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.


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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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 to 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.

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.
51

LIFE SCIENCES (GENERAL)

A91-45225* Hospital Lariboisiere, Paris (France).
MECHANICALLY INDUCED ORIENTATION OF ADULT RAT CARDIAC MYOCYTES IN VITRO
J.-L. SAMUEL (Hospital 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
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 O2 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), and SAMUEL BLACK (San Jose State University Foundation, CA), and LYNN CUTLER (Annals of Otology, Rhinology and Laryngology (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 character, 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 intimately, 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 polyamic sites. They have a nodelike 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 nervous system, 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
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). 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 VNUTrICHEREPNOGO DAVLENIYA V POKOE I PRI PEREMENNE POLOZHENII TELA)
V. P. KROTOV, E. V. TRAMBOVETSKII, and A. N. NAZIN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR).
Fiziolicheski Zhurnal SSSR (ISSN 0015-329X), vol. 77, Jan. 1991, p. 68-75. In Russian. refs
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The relationship between epidural and subdural methods for...
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 IZMENENIIA GEMODINAMIKI LEGKIKH U KRSY 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

Transcerebral electrophysiology 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 [VLVIANIE SKOROSTI RAZOGREVANIIA NA OBSCHCHIY METABOLIZM ORGANIZMA I TONUS KOZHNYKH SOSUDOV]

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 [VLVIANIE DVIGATEL'NYKH REZHIMOV UMERENNOI INTENSVISTI NA SPONTANNIIU DVIGATEL'NUII AKTIVNOST' Y USTOICHIVOST' K RYS K OSTROI GIPOKSICHESKOI GIPOKSI]

A91-47484
THE STATE OF WATER-SALT METABOLISM IN GUINEA PIGS AFTER A PROLONGED STAY AT DIFFERENT TEMPERATURES OF A HYPERBARIC ENVIRONMENT [SOSTOIANIE VODNO-SOLOVOGO OBUMENJA U MORSKIH SVINOK POSLE DLITEL'NOGO PREBLYANIIA PRI RAZLICHNYKH TEMPERATURakh GIPERBARICHESKOI SREDY]
V. B. BAKHTEEVA and V. B. KOSTKIN (AN SSSR, Institut Evoluiotnnoi Fiziologi 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 [IZMENENIIA NEITROFILOV PERIFERICHESKOI KROVII KRS PRI SOCHETANNOM VOZDEISTVIY MAGNITNOGO POLIA, BAROKAMERNOI GIPOKSII I NIZKIKH TEMPERATUR]

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

PHYLOGENETIC RELATIONSHIPS AMONG SUBSURFACE MICROORGANISMS
S. A. NIERZWICKI-BAUER 1991 10 p (Contract DE-FG02-90ER-60989)
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
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 mutation and selection 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.

Author

N91-27728# Joint Publications Research Service, Arlington, VA.
FEATURES OF TERRESTRIAL NIGHTTIME SLEEP OF MONKEYS AND SLEEP DURING SPACE FLIGHT ABOARD COSMOS-1667 BIODOSATILE Abstract Only
Nighttime sleep patterns were assessed in two monkeys, Verny 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 Verny, 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, Verny exhibited the recall 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 Gordy reflected less capacity for adaptation and tolerance of stress. The maximum increase in the REM/delta sleep ratio was less than 50 percent in Verny, but was more than twofold in Gordy (largely the result of extremely short delta sleep). Furthermore, Gordy also failed to exhibit the recall phenomenon.

Author

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

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 utriculus, saccus, and ampullae of the semicircular canals. The study revealed considerable variation in the receptor epithelium. Receptor cells in the auditory striae of the utriculus and saccus 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

N91-27730# 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.

Author

N91-27731# 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 of Soviet research projects in the life sciences are presented. Topics covered include biochemistry, biophysics, epidemiology, public health, virology, laser bioeffects, environment, radiation biology, medicine, physiology, immunology, microbiology, pharmacology, nonionizing radiation effects, and toxicology.

Author

N91-27732# Arizona Univ., Tucson.
CSCL 15/6
The topics of each session focused on understanding new developments in the area of formation/detoxification of reactive intermediates and the consequences 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 consequences of reactive intermediate formation. The final talk

Author
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 19 p
(Contract N0014-86-K-0041; DAAL03-88-K-0116; NSF EET-87-19102; NSF DIR-87-20094)
(AD-A236223) Avail: NTIS HC/MF A04 CSDL 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, strabismos, 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

BARBARA B. PREZELIN and EDWARD L. TRIPLETT 4 Jun. 1991 5 p
(Contract N00014-88-K-0060; NR PROJ. RRO-4106)
(AD-A236623) Avail: NTIS HC/MF A04 CSDL 08/1
The goal is to continue to use biophysical 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
(Contract NCC2-12; NCC2-455)
Avail: NTIS HC/MF A23 CSDL 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 pcf. 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
(Contract NAG10-24)
Avail: NTIS HC/MF A23 CSDL 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
(Contract NAG10-24)
Avail: NTIS HC/MF A23 CSDL 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
to be analyzed through dissection and/or chemical purification; thus the sample is merely combusted and graphitized at the AMS facility. However, since the example 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 radiocarbon tracing. Such work requires a dedicated amalgamation of AMS scientists and biomedical researchers and we envision 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
(Contact DE-FG02-89ER14029)
(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 O2-evolution. These objectives are studied in the transformable cyanobacterium 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, 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 PSI reaction center are computationally 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 lumenal 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 ipR 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
(Contact 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 catalysed 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 Conference, Bethesda, 3-9 May 1991
(Contact DE-AC06-76RL01830)
containing atmosphere. It has been discovered that light intensity
on H. reinhardtii and C. Moewusii was measured under an anoxic, CO2
contract DE91-013232; CONF-9105197-1) Avail: NTIS
25-27 Jun, 1991
Symposium on New Biomaterials and Global Ecology, Tokyo
AND PHOTOCONDUCTIVITY OF METALIZED CHLOROPLASTS
PHOTOBIOTECHNOLOGY: ALGAL HYDROGEN PRODUCTION
the production of physical linking clones that contain rare restriction
of rare-cutter endonucleases. DOE
in vitro. And a method was applied to double the apparent specificity
was made of two new isoschizomers. A reliable way to produce partial
sites; (4) application of these methods and available resources to
had precision methods for the production of unique sequence clones from the
misrepair. DOE
radiation induced chromosome damage and subsequent repair or
low dose medium LET radiation, and time dependent modeling of
mechanistic model of oncogenesis showing the role of long term
mammalian cell 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
researchers at the cross level with the admixture 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 C57
101/2 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
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 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 metalloenzymes. 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.
PHOTOBIO TECHNOLOGY: 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, CO2
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 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 H2
photoevolution. Under saturating light (25 W m(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
H2 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 platinumized chloroplasts
at varying perpendicular distances from a single linear platinum
electrode in pressure contact with the platinumized 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
untreated 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 (H184BS) and human epidermal keratinocytes (HEK).

DOE
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

GENETIC CHANGES IN MAMMALIAN CELLS TRANSFORMED BY HELIUM CELLS


(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

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-S1 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

ANTENNA ORGANIZATION IN GREEN PHOTOSYNTHETIC BACTERIA

R. E. BLANKENSHIP 1990 23 p

(Contract DE-FG02-85ER-13986)
(DE91-014814; DOE/ER-13988/5) Avail: NTIS HC/MF A03

Chlorosomes are pigment-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
AEROSPACE MEDICINE

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

A91-45645f
CIRCULATORY BIOMECHANICS - ACCELERATION EFFECTS [BIOMECANIQUE CIRCULATOIRE - EFFETS DES ACCELERATIONS]

Germany) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, June 1991, p. 45-47. refs

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 (OHB 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

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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 (OHB 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

Copyright

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

Copyright

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.


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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; Rockwall 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

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 and associated with mild, reversible AMS and provide evidence that hypoxia may produce supraspinual inhibition of motor pathways.

A91-46832 Brandeis Univ., Waltham, MA.
ALTERED SENSORMOTOR 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) Copyright

Exposure to nonterrestrial force levels affects the activity of graviceptoral, 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 value both for space motion sickness and the re-entry disturbances that occur after prolonged spaceflight.

A91-46833
A DOUBLE-BLIND PLACEBO CONTROLLED EVALUATION OF ACUPRESSURE IN THE TREATMENT OF MOTION SICKNESS

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.

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.

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 lymphomas 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.

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.

A91-47102 Massachusetts Inst. of Tech., Cambridge.
A SIMPLE ELECTRICAL-MECHANICAL MODEL OF THE HEART APPLIED TO THE STUDY OF ELECTRICAL-MECHANICAL ALTERNANS
52 AEROSPACE MEDICINE
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 authors present evidence that a mechanical alternation in the heart beat (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.

**A91-147446**

**PERCEPTION OF TEMPERATURE RISE BY HUMANS DURING SEASONAL HEAT ADAPTATION**

V. A. PONOMARENKO, V. V. LAPA, and I. S. NIKITIN

Abstract Only

**PLANT PHYSIOLOGY**

Copyright

In Russian. refs

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 (1.60, 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 environment in the functional activity of the temperature analyzer.

**A91-27737**

**JOINT PUBLICATIONS RESEARCH SERVICE**

**ARLINGTON, VA.**

**PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF SENSORIMOTOR ACTIVITY OF OPERATORS AFTER SHORT-TERM SIMULATED WEIGHTLESSNESS Abstract Only**


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.

**A91-277332**

**JOINT PUBLICATIONS RESEARCH SERVICE**

**ARLINGTON, VA.**

**FUNCTIONAL TESTING DURING YEARLONG ANTIORTOSTATIC HYPOKINESIA Abstract Only**

V. M. MIKHAYLOV, G. V. MACHINSKIY, V. P. BUZULINA, V. S. GEORGIEVSKY, E. N. NECHAYeva, and S. G. KRYUTCHENKO In its JPRS Report: Science and Technology.
As expected, the adverse effects of a 3.5 hour flight were more pronounced than at higher latitudes. Whereas at higher latitudes recovery of factors, 2 to 3.5 hours of flight activity were much more stressful than 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.

Pathogenesis and Prevention of Pain Syndrome in Pilots on Long Flights Abstract Only

The purpose of research on 370-day antiorthostatic hypokinesia is to improve the complex of preventive measures that are 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.

The 370-Day Antiorthostatic Hypokinesia: Goals and Protocols

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


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 24-hour breath holding 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


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


The effects of different levels of CO2 in inspired air on acid-base balance were studied in 34 men, subjected to 3.5, 4.5 or 5.5 percent CO2 for 72, 42 or 22 h, respectively. Oxygen was maintained at 17 to 18 percent. Hypocapnia was most pronounced in the 5.5 percent CO2 group, with the arterial pH falling to 7.322 and venous pH to 7.252 and the corresponding pCO2 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 CO2 for 22 h represents a critical situation in closed systems, as prevails in space ships.

Author


An assessment was conducted on the effects of physical exertion (57 W for 20 min) and raised ambient CO2 (5-6 percent) on respiration and thermoregulation. The study encompassed 8 men, subjected to 5-6 percent CO2 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 CO2 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 CO2. 

Author


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 unanesthesized rats. Both series (experimental and control) involved measurement of rheographic parameters, arterial pressure, rectal temperature, and determination of length of survival after hypertermia. 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


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 - 6V 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.

Author


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.

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).

N91-27755# Naval Medical Research Inst., Bethesda, MD.
COMPUTER-BASED TECHNIQUES FOR COLLECTION OF PULMONARY FUNCTION VARIABLES DURING REST AND EXERCISE Technique Development, 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.

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 121:7011(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.

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.

EXCIMER LASER INTERACTION WITH DENTIN OF THE HUMAN TOOTH
Avail: NTIS HC/MF A23
CSCL 06/16

The use 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.

X RAY SENSITIVITY OF DIPLOID SKIN FIBROBLASTS FROM PATIENTS WITH FANCONI'S ANEMIA Abstract Only
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.

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

289
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.

**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

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.

**53**

**BEHAVIORAL SCIENCES**

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

**A91-46522**

**DEVELOPMENT OF SUBJECTIVE MEASURES OF WORKLOAD. 1. APPROPRIATENESS OF FORMS OF SCALES AND DIMENSIONS FOR RATING**
MIYAKO OKAUE, ZOUJIRU KATOH, ATUSHI KADO, AND S. NISHI

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.

A91-46623# A STUDY ON PILOT WORKLOAD. I - THE STUDY OF PILOTING PERFORMANCE MEASUREMENT S. NISHI, ATSUSHI KADOO, KIYOSHI MIZUMOTO, and ZOJIRO KATO# 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.

A91-46927 STEREOTYPES OF PILOTS AND APPREHENSION ABOUT FLYING WITH THEM - A STUDY OF COMMERCIAL AVIATION SCENARIOS RICHARD L. DUKES, RUTH HUBERT-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.

A91-46928 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. Subjects, 4 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.

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 DTFA02-87-068)

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.


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.


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 display-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
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-6620) Avail: NTIS HC/MF A05 CSCL 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. SNYDER Apr. 1991 49 p
(Contract DA PROJ. 1L1-62716-AH-70)
(AD-A235703; HEL-TM-9-91) Avail: NTIS HC/MF A03 CSCL 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.
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 CSCL 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 CSCL 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**
(Contract N7-504-05)
(NASA-CR-4385; NAS 1.26:4385) Avail: NTIS HC/MF A10 CSCL 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 task, a resource management task, 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. PROFFIT (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 heuristic 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


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.

N91-44862

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


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


An investigation is carried out on the effect of various luminance ramps on the image quality of gray-scale anti-aliased 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


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


Human-factor problems that might occur in modern civilian helicopters are analyzed by examining human-factor implications of the cockpit design of the Aerspatiale 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-braking 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

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


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V.T.

A91-45403#

THE INVOLUNTARY PARTICIPATION OF A HUMAN PILOT IN A HELICOPTER COLLECTIVE CONTROL LOOP
A91-45734
TRUSSARM - A VARIABLE-GEOMETRY-TRUSS MANIPULATOR

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

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
ALENE 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 heat/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 (OBDOM METODE OTSENKI NADEZHNOTI FUNKTSIONIROVANIYA SISTEMY EKIPAZH-LETATEL'NYI APPARAT PRI RESHENII ZADACHI KOMPENSIATORNogo SLEZHENIYA)

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 (SYNTHETIZATSIONNOGO UPRAVLENIIA V USLOVIYAH POMEKH)
V. I. VASIL'EV, IU. I. GORELOV, and Z. D. USMANOV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naya Tekhnika (ISSN 0454-9910), no. 98, 1990, p. 29-34. 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.
The paper examines the possibility of using methods of optimal simulation control synthesis under conditions of constantly acting uncontrollable 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 does not belong to these narrowings, two control modes are substantiated: active noise suppression and dual control.

A9-47520
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 Copyright

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.

A9-47521
SYMBOLIC-ALGEBRAIC METHODS FOR THE ANALYSIS OF NONLINEAR AND BILINEAR MODELS OF MAN-MACHINE CONTROL SYSTEMS (SIMVOL’NO-ALGEBRAICHESKIE METODY ANALIZA NELINEINYKH I BILINEINYKH MODELEI ERGATICHESKIIK SISTEM UPRAVLNIIA)
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.

A9-47522
ON HUMAN-OPERATOR ADAPTATION (OB ADAPTATSION CHELOVEKA-OPERATORA)
A. E. RADIEVSII (Kievski 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.

A9-47523
SYNTHESIS OF MAN-MACHINE CONTROL SYSTEMS (SINTEZ ERGATICHESKIIK SISTEM UPRAVLNIIA)
V. V. PAVLOV and O. S. IKOPOLEV (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.
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

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

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, 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

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

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 CUING BASED ON THE RELATIONSHIP BETWEEN SIMULATED AIRCRAFT DYNAMICS AND PILOT PERFORMANCE - A REVIEW OF THE LITERATURE

This paper reviews a method of assessing the need for motion cuing based on the simulated aircraft flight dynamics environment. The flight environment is reduced to 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 cuing requirements on that basis. Also reviewed is the motion cuing 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 cuing and the task performed in the simulator.

Author

A91-47850/

RECENT PROCEEDINGS OF THE NASA STEERING COMMITTEE ON SIMULATOR INDUCED SICKNESS

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
A91-47652# Monterey Technologies, Inc., Carmel, CA.

THE EFFECT OF GLOBAL VISUAL FLOW ON SIMULATOR SICKNESS

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 concept hypothesis of Reason and Brand, 1979). The results, based on subjective evaluations, physiological measurements, and computer 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. 1999 168 p

(NASA-CR-186115; NAS 1.28:186115; UAH-RR-823) Copyright

Avail: NTIS HC/MF A08 CSCL 08/11

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

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

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

Copyright

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

N91-27766# Alabama Univ., Huntsville.

A DIAGNOSTIC PROTOTYPE OF THE POTABLE WATER SUBSYSTEM OF THE SPACE STATION FREEDOM ECLSS

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
Three criteria must be met. Application of these criteria will enable better evaluation of and comparison to cold weather clothing rate is greater than or equal to approximately 180 kcal/hr). All than or equal to 28 C (82 F), (2) local skin temperature at any were developed: (1) a mean weighted skin temperature is greater clothing items are worn, it is not practical to expect that the optimal subjective feelings of thermal comfort and temperature sensation 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 a core (38 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.
MARS SURFACE BASED FACTORY. PHASE 2, TASK 1C: the scope of the study. The study revealed that none of the gloves were not tested for their intended uses, since this was not multi-purpose hazardous-chemical protective glove material. 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.

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


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 of 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 into the planet and obtaining oxygen and water for eventual consumption, was 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.


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.

N91-28732# Edgerton, Gernshausen and Grier, Inc., Idaho Falls, ID. USING HSYS IN THE ANALYSIS OF HUMAN-SYSTEM INTERACTIONS: EXAMPLES FROM THE OFFSHORE PETROLEUM INDUSTRY


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 models, 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 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, inaccurate 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.

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

(TN91-85149) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69797, 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.
55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A91-45444
SYNTHESIS OF BIOMOLECULES FROM N2, CO, AND H2O BY ELECTRIC DISCHARGE
Y. HIROSE, K. OHMURO, M. SAIGOH, 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
Copyright
A model primitive gas containing a mixture of N2, CO and water vapor over a water pool was subjected to electric discharges. The discharge vessel was equipped with a CO2 absorber, thus simulating possible absorption of CO2 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, glycylglycine, orotic acid and small amounts of the other amino acids were found.

A91-45445
MECHANISMS OF AMINO ACID POLYCONDENSATION ON SILICA AND ALUMINA SURFACES
Copyright
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.

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
Copyright
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.

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
Copyright
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.

A91-48417
VOLCANIC PRODUCTION OF POLYPHOSPHATES AND ITS RELEVANCE TO PREBIOTIC EVOLUTION
Copyright
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 P4O10. This mechanism seems to be the only viable route identified so far for the production of these species on the primitive earth.

K.K.
C.D.
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<td>UNIV OF COLORADO - BOULDER Norlin Library</td>
<td>Boulder, CO 80303</td>
<td>(303) 571-2135</td>
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<td>Library West, Gainesville, FL 32611-2046</td>
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<td>LOUISIANA TECHNICAL UNIV</td>
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<td>DETROIT PUBLIC LIBRARY</td>
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<td>UNIVERSITY OF MISSISSIPPI</td>
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<td>MISSOURI</td>
<td>UNIVERSITY OF MISSOURI - COLUMBIA</td>
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<td>MONTANA</td>
<td>UNIVERSITY OF MONTANA</td>
<td>Missoula, MT 59812-1195</td>
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<td>NEBRASKA</td>
<td>UNIVERSITY OF NEBRASKA - LINCOLN</td>
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<td>NEVADA</td>
<td>UNIV OF NEVADA</td>
<td>Reno Library</td>
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<td>NEWARK PUBLIC LIBRARY</td>
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<td>UNIV OF NORTH CAROLINA - CHAPEL HILL</td>
<td>Chapel Hill</td>
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<td>NORTH DAKOTA STATE UNIV. LIBRARY</td>
<td>Fargo, ND 58105</td>
<td>(701) 237-8886 FAX: (701) 237-7138 In cooperation with Univ. of North Dakota, Chester Fritz Library, Grand Forks</td>
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<td>Columbus</td>
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<td>Oklahoma City, OK 73105-3298</td>
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<td>Austin, TX 78711</td>
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<td>UNIV OF VIRGINIA</td>
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<td>WASHINGTON STATE LIBRARY</td>
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<td>WEST VIRGINIA</td>
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<td>Morgantown, WV 26506</td>
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<td>ST. HIST. SOC. OF WISCONSIN LIBRARY</td>
<td>Madison, WI 53706</td>
<td>(608) 262-2781 FAX: (608) 262-4711 In cooperation with Univ. of Wisconsin-Madison, Memorial Library</td>
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<td>MILWAUKEE PUBLIC LIBRARY</td>
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