hydrolysis of P<sub>4</sub>O<sub>10</sub>. This mechanism seems to be the only viable route identified so far for the production of these species on the primitive earth. C.D.

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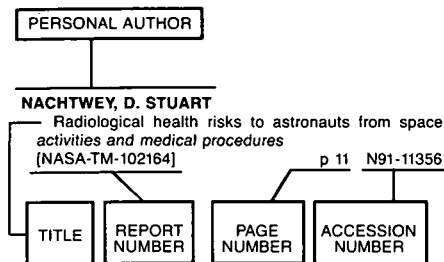
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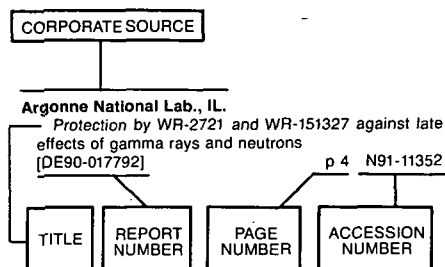
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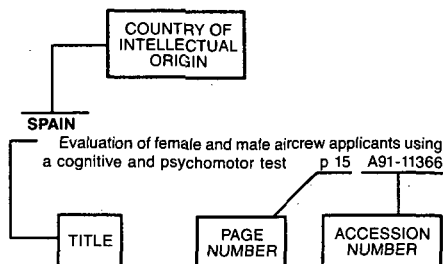


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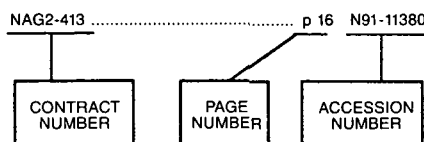
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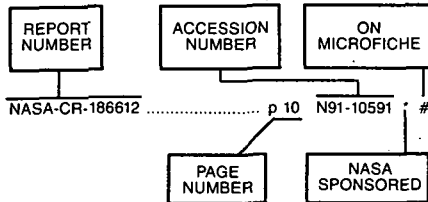
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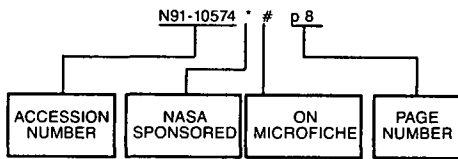
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