



Aerospace Medicine
and Biology
A Continuing
Bibliography
with Indexes

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Space Administration

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Aerospace Medicine and Biology

AEROSPACE MEDICINE AND BIOLOGY

**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

(Supplement 339)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in July 1990 in

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



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Office of Management
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Washington, DC

1990

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 105 reports, articles and other documents announced during July 1990 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

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

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

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

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1990 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → N90-10571*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

TITLE → A SIMPLE, MASS BALANCE MODEL OF CARBON FLOW IN A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM

AUTHOR AND PUBLICATION DATE → JAY L. GARLAND Mar. 1989 37 p Prepared in cooperation with Bionetics Corp., Cocoa Beach, FL

CONTRACT NUMBER → (Contract NAS10-10285)

REPORT NUMBERS → (NASA-TM-102151; NAS 1.15:102151) Avail: NTIS HC A03/MF A01

COSATI CODE → CSCL 05/8

← AVAILABILITY SOURCE
 ← PRICE CODE

Internal cycling of chemical elements is a fundamental aspect of a Controlled Ecological Life Support System (CELSS). Mathematical models are useful tools for evaluating fluxes and reservoirs of elements associated with potential CELSS configurations. A simple mass balance model of carbon flow in CELSS was developed based on data from the CELSS Breadboard project at Kennedy Space Center. All carbon reservoirs and fluxes were calculated based on steady state conditions and modelled using linear, donor-controlled transfer coefficients. The linear expression of photosynthetic flux was replaced with Michaelis-Menten kinetics based on dynamical analysis of the model which found that the latter produced more adequate model output. Sensitivity analysis of the model indicated that accurate determination of the maximum rate of gross primary production is critical to the development of an accurate model of carbon flow. Atmospheric carbon dioxide was particularly sensitive to changes in photosynthetic rate. The small reservoir of CO₂ relative to large CO₂ fluxes increases the potential for volatility in CO₂ concentration. Feedback control mechanisms regulating CO₂ concentration will probably be necessary in a CELSS to reduce this system instability.

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED
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 CORPORATE SOURCE

ACCESSION NUMBER → A90-11091* Krug International, San Antonio, TX.

TITLE → DETERMINING A BENDS-PREVENTING PRESSURE FOR A SPACE SUIT

AUTHORS → R. W. KRUTZ, JR., J. T. WEBB (Krug International, Technology Services Div., San Antonio, TX), and G. A. DIXON (USAF, School of Aerospace Medicine, Brooks AFB, TX) SAFE Journal, vol. 19, Fall 1989, p. 20-24. Research sponsored by USAF. refs

PUBLICATION DATE → (Contract NASA ORDER T-82170) Copyright

← AUTHORS' AFFILIATION
 ← JOURNAL TITLE

Research conducted to determine the proper pressure for preventing bends during EVA without preoxygenation is examined. Male and female subjects with different breathing gas mixtures and pressures are studied in order to define the pressure. Visual and auditory Doppler ultrasonic signals are utilized to monitor intravascular gas bubbles. The workload, which simulates EVA, consists of a handturned bicycle ergometer, a torque wrench operation, and a rope pull. The experimental data reveal that the minimum space suit pressure needed to prevent decompression sickness is 9.5 psi.

I.F.

LIFE SCIENCES (GENERAL)

A90-32388#

EXPERIMENTAL STUDY OF THE WHOLE-BODY RESPONSE IN A VIBRATIONAL ENVIRONMENT. II - THE EFFECT OF WHOLE-BODY VIBRATION ON THE PULMONARY VENTILATION OF UNANESTHETIZED DOGS

AKIHIKO ONOZAWA and YOSHIHIRO IWATA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, March 1989, p. 1-12. In Japanese, with abstract in English. refs

The effects of whole-body vibration on pulmonary ventilation of five unanesthetized mongrel dogs were studied under conditions of five-minute exposures to vertical sinusoidal vibrations from 3 to 30 Hz with peak acceleration at + or - 5 G. Heart and respiratory rates increased during exposure to vertical sinusoidal whole-body vibration. Acceleration of the dogs' heads experienced a maximum value of 2.4 + or - 1.2 G at 10 Hz. Maximum oscillation of the respiratory airflow was observed at 4 Hz. The resonant frequency of the respiratory system calculated from the mechanical oscillatory response was 4 Hz or less. The maximum increase of minute ventilation was seen at 10 Hz and seemed to be related to the maximum acceleration at the dog head vertex; its value after five minutes of exposure increased from 110 to 120 percent of the control value. Air volume oscillation showed peak value at 4 Hz, but was not related directly to pulmonary ventilation. C.D.

A90-32543

CHANGES IN THE CATECHOLAMINE CONTENTS IN THE BLOOD PLASMA OF RATS EXPOSED TO HIGH TEMPERATURES [IZMENENIE SODERZHANIYA KATEKHOLAMINOV V PLAZME KROVI U KRYSA V USLOVIYAKH DEISTVIA VYSOKIKH TEMPERATUR]

V. N. GURIN, D. DIB, and S. B. KONDRASHOVA (AN BSSR, Institut Fiziologii, Minsk, Belorussian SSR) Akademiia Nauk BSSR, Doklady (ISSN 0002-354X), vol. 34, March 1990, p. 279-282. In Russian. refs

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The effects of high temperature exposure on the contents of adrenaline (A), noradrenaline (NA), dopamine (DA), adrenocorticotrophic hormone, and cortisol in the blood and of acetylcholine synthetase in the adrenal gland were investigated in rats exposed to temperatures of 30, 35, and 40 C for 1 or 3 hrs. It was found that responses of the sympathoadrenal system to high temperatures differed from the responses to other extreme conditions. Thus, after 1 hr at 35 or 40 C, the A content increased significantly (concurrently with an increase in cortisol), while the content of DA fell below the level of detection. Exposure to 35 C for 3 hrs resulted in decreased concentrations of A and cortisol and in an increase in NA. Exposure to 40 C for 1 hr also led to an increased synthesis of acetylcholine in adrenal tissue. I.S.

A90-32568

MORPHOLOGICAL AND FUNCTIONAL ORGANIZATION OF AMINERGIC SYSTEMS AND THEIR ROLE ON THE CEREBRAL MOTOR ACTIVITY [MORFOFUNKTSIONAL'NAIA ORGANIZATSIYA AMINERGICHESKIKH SISTEM I IKH ROL' V MOTORNOI DEIATEL'NOSTI MOZGA]

IU. P. LIMANSKII (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 21, Apr.-June 1990, p. 3-17. In Russian. refs

Copyright

Experimental data are presented on the functional organization of aminergic neurons which are part of the neuroregulatory system of the brain stem. The morphology of these neurons and their synaptic organization are discussed together with the transmitters, cotransmitters, and receptors of aminergic systems. Special consideration is given to the role of aminergic systems in the regulation of somatic and visceral reflexes and to the mechanisms of interaction of amines with the neurons of reflex arches. The results of this study demonstrate the important role of the aminergic system in long-term changes of motor reflexes. I.S.

A90-32569

CENTRAL CONTROL OF REACTIONS IN THE VESTIBULAR SYSTEM [TSENTRAL'NYI KONTROL' REAKTSII VESTIBULIARNOI SISTEMY]

V. S. RAITSES and A. A. SHLIKHOVENKO (Ivano-Frankovskii Gosudarstvennyi Meditsinskii Institut, Ivano-Frankovsk, Ukrainian SSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 21, Apr.-June 1990, p. 56-70. In Russian. refs

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Data obtained on the efferent control of reactions in the vestibular system are presented together with results available from the literature. Special attention is given to the controlling influences of the cerebellum, reticular formation, hypothalamolimbic structures, and the cerebral cortex on the activities of nuclei of the vestibulobulbar complex and the systemic vestibular reactions. Possible mechanisms of these influences are examined. I.S.

A90-32578

CHANGE IN THE SLEEP-WAKEFULNESS CYCLE IN CATS IN RESPONSE TO ELECTRICAL STIMULATION OF THE ORBITAL CORTEX [IZMENENIE TSIKLA BODRSTVOVANIE-SON V OTVET NA ELEKTRICHESKOE RAZDRAZHENIE ORBITAL'NOI KORY KOSHKI]

P. N. VARAZASHVILI (AN GSSR, Institut Fiziologii, Tbilisi, Georgian SSR) Akademiia Nauk Gruzinskoi SSR, Soobshcheniia (ISSN 0132-1447), vol. 136, Nov. 1989, p. 425-428. In Russian. refs

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A90-33322* California Univ., San Francisco.

DESCENDING PATHWAYS TO THE CUTANEUS TRUNCI MUSCLE MOTONEURONAL CELL GROUP IN THE CAT

GERT HOLSTEGE (California, University, San Francisco) and BERTIL F. BLOK (Rotterdam, Universiteit, Netherlands) Journal of Neurophysiology (ISSN 0022-3077), vol. 62, Dec. 1989, p. 1260-1269. Research supported by R. A. Laan Fonds, A. A. van Beek Fonds, Fundatie van Vrijvrouwe van Renswoude, Bekker-La Bastide Fonds, and Universiteit Rotterdam. refs

(Contract NCC2-491)

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Pathways involved in the cutaneous trunci muscle (CTM) reflex in the cat were investigated. Experimental animals were injected with tritium-labeled L-leucine into their spinal cord, brain stem, or diencephalon and, after six weeks, perfused with 10-percent formalin. The brains and spinal cords were postfixed in formalin and were cut into transverse 25-micron-thick frozen sections for autoradiography. Results based on injections in the C1, C2, C6, and C8 segments suggest that propriospinal pathways to the CTM motor nucleus originating in the cervical cord do not exist, although these propriospinal projections are very strong to all other motoneuronal cell groups surrounding the CTM motor nucleus. The results also demonstrate presence of specific supraspinal projections to the CTM motor nucleus, originating in the contralateral nucleus retroambiguus and the ipsilateral dorsolateral pontine tegmentum. I.S.

A90-33659**ATROPINE - EFFECTS ON GLUCOSE METABOLISM**

MICHAEL DURKOT, OSVALDO MARTINEZ, VIRGINIA PEASE, RALPH FRANCESCONI, and ROGER HUBBARD (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 424-429. refs

Copyright

The primed constant infusion technique was employed to investigate the metabolic effects of the organophosphate antidote, atropine, on glucose homeostasis in rats. This method utilizes the radioisotopes 6-H-3-glucose to measure production and uptake and U-C-14-glucose to measure oxidation. The data indicate that glucose production significantly increased following atropine administration. The elevated rate of glucose turnover was associated with concomitant increases in glucose oxidation, the percent of glucose uptake oxidized, and the percent carbon dioxide produced from glucose. Presumably, these glucokinetic changes were mediated by elevated plasma catecholamines, since other glucoregulatory hormones (insulin, glucagon, and corticosterone) were not significantly affected by atropine administration. Author

A90-33715**BUBBLE-INDUCED DYSFUNCTION IN ACUTE SPINAL CORD DECOMPRESSION SICKNESS**

T. J. R. FRANCIS, J. L. GRIFFIN, L. D. HOMER, G. H. PEZESHKPOUR, A. J. DUTKA (U.S. Navy, Naval Medical Research Institute, Bethesda, MD; U.S. Armed Forces Institute of Pathology, Washington, DC) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 68, April 1990, p. 1368-1375. Research supported by the U.S. Navy. refs

Copyright

Five anesthetized dogs undertook a chamber dive, on air, to 300 feet of seawater for 15 min. After the dive, spinal cord decompression sickness was detected by recording a reduced amplitude of the somatosensory evoked potential compared with pre-dive base-line values and, after rapid perfusion fixation of the animal, the spinal cord was removed and examined histologically. Numerous space-occupying lesions (SOL) that disrupted the tissue architecture were found in each cord, mainly in the white matter. The size and distribution of the SOL were determined using computerized morphometry, and a number of algorithms was tested to assess whether the SOL may have been directly involved in the loss of spinal cord function that followed the dive. It was determined that the loss of somatosensory evoked potential amplitude may be attributed to the SOL if 30-100 percent of the spinal cord fibers that they displaced were rendered nonconducting. Author

A90-33734**GENETIC DIVERSITY IN SARGASSO SEA BACTERIOPLANKTON**

STEPHEN J. GIOVANNONI, THERESA B. BRITSCHGI, CRAIG L. MOYER, and KATHARINE G. FIELD (Oregon State University, Corvallis) *Nature* (ISSN 0028-0836), vol. 345, May 3, 1990, p. 60-63. Research supported by NSF. refs

Copyright

Clone libraries of eubacterial 16S ribosomal RNA genes amplified from natural populations of Sargasso Sea picoplankton have been phylogenetically analyzed by the polymerase chain reaction. The analysis indicates the presence of a novel microbial group, the SAR11 cluster, which appears to be a significant component of this oligotrophic bacterioplankton community. A second cluster of lineages related to the oxygenic phototrophs was also observed. However, none of the genes matched the small subunit rRNA sequences of cultivated marine cyanobacteria from similar habitats. The diversity of 16S rRNA genes observed within the clusters suggests that these bacterioplankton may be consortia of independent lineages sharing surprisingly distant common ancestors. C.D.

A90-33735**16S RRNA SEQUENCES REVEAL NUMEROUS UNCULTURED MICROORGANISMS IN A NATURAL COMMUNITY**

DAVID M. WARD, ROLAND WELLER, and MARY M. BATESON (Montana State University, Bozeman) *Nature* (ISSN 0028-0836), vol. 345, May 3, 1990, p. 63-65. Research supported by NSF. refs

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It is widely believed that fewer than 20 percent of the extant microorganisms have been discovered and that culture methods are inadequate for studying microbial community composition. A culture-independent analysis has been performed of the composition of a well-studied hot spring microbial community, using a common but distinctive cellular component, 16S ribosomal RNA. The results confirm speculations about the diversity of uncultured microorganisms it contains. C.D.

A90-34000**AMERICAN SOCIETY FOR GRAVITATIONAL AND SPACE BIOLOGY, ANNUAL MEETING, 5TH, COCOA BEACH, FL, OCT. 25-28, 1989, ABSTRACTS**

ASGSB Bulletin (ISSN 0898-4697), vol. 3, Dec. 1989, 152 p. No individual items are abstracted in this volume.

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This volume presents abstracts from symposia on the intercellular and intracellular communication; cellular regulation of organization and metabolism; and sensing, signals, and responses to stimuli. Topics discussed in poster sessions include vestibular and neurophysiology; animal gravity sensors; cardiopulmonary and animal regulatory physiology; life sciences instrumentation facilities, monitoring, and modeling; plant environmental controls and metabolism; plant growth, development, and genetics; animal growth, development, and genetics; bone and muscle physiology; and plant gravity perception. Abstracts are also presented from student sessions on plant physiology/instrumentation and animal physiology. Abstracts presented include those on new approaches for analyzing cell structure and biochemical content; the response of nonweightbearing hindlimbs of growing rats to null magnetic fields; structural and functional variety in animal gravity-sensing organs; and mechanisms of cell polarity. I.S.

A90-34002* Georgia State Univ., Atlanta.**LANA CHIMPANZEE LEARNS TO COUNT BY 'NUMATH' - A SUMMARY OF A VIDEOTAPED EXPERIMENTAL REPORT**

DUANE M. RUMBAUGH, WILLIAM D. HOPKINS, DAVID A. WASHBURN, and E. SUE SAVAGE-RUMBAUGH (Georgia State University; Emory University, Atlanta) *Psychological Record* (ISSN 0340-0727), vol. 39, 1989, p. 459-470.

(Contract NAG2-438; NIH-HD-06016; NIH-AR-00165)

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Computerized training programs whereby an adult female chimpanzee learned to use a joystick to remove from a screen the number of boxes appropriate to the value of a randomly selected Arabic numeral 1, 2, or 3, are studied. Initial training provided a variety of cues, both numeric and otherwise, to support correct performance. In the final test, the ape was correct on over 80 percent of trials in which there was no residual feedback of intratrial events and where only her memory of those events

could provide the cue to indicate that she had removed boxes in accordance with the value of the target numbers and should terminate the trial. R.E.P.

A90-34010* California Univ., San Diego.
TISSUE FLUID PRESSURES - FROM BASIC RESEARCH TOOLS TO CLINICAL APPLICATIONS

ALAN R. HARGENS, WAYNE H. AKESON, SCOTT J. MUBARAK, CHARLES A. OWEN, DAVID H. GERSHUNI (California, University; U.S. Veterans Administration Medical Center, San Diego) et al. *Journal of Orthopaedic Research* (ISSN 0736-0266), vol. 7, no. 6, 1989, p. 902-909. Research supported by the U.S. Veterans Administration and National Geographic Society. refs (Contract NIH-AM-18824; NIH-GM-24901; NIH-AM-25501; NIH-AM-26344; NIH-HL-32703; NSF DCB-84-09253; NAS9-16039) Copyright

This paper describes clinical applications of two basic research tools developed and refined in the past 20 years: the wick catheter (for measuring tissue fluid pressure) and the colloid osmometer (for measuring osmotic pressure). Applications of the osmometer include estimations of the reduced osmotic pressure of sickle-cell hemoglobin with deoxygenation, and of reduced swelling pressure of human nucleus pulposus with hydration or upon action of certain enzymes. Clinical uses of the wick-catheter technique include an improvement of diagnosis and treatment of acute and chronic compartment syndromes, the elucidation of the tissue pressure thresholds for neuromuscular dysfunction, and the development of a better tourniquet for orthopedics. I.S.

A90-34013* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

COSMOS 1887 MISSION OVERVIEW - EFFECTS OF MICROGRAVITY ON RAT BODY AND ADRENAL WEIGHTS AND PLASMA CONSTITUENTS

R. E. GRINDELAND, M. VASQUES, S. B. ARNAUD (NASA, Ames Research Center, Moffett Field, CA), and I. A. POPOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) *FASEB Journal* (ISSN 0892-6638), vol. 4, Jan. 1990, p. 105-109. refs Copyright

Tissues of male, specific pathogen-free Wistar rats flown on the Cosmos 1887 biosatellite are studied. First the mission is described, and then analytical methods are outlined. It is noted that flight rats grew more slowly and had larger adrenal glands than earth gravity controls. Analysis of plasma reveals increased concentrations of hepatic alkaline phosphatase, glucose, urea nitrogen, and creatinine in flight rats. In contrast, electrolytes, total protein, albumin, corticosteron, prolactin, and immunoreactive growth hormone levels are unchanged. However, testosterone concentration is marginally decreased after flight and thyroid hormone levels are suggestive of reduced thyroid function. V.T.

A90-34014* North Carolina Univ., Chapel Hill.
REGIONAL DISTRIBUTION OF MINERAL AND MATRIX IN THE FEMURS OF RATS FLOWN ON COSMOS 1887 BIOSATELLITE

GERALD L. MECHANIC (North Carolina, University, Chapel Hill), SARA B. ARNAUD (NASA, Ames Research Center, Moffett Field, CA), ALAN BOYDE (University College, London, England), TIMOTHY G. BROMAGE (London Hospital, England), PATRICIA BUCKENDAHL (California, University, Santa Cruz) et al. *FASEB Journal* (ISSN 0892-6638), vol. 4, Jan. 1990, p. 34-40. refs (Contract NAG2-181; NCC2-363) Copyright

The location and nature of the defect in mineralization known to occur in growing animals after spaceflight are studied. The distribution of bone mineral density in situ is mapped, and these images are correlated with the chemical composition of the diaphyseal bone. Concentrations of mineral and osteocalcin are found to be low in the distal half of the diaphysis and concentrations of collagen to be low with evidence of increased synthesis in the proximal half of the diaphysis of the flight bones. X-ray microtomography indicates a longitudinal gradient of decreasing mineralization toward the distal diaphysis. Analysis of embedded sections by backscattered electrons reveals patterns of mineral

distribution in the proximal, central, and distal regions of the diaphysis and also shows a net reduction in mineral levels toward the distal shaft. Increases in mineral density to higher fractions in controls are less in the flight bones at all three levels. V.T.

A90-34015* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

COSMOS 1887 - SCIENCE OVERVIEW

R. E. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA) *FASEB Journal* (ISSN 0892-6638), vol. 4, Jan. 1990, p. 10-15. refs

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Twenty two groups of U.S. investigators participated in joint studies of ten male rats flown on the Cosmos 1887 biosatellite. A summary of these studies embracing skeletal muscle, bone, endocrine, neural, intestinal, metabolic, immunology, cardiac, and gonadal investigations is presented. Three general objectives of the rat experiments are outlined - verification of previous observations of the biological responses to microgravity; clarification of the effects of microgravity on both the tissues investigated and the measurements performed; and relation of biological responses to flight duration. It is concluded that the first objective is met fully and the second with a varying degree of success. The confounding effects of overshooting the designated landing site and delayed recovery of the animals largely precluded meeting the last objective. It is also noted that investigations were performed for the first time on brain and spinal cord enzymes, a neurotransmitter, transmitter receptors, hypothalamic regulatory factors, pineal metabolites, atrial granules, liver histology, and jejunal mitotic rate in spaceflight animals. V.T.

A90-34021* Georgia State Univ., Atlanta.

VIDEO-TASK ASSESSMENT OF LEARNING AND MEMORY IN MACAQUES (MACACA MULATTA) - EFFECTS OF STIMULUS MOVEMENT ON PERFORMANCE

DAVID A. WASHBURN, WILLIAM D. HOPKINS, and DUANE M. RUMBAUGH (Georgia State University, Atlanta) *Journal of Experimental Psychology: Animal Behavior Processes* (ISSN 0097-7403), vol. 15, no. 4, 1989, p. 393-400. refs (Contract NAG2-438; NIH-HD-06016) Copyright

Effects of stimulus movement on learning, transfer, matching, and short-term memory performance were assessed with 2 monkeys using a video-task paradigm in which the animals responded to computer-generated images by manipulating a joystick. Performance on tests of learning set, transfer index, matching to sample, and delayed matching to sample in the video-task paradigm was comparable to that obtained in previous investigations using the Wisconsin General Testing Apparatus. Additionally, learning, transfer, and matching were reliably and significantly better when the stimuli or discriminanda moved than when the stimuli were stationary. External manipulations such as stimulus movement may increase attention to the demands of a task, which in turn should increase the efficiency of learning. These findings have implications for the investigation of learning in other populations, as well as for the application of the video-task paradigm to comparative study. Author

A90-34030

AMERICAN SOCIETY FOR GRAVITATIONAL AND SPACE BIOLOGY, ANNUAL MEETING, 4TH, WASHINGTON, DC, OCT. 20-23, 1988, PROCEEDINGS

ASGSB Bulletin (ISSN 0898-4697), vol. 2, Aug. 1989, 140 p. For individual items see A90-34031 to A90-34035.

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Papers concerning the space life sciences are presented, including a discussion of gravity-dependent phenomena at the scale of the single cell, and overviews of the French, German, ESA, and NASA space life science programs. In addition, abstracts of papers pertaining to gravitational and space biology are given, covering topics such as the turnover of cellular proteins, vestibular and neurophysiology studies, animal gravity receptors, cardio-pulmonary and animal regulatory physiology, and life sciences

51 LIFE SCIENCES (GENERAL)

instrumentation, facilities, and modeling. Also, abstracts are provided for papers concerning environmental controls and plant metabolism, the regulation of cellular differentiation, bone and muscle physiology, plant gravity perception, cellular sensory perception, and plant and animal growth, development, and genetics. R.B.

A90-34035

GRAVITY-DEPENDENT PHENOMENA AT THE SCALE OF THE SINGLE CELL

PAUL TODD (NIST, Chemical Engineering Science Div., Boulder, CO) ASGSB Bulletin (ISSN 0898-4697), vol. 2, Aug. 1989, p. 95-113. refs

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Progress in gravitational cell biology research will depend on the continuing evaluation of a wide variety of physical phenomena affected by gravity and their roles in extracellular, intercellular, and intracellular processes. This paper examines those responses of organisms to gravity which depend on functions at the single cell level. Single cell functions are affected by perturbations in their internal and external environment by a variety of factors, one of which is the effect of gravity. Physical phenomena that could influence cell function include sedimentation, buoyancy-driven convection, streaming potential, hydrostatic pressure, and interactions among physical transport processes. Thermal motion and fluid viscosity play a significant role in all transport processes at the cellular level. The sedimentation of intracellular organelles tends to be counteracted by the cytoskeleton. Intracellular convective transport may be possible in large cells. In a microgravity environment extracellular solutes must be transported by diffusion or active circulatory processes in the absence of density gradient-driven convection, and flocculation and coalescence are reduced by the lack of motion of aggregates. Author

A90-34276

THE UNIVERSE AND THE ORIGIN OF LIFE - ORIGIN OF ORGANICS ON CLAYS

V. I. MARON (Moskovskii Institut Nefti i Gaza, Moscow, USSR) and M. D. NUSSINOV British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Jan. 1990, p. 3-10. refs

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The similarity of the self-organization processes of matter, which occurred at the chemical stage of evolution in space, to the biological processes on the earth's surface makes it possible to develop a scenario of the earliest beginning of the noncellular physicochemical phase of biological evolution during the period about 4×10 to the 9th years ago. The products of chemical reactions which occurred in space as complicated organic compounds, the bricks of life, such as bases of nucleic acids and amino acids reached the 'juvenile' earth mainly in meteoroids and subsequently took part in building up the first viruslike nucleoproteinaceous biological structures. Thus, the essential link was accomplished between the chemical and the biological stages of the evolution of matter. The nucleotide hypothesis as the origin of live matter includes the possible formation, during a transient period, of symbiotic material systems composed probably of the RNA molecule of polynucleotide and the molecule of polypeptide, both synthesized abiogenetically in situ within a clayish 'liposome', which served as the basis for a nucleoproteinaceous complex (protovirus) origination. Author

A90-34277

MOLECULAR ELECTRONIC DEVICES AND DREXLER'S NANOMACHINES - ENGINEERED MOLECULES TO UNDERSTAND CHEMICAL EVOLUTION?

SALVATORE SANTOLI British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Jan. 1990, p. 11-17. refs

Copyright

Small-size and/or low-dimensional states of matter might be involved in chemical evolution and will certainly be met with in actualizing the recent idea of pushing the miniaturization frontier down to nanometer scale by building molecular-size electronic and mechanical devices. The foreseeable steps to successful

miniaturization should parallel the experimental pathways to retrace prebiotic evolution, while constructionistic approaches to the origin of life event could be attempted through a new synthetic chemistry whose nanodevices, such as assemblers, controllers, probes, replicators, would modify matter to atomic-scale precision 'putting atoms down where the chemist says', as Feynman envisioned in 1959. Author

A90-34281

PREBIOTIC SYNTHESIS OF BIOLOGICALLY INTERESTING MONOMERS IN AQUEOUS SOLUTIONS - FACTS AND CONSTRAINTS

F. RAULIN (Paris XII, Universite, Creteil, France) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Jan. 1990, p. 39-45. refs

(Contract CNES-86-1245; CNES-87-1247)

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While the prebiotic syntheses of most of the protein amino acids as well as the pentoses and natural purines and pyrimidines occurring in biological nucleotides appear to have been demonstrated, the concentrations of these starting ingredients in several of the postulated syntheses are considered to be so high that they might be inconsistent with early geological conditions. In this paper, the upper limits of plausible concentrations of these starting materials, such as HCHO, HCN, and HC₃N, are estimated, and a critical review of such experiments is presented. It is shown that, effectively, the prebiotic syntheses of amino acids, purines, and pyrimidines have been indeed demonstrated. However, the prebiotic synthesis of sugars of biological interest remains a problem. I.S.

A90-34675

LOCAL BLOOD FLOW IN THE BRAIN AND FEMUR-MUSCLE TISSUES UNDER HYPOXIA UNDER NORMOBARISM AND HYPOBARISM [LOKAL'NYI KROVOTOK V TKANIAXH GOLOVNOGO MOZGA I MYSHTSY BEDRA PRI GIPOKSII V USLOVIAKH NORMO- I GIPOBARII]

V. P. AGAFONOV (Leningradskii Institut Uovershenstvovaniia Vrachei, Leningrad, USSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 36, Mar.-Apr. 1990, p. 95-99. In Russian. refs

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A90-34677

CENTRAL NEUROPHYSIOLOGICAL MECHANISMS REGULATING THE INHIBITION OF LOCOMOTION [TSENTRAL'NYE NEIROFIZIOLOGICHESKIE MEKHANIZMY REGULIATSII TORMOZHENIIA]

B. IU. MILEIKOVSKII, S. V. VEREVKINA, and A. D. NOZDRACHEV (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, March 1990, p. 289-294. In Russian. refs

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The organization of the inhibitory zones of the brain stem and their interaction during the inhibition of locomotion were investigated using freely moving rats with implanted electrodes. It was found that electrical as well as chemical stimulation of the neurons from the nucleus cuneatus, the parabrachial medial nucleus, the nucleus median raphe, and the nucleus magnus raphe caused an inhibition of locomotor activity in these animals. Lesions of the nucleus median raphe and nucleus magnus raphe was found to block the inhibitory effects of electrical stimulation of the nucleus cuneatus and the parabrachial medial nucleus. I.S.

A90-34678

COMPARATIVE NEUROPHYSIOLOGICAL ANALYSIS OF THERMOREGULATORY MUSCULAR ACTIVITY IN HIBERNATING AND NONHIBERNATING ANIMALS DURING THE DEVELOPMENT OF HYPOTHERMIA [SRAVNITEL'NYI NEIROFIZIOLOGICHESKII ANALIZ TERMOREGULIATSIONNOI MYSHECHNOI AKTIVNOSTI U ZIMNESPIASHCHIKH I NEZIMNESPIASHCHIKH ZHIVOTNYKH V PROTSESSE RAZVITIIA GIPOTERMII]

V. L. CHUPAKHINA, A. IU. MEIGAL, and IU. V. LUPANDIN

(Petrozavodskii Gosudarstvennyi Universitet, Petrozavodsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, March 1990, p. 406-413. In Russian. refs
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A90-34697

CHANGES IN VOLUMES OF BODY FLUIDS DURING DIFFERENT LEVELS OF LOCOMOTOR ACTIVITY UNDER THERMAL STRESS [IZMENENIE OB'EMOV ZHIDKOSTEI TELA PRI RAZLICHNOI DVIGATEL'NOI AKTIVNOSTI KRYS V USLOVIAKH TERMICHESKOGO VOZDEISTVIA]

T. V. NAGIBINA (AN USSR, Institut Fiziologii, Tashkent, Uzbek SSR) Akademiia Nauk Uzbekskoi SSR, Doklady (ISSN 0134-4307), no. 3, 1990, p. 51-53. In Russian. refs
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The volume-change dynamics of the total, intercellular, and intracellular fluids, the circulating blood, the plasma, and the erythrocytes was investigated in rats that were either permitted normal locomotive activity or subjected to 60-day-long hypokinesia, under conditions of room temperature (18-20 C) or in the presence of thermal stress (38-40 C for 2 hrs daily). It was found that freely moving animals subjected to thermal stress exhibited decreases in the volumes of the extracellular fluid, circulating blood, plasma, and erythrocytes; these changes leveled up after the 10th day of the experiment, and then reversed to reach the starting levels at day 60. The hypokinetic animals, on the other hand, exhibited progressive decreases in these parameters up to day 60, indicating that hypokinesia inhibited the ability of adaptation to thermal stress in these animals. I.S.

A90-34920

HYPERTHERMOPHILIC ARCHAEACTERIA WITHIN THE CRATER AND OPEN-SEA PLUME OF ERUPTING MACDONALD SEAMOUNT

R. HUBER, K. O. STETTER (Regensburg, Universitaet, Federal Republic of Germany), P. STOFFERS (Kiel, Universitaet, Federal Republic of Germany), J. L. CHEMINEE (Paris VI, Universite, France), and H. H. RICHNOW (Hamburg, Universitaet, Federal Republic of Germany) Nature (ISSN 0028-0836), vol. 345, May 10, 1990, p. 179-182. Research supported by DFG, BMFT, and Fonds der Chemischen Industrie. refs
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A community of hyperthermophilic archaeobacteria living within the active zone of an erupting submarine volcano is reported for the first time. The spread of the community through the cooled-down, open-ocean plume is described. Most of the organisms are close relatives of species previously known only from submarine sulfataric field in Italy, whereas others are new. C.D.

N90-20608# Microbial Products, Inc., Vacaville, CA.

DESIGN AND OPERATION OF AN OUTDOOR MICROALGAE TEST FACILITY Final Report

J. C. WEISSMAN, D. M. TILLET, and R. P. GOEBEL Oct. 1989 56 p Prepared in cooperation with Midwest Research Inst. Sponsored in part by New Mexico Research and Development Inst.

(Contract DE-AC02-83CH-10093)
(DE89-009493; SERI/STR-232-3569) Avail: NTIS HC A04/MF A01

The objective of the project covered in this report is to establish and operate a facility in the American Southwest to test the concept of producing microalgae on a large scale. This microalgae would then be used as a feedstock for producing liquid fuels. The site chosen for this project was an existing water research station in Roswell, New Mexico; the climate and water resources are representative of those in the Southwest. For this project, researchers tested specific designs, modes of operation, and strains of microalgae; proposed and evaluated modifications to technological concepts; and assessed the progress toward meeting cost objectives. DOE

N90-20609# Letterman Army Inst. of Research, San Francisco, CA.

ACUTE ORAL TOXICITY OF JA-2 SOLID PROPELLANT IN ICR MICE Report, 17 Dec. 1985 - 17 Jan. 1986

EARL W. MORGAN, DENZIL F. FROST, CONRAD R. WHELLER, and DON W. KORTE, JR. Dec. 1989 73 p
(AD-A217264; LAIR-414; TOXICOLOGY-SER-177) Avail: NTIS HC A04/MF A01 CSCL 06/11

The acute oral toxicity of JA-2 Solid Propellant was determined in male and female ICR mice by using an oral gavage, split-dose method. The minimum lethal dose (MLD) was 3774.6 + or - 150.5 mg/kg for male mice and 3528.8 + or - 133.8 mg/kg for female mice. JA-2 produced component, diethyleneglycol dinitrate and nitroglycerin. These signs included tremors, inactivity, depression of reflexes, loss of equilibrium, opisthotonus, and increased respiratory activity. Other clinical signs observed were associated with the general malaise of the animals following dosing and included perianal staining, hunched posture, squinting, and rough coat. Most animals exhibited signs by 2 hours after dosing and either had died or the signs had cleared within 5 days of dosing. According to the classification scheme of Hodge and Sterner, these results place JA-2 in the slightly toxic class. GRA

N90-20610# California Univ., Berkeley. Lawrence Berkeley Lab. Center for X Ray Optics.

BIOLOGICAL SOFT X RAY CONTACT MICROSCOPY: IMAGING LIVING CHO-SC1 CELLS AND OTHER BIOLOGICAL MATERIALS Ph.D. Thesis

GEOFFREY DAVID GUTTMANN Aug. 1989 223 p

(Contract DE-AC03-76SF-00098; F49620-87-K-0001)

(DE90-007560; LBL-28042) Avail: NTIS HC A11/MF A02

This dissertation is a description of soft x ray contact microscopy and the successful efforts to expand this technique to image at high resolution, living mammalian cells. Soft x ray contact microscopy (SXXM) is a form of x ray lithography. However, the biological cell is imaged instead of an electron-cut microcircuit mask. The contrast mechanism is based upon the x ray absorption lengths of carbon and nitrogen. The soft x rays were generated by a conventional laboratory source or a laser-induced plasma x ray source. The conventional laboratory soft x ray source was a converted electron evaporator. The target materials were vanadium and carbon. The laser-induced plasma x ray source was the Lawrence Livermore National Laboratory (LLNL) JANUS laser facility. The target material was tantalum. A radiachromic nylon film was used to calibrate the exposure dose. The imaging detector was an x ray sensitive resist or a copolymer. A wet cell chamber (WCC) was designed to keep a biological sample alive at atmospheric pressure yet permit imaging by soft x rays. The limits of resolution required an understanding of the interaction of soft x rays with matter, Fresnel diffraction, penumbral blurring and secondary electron travel within a resist. DOE

N90-20611# California Univ., Berkeley. Lawrence Berkeley Lab.

LIFE SCIENCES: LAWRENCE BERKELEY LABORATORY, 1988 Jul. 1989 76 p

(Contract DE-AC03-76SF-00098)

(DE90-008061; LBL-27460) Avail: NTIS HC A05/MF A01

Life Sciences Research at the Lawrence Berkeley Laboratory (LBL) has both a long history and a new visibility. The physics technologies pioneered in the days of Ernest O. Lawrence found almost immediate application in the medical research conducted by Ernest's brother, John Lawrence. And the tradition of nuclear medicine continues today, largely uninterrupted for more than 50 years. Until recently, though, life sciences research has been a secondary force at LBL. Today, a true multi-program laboratory has emerged, in which the life sciences participate as a full partner. The LBL Human Genome Center is a contribution to the growing international effort to map the human genome. Its achievements represent LBL divisions, including Engineering, Materials and Chemical Sciences, and Information and Computing Sciences, along with Cell and Molecular Biology and Chemical Biodynamics. The Advanced Light Source Life Sciences Center will comprise

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not only beamlines and experimental end stations, but also supporting laboratories and office space for scientists from across the U.S. This effort reflects a confluence of scientific disciplines --- this time represented by individuals from the life sciences divisions and by engineers and physicists associated with the Advanced Light Source project. And finally, this report itself, the first summarizing the efforts of all four life sciences divisions, suggests a new spirit of cooperation. DOE

N90-20612# Brandeis Univ., Waltham, MA.
CARBON AND HYDROGEN METABOLISM OF GREEN ALGAE IN LIGHT AND DARK

1990 7 p
(Contract DE-FG02-86ER-13486)
(DE90-008648; DOE/ER-13486/T1) Avail: NTIS HC A02/MF A01

After adaptation to a hydrogen metabolism, *Chlamydomonas reinhardtii* can photoanaerobically metabolize acetate with the evolution of H₂ and CO₂. An enzyme profile of the chloroplastic, cytoplasmic, and mitochondrial fractions were obtained with a cellular fractionation procedure that incorporated cell wall removal by autolysine, digestion of the plasmalemma with digitonin and fractionation by differential centrifugation on a Percoll step gradient. The sequence of events leading to the photo-evolution of H₂ from acetate includes the conversion of acetate into succinate via the extraplasmidic glyoxylate cycle, the oxidation of succinate to fumarate by chloroplastic succinic dehydrogenase and the oxidation of malate to oxaloacetate in the chloroplast by NAD dependent malate dehydrogenase. The level of potential activity of the enzymes was sufficient to accommodate the observed rate of gas evolution. The isolated darkened chloroplast evolves aerobically CO₂ from glucose indicating a chloroplastic respiratory pathway. Evolution of CO₂ is blocked by mitochondrial inhibitors. DOE

N90-20613# Letterman Army Inst. of Research, San Francisco, CA.

ACUTE ORAL TOXICITY OF DIGL-RP SOLID PROPELLANT IN ICR MICE Report, 7 Feb. - 3 Jul. 1986
LARRY D. BROWN, CONRAD R. WHEELER, YVONNE C. LETELLIER, and DON W. KORTE, JR. Dec. 1989 68 p
(AD-A217711; LAIR-410; TOXICOLOGY-SER-178) Avail: NTIS HC A04/MF A01 CSCL 06/11

The acute oral toxicity of DIGL-RP solid propellant was determined in male and female ICR mice by using an oral gavage split-dose method. The MLD was 4176.1 + or - 116.6 mg/kg for male mice and 3447.5 + or - 42.1 mg/kg for female mice. DIGL-RP produced clinical signs that were attributed to its nitrate ester component, diethyleneglycol dinitrate. These signs included tremors, depression of reflexes, and inactivity. Other clinical signs observed were associated with the general malaise of the animals following dosing and included urine staining (males), hunched posture, squinting, and rough coat. Most animals exhibited signs by 2 to 3 hours after dosing and either had died or the signs had cleared by 96 hours after dosing. According to the classification scheme of Hodge and Sterner, these results place DIGL-RP in the slightly toxic class. GRA

N90-20614# Letterman Army Inst. of Research, San Francisco, CA.

ACUTE ORAL TOXICITY OF DIGL-RP SOLID PROPELLANT IN SPRAGUE-DAWLEY RATS Report, 30 Dec. 1985 - 1 Jun. 1986
LARRY D. BROWN, CONRAD R. WHEELER, and DON W. KORTE, JR. Nov. 1989 82 p
(AD-A217712; LAIR-409; TOXICOLOGY-SER-167) Avail: NTIS HC A05/MF A01 CSCL 06/11

The DOD is considering the use of diethyleneglycol dinitrate (DEGDN), triethyleneglycol dinitrate; or trimethylolethane trinitrate as a replacement for nitroglycerin in munition formulations. A health effects review identified numerous gaps in the toxicology database of these compounds. Consequently, an initial health effects evaluation of DEGDN, TMETN, TEGDN, and two DEGDN-based propellants, JA-2 and DIGL-RP was conducted. The acute oral toxicity of DIGL-RP solid propellant was determined in male and

female Sprague-Dawley rats by using an oral gavage split-dose method. The medium lethal dosage was 2946.1 + or - 39.2 mg/kg for male rats and 2636.4 + or - 117.8 mg/kg for female rats. DIGL-RP produced clinical signs that were attributed to its nitrate ester component, DEGDN. These signs included tremors, depression of reflexes, cyanosis, increases in respiratory rate and depth, and decreased body temperature. Other clinical signs observed were associated with the general malaise of the animals and dosing and included hunched posture, squinting, reddish stains around the eyes and nose, and perianal staining. Most animals exhibited signs by 4 hours after dosing and either had died or the signs had cleared by 96 hours after dosing. According to the classification scheme of Hodge and Sterner, these results placed DIGL-RP in the slightly toxic class. GRA

N90-20615# Army Research Inst. of Environmental Medicine, Natick, MA.

HYPOBARIC HYPOXIA (380 TORR) DECREASES INTRACELLULAR AND TOTAL BODY WATER IN GOATS
R. W. HOYT, M. J. DURKOT, V. A. FORTE, JR., L. J. HUBBARD, L. A. TRAD, and A. CYMERMAN 1989 24 p
(AD-A218192; USARIEM-M7-90) Avail: NTIS HC A03/MF A01 CSCL 06/10

The effect of 16 days of hypobaric hypoxia on body fluid distribution was studied in four unanesthetized adult goats (*Capra hircus*). Total body water (TBW), extracellular fluid volume (ECF), and plasma volume (PV) were determined with (3)H₂O, (14C)-inulin, and indocyanine green, respectively. Blood volume (BV = PV x 100/100 - HEMATOCRIT), red cell volume (RCV = BV - PV), intracellular fluid (ICF = TBW - ECF) and interstitial fluid (ISF = ECF - PV) volumes were calculated. Body mass (-7.1 percent), TBW (-9.1 percent), and ICF volume (-14.4 percent) decreased, while ECF (+11.7 percent), and ISF (+27.7 percent) volumes increased with exposure (p less than 0.05). The decrease in TBW accounts for 89 percent of the loss of body mass. Hematocrit increased from 24.0 + or - 1.0 percent SEM to 34.2 + or - 2.2 percent (p less than 0.05). BV was unchanged; an increase in RCV (+39.5 percent) counterbalanced the decrease in PV (-15.3 percent) (p less than 0.05). Goats were similar to humans in that prolonged hypobaric hypoxia resulted in decreases in TBW volume, ICF volume, and PV. GRA

N90-21512# Lawrence Livermore National Lab., CA. Biomedical Sciences Div.

DOES DNA CYTOMETRY HAVE A PLACE IN THE CLINICAL LABORATORY
BRIAN MAYALL, FREDERIC WALDMAN, KAREN CHEW, KONSTANTIN CHRISTOV, WILLIAM GOODSON, BRITT-MARIE LJUNG, and HELENE S. SMITH (Brush, Geraldine Cancer Research Inst., San Francisco, CA) 24 Jan. 1990 4 p Presented at the European Society for Analytical Cellular Pathology on Advances in Analytical Cellular Pathology, Schloss Elmau, Fed. Republic of Germany, 12-17 Nov. 1989 Sponsored in part by Lab. for Cell Analysis, Univ. of California, San Francisco; Univ. of California Program for Analytical Cytology; and Brush (Geraldine) Cancer Research Inst., San Francisco, CA
(Contract W-7405-ENG-48; CA-44768)
(DE90-007652; UCRL-102862; CONF-8911174-1) Avail: NTIS HC A01/MF A01

We are investigating the potential utility of cellular markers, including cellular proliferation and DNA cytometry, as independent diagnostic and prognostic markers in human breast cancer. However, as the clinical laboratory is responsible for providing physicians with data relevant to the patient, it is essential first to establish the validity of such markers before their use is recommended. Prospective validation is time-consuming and costly for tests of human malignancies, such as breast cancer, which may follow a lengthy and indolent course requiring patients to be followed for a decade or more before their clinical outcome is known. Therefore, retrospective studies on archival material are used whenever possible. Cell proliferation is recognized as an important diagnostic and prognostic marker for human breast cancer and a tritiated thymidine DNA labeling index greater than

5 percent is associated with a markedly less favorable outcome. Incorporation of bromodeoxyuridine (BrdUrd) into the DNA of S phase cells gives a similar labeling index. Unfortunately, paraffin-embedded archival material is rarely pre-labeled, and so DNA cytometry of either whole nuclei disaggregated from thick sections or partial nuclei in thin sections must be used as an indirect approach to estimate cellular proliferative activity. We are particularly interested in validating the DNA cytometry of thin sections and in relating the DNA histogram to in vivo BrdUrd labeling index, which is our standard for cellular proliferation.

DOE

N90-21513*# Lockheed Engineering and Sciences Co., Washington, DC.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 26

LYDIA RAZRAN STONE, ed., MARY ANN FREY, ed., RONALD TEETER, ed., VICTORIA GARSHNEK, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, DC.) Washington, DC NASA May 1990 104 p
(Contract NASW-4292)

(NASA-CR-392231; NAS 1.26:392231) Avail: NTIS HC A06/MF A01 CSCL 06/3

This is the twenty-sixth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 35 journal papers or book chapters published in Russian and of 8 Soviet books. In addition, the proceedings of an Interkosmos conference on space biology and medicine are summarized. Author

N90-21514# Pacific Northwest Lab., Richland, WA.

BIOLOGICAL EFFECTS OF ELF (EXTREMELY-LOW-FREQUENCY) ELECTRIC AND MAGNETIC FIELDS

L. E. ANDERSON Oct. 1989 7 p Presented at the US/USSR Cooperative Agreement on Physical Factors in the Environment, Prague, Czechoslovakia, 24 Sep. - 10 Oct. 1989
(Contract DE-AC06-76RL-01830)

(DE90-008634; PNL-SA-17321; CONF-8909315-1) Avail: NTIS HC A02/MF A01

Studies were conducted at the Pacific Northwest Laboratory to examine extremely-low-frequency (ELF) electromagnetic fields for possible biological effects in animals. Two areas of investigation are reported here: studies on the nervous system, including behavior and neuroendocrine function, and experiments on cancer development in animals. In behavioral experiments, preliminary data suggest that short term memory may be affected in albino rats exposed to combined ELF and static magnetic fields. Neuroendocrine studies were conducted to demonstrate an apparent stress-related response in rats exposed to 60-Hz electric fields. Finally, using a chemically-induced mammary tumor model, experiments were conducted in which rats, chronically exposed to 60-Hz electric fields, showed an enhancement in the number of tumors per tumor bearing animal. DOE

N90-21515# Los Alamos National Lab., NM.

ARTIFICIAL LIFE: THE COMING EVOLUTION

J. DOYNE FARMER and ALLETA DA. BELIN (Shute, Mihaly and Weinberger, Santa Fe, NM.) 1990 26 p Presented at the Indirect Liquefaction Contractors Review Meeting, Pittsburgh, PA, 13-15 Nov. 1989 Prepared in cooperation with Santa Fe Coll., NM

(Contract W-7405-ENG-36)

(DE90-008860; LA-UR-90-378; CONF-891131) Avail: NTIS HC A03/MF A01

Within fifty to a hundred years a new class of organisms is likely to emerge. These organisms will be artificial in the sense that they will originally be designed by humans. However, they will reproduce, and will evolve into something other than their initial form; they will be alive under any reasonable definition of the word. These organisms will evolve in a fundamentally different manner than contemporary biological organisms, since their reproduction will be under at least partial conscious control, giving it a Lamarckian component. The pace of evolutionary change consequently will be extremely rapid. The advent of artificial life

will be the most significant historical event since the emergence of human beings. The impact on humanity and the biosphere could be enormous, larger than the industrial revolution, nuclear weapons, or environmental pollution. We must take steps now to shape the emergence of artificial organisms; they have potential to be either the ugliest terrestrial disaster, or the most beautiful creation of humanity. DOE

N90-21516# Cornell Univ., Ithaca, NY.

ANAEROBIC METABOLISM OF AROMATIC COMPOUNDS BY PHOTOTROPHIC BACTERIA: BIOCHEMICAL ASPECTS Annual Progress Report, 1 Apr. - 15 Nov. 1989

JANE GIBSON 1989 4 p Presented at the Annual Meeting of the American Society for Microbiology, Anaheim, CA, May 1990

(Contract DE-FG02-86ER-13495)

(DE90-009503; DOE/ER-13495/T3) Avail: NTIS HC A01/MF A01

Two aspects of the work proposed have received major emphasis during the period since the grant was activated: isolation and characterization of transposon insertion mutants of *Rhodospseudomonas palustris* defective in phototrophic growth on aromatic compounds, and attempts to purify and characterize the Coenzyme A ligase enzyme involved in activating 4-hydroxybenzoate. The HPLC apparatus was installed in August, and calibration of columns both for metabolite and for protein separations was initiated. A start has also been made on synthesis of Coenzyme A thioesters of compounds that are potential intermediates in the anaerobic degradation pathways. DOE

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AEROSPACE MEDICINE

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

A90-32389#

+GZ-INDUCED LOSS OF CONSCIOUSNESS AND INCAPACITATION TIME DURING ANTI-G TRAINING

MITSUKO KAMIKURA, CHIEKO MIZUMOTO, and AKIO NAKAMURA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, March 1989, p. 13-23. In Japanese, with abstract in English. refs

A detailed study of the characteristics of +Gz-induced loss of consciousness (GLOC) and the resulting incapacitation time in 45 subjects is reported. The subjects were divided into two groups: one with convulsive movements and one without such movements. The absolute (unconsciousness), relative (disorientation, confusion), and total incapacitation times for both groups were measured and compared. The mean G-level where GLOC occurred was found to be +5.4 Gz. The absolute and relative incapacitation times for all cases were 8.1 and 8.5 seconds, respectively. The absolute incapacitation time of the group with convulsive movements was 9.8 seconds, while that of the other group was 5.7 seconds. The difference is statistically significant. C.D.

A90-32390#

TWO CASES OF NECK INJURY INDUCED BY HIGH-G FORCES DURING AIR-TO-AIR COMBAT MANEUVERS

SHOICHI TACHIBANA and TOMOMITSU AKAMATSU Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, March 1989, p. 25-33. In Japanese, with abstract in English.

Two cases of severe neck injury sustained by pilots during high-G force maneuvers are discussed. One pilot suffered a cervical herniated disk and the other suffered acute neck strain and sensory deficits in the right arm. Both pilots were looking back over their shoulders when they sustained their injuries. Neither had a past

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history of injury. The pilot with a herniated disk was recommended to be transferred to cargo aircraft pilot, while the other recovered completely. C.D.

A90-32600

FUNCTIONAL STATE OF CARRIER-STATIONED PILOTS IN THE INITIAL PERIOD OF SERVICE [FUNKSIONAL'NOE SOSTOIANIE LETCHIKOV V NACHAL'NOM PERIODE PALUBNOGO BAZIROVANIIA]

A. A. BOCHENKOV, I. A. KOLOSOV, M. M. ODINAK, and A. E. FEDOROV *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Feb. 1990, p. 56-58. In Russian.

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Six groups, 10-16 subjects each, of healthy pilots serving on an aircraft carrier were examined periodically on nonflight days during the first month of their service for symptoms of cardiovascular disease, in order to identify the effect of having to take-off from and to land on the carrier deck (as opposed to an airport runway) on the functional state of the subjects. It was found that the increase in stress reactions (blood pressure, heart rate, the vegetative index, and the coefficient of cardiovascular endurance) did not exceed the norm limits, indicating that the body systems of these subjects were able to functionally reorganize during the first month of flying from the carrier deck. With extended service, the physiological changes were found to correlate with changes in psychological indexes. I.S.

A90-33304* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EFFECTS OF CARDIAC PHASE ON DIAMETER MEASUREMENTS FROM CORONARY CINEANGIOGRAMS

ROBERT H. SELZER, MARIA SIEBES, PAUL L. LEE (JPL, Pasadena, CA), CHERYL HAGERTY, P. AZEN (Southern California, University, Los Angeles, CA) et al. IN: *Computers in Cardiology Meeting*, Washington, DC, Sept. 25-28, 1988, Proceedings. Washington, DC, IEEE Computer Society Press, 1989, p. 363-366. refs

(Contract NIH-HL-23619)

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The measurement variability of end-diastolic frames is compared with frames taken from the other portions of the cardiac cycle. Two computer measurements, average diameter and minimum, are obtained for every frame of two complete cardiac cycles in angiograms of 20 subjects. Six schemes for sampling frames in various portions of the cardiac cycle are defined and the standard deviation is calculated for pairs of measurements from each scheme. The results suggest that the best strategy for frame selection is to use sequential frames in end-diastole. However, it is noted that if random samples are taken anywhere in the cardiac cycle instead of sequentially in end-diastole, the variability of two vessel edge measures changes from 4.9 percent to 6.3 percent, which is considered to be a small penalty. V.T.

A90-33655* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

THE STABILITY OF INDIVIDUAL PATTERNS OF AUTONOMIC RESPONSES TO MOTION SICKNESS STIMULATION

PATRICIA S. COWINGS (NASA, Ames Research Center, Moffett Field, CA), WILLIAM B. TOSCANO (California, University, San Francisco), and KAREN H. NAIFEH *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 399-405. refs

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As part of a program to develop a treatment for motion sickness based on self-regulation of autonomic nervous system (ANS) activity, this study examined the stability of an individual's pattern of ANS responses to motion sickness stimulation on repeated occasions. Motion sickness symptoms were induced in 58 people during two rotating chair test. Physiological responses measured were heart rate, finger pulse volume, respiration rate, and skin conductance. Using standard scores, stability of responses of specific magnitudes across both tests is as examined. Correlational analyses, analysis of variance, and a components of variance

analysis all revealed marked, but quite stable, individual differences in ANS responses to both mild and severe motion sickness. These findings confirm the prior observation that people are sufficiently unique in their ANS responses to motion sickness provocation to make it necessary to individually tailor self-regulation training. Further, these data support the contention that individual ANS patterns are sufficiently consistent from test to test so as to serve as an objective indicator of individual motion sickness malaise levels. Author

A90-33656

RECOGNIZING +GZ-INDUCED LOSS OF CONSCIOUSNESS AND SUBJECT RECOVERY FROM UNCONSCIOUSNESS ON A HUMAN CENTRIFUGE

JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 406-411.

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Detailed kinetic analysis of over 500 +Gz-induced loss of consciousness (G-LOC) episodes on a human centrifuge allowed an evaluation of the time for subjective recognition by observers of the onset of G-LOC and subsequent recovery to normal baseline conditions. The characteristics of early, coincident, and late recognition of the onset of G-LOC were evaluated. Earlier recognition of G-LOC was observed to occur when the rate of onset of the +Gz-stress was gradual (slower than 0.6 G/s). Rapid onset rate (faster than 0.6 G/s) exposures were more likely to result in late recognition of G-LOC. The duration of the resulting period of unconscious (absolute incapacitation) was very sensitive to the time for recognition of G-LOC and most rapid return to a normal (+ 1 Gz) environment. The absolute incapacitation increased significantly from early (10.7 s) to coincident (11.4 s) to late (13.2 s) recognition of G-LOC which differed by a total of only 4.6 s. The results allow development of an initial standard of care envelope for apparently safe exposure of human subjects to centrifuge G-LOC since no adverse effects were observed with any of the exposures. Author

A90-33657

PILOTS' KNOWLEDGE OF BLOOD ALCOHOL LEVELS AND THE 0.04 PERCENT BLOOD ALCOHOL CONCENTRATION RULE

SUSAN M. ROSS and LEONARD E. ROSS (Wisconsin, University, Madison) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 412-417. refs

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A national sample of licensed pilots was surveyed regarding their knowledge of the Federal Aviation Administration's 0.04-percent blood alcohol concentration (BAC) limit, the relationship between the number of drinks and BAC, and the manner in which BAC decays with time. A majority of the 1039 respondents were unaware of the 1985 0.04-percent BAC rule change. In addition, many lacked an understanding of the relationship between the amount of alcohol consumed and the resulting BAC, and of the rate at which BAC decays. The number of drinks necessary to raise BAC to specific levels was frequently overestimated, and the amount of time necessary for BAC to decay was frequently underestimated. These errors were more pronounced for moderate and heavy drinkers than for abstainers and infrequent drinkers. These results suggest that pilots could have difficulty if they attempt to use the 0.04-percent BAC value as a guide to safety in their flying activities. Author

A90-33660

THE EFFECT OF REPEATED DOSES OF 30 MG PYRIDOSTIGMINE BROMIDE ON PILOT PERFORMANCE IN AN A-4 FLIGHT SIMULATOR

S. IZRAELI, D. AVGAR, S. ALMOG, I. SHOCHAT, Z. TOCHNER (Israel Air Force, Medical Corps and Aeromedical Centre, Ramat Gan) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 430-432. refs

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The effect of repeated doses of 30 mg pyridostigmine bromide every 8 h on flight skills in an A-4 simulator was tested in this crossover double-blind placebo-controlled study on 10 pilots experienced in actual and simulated A-4 flights. The pilots flew two test simulator flights 2 h after the fourth dose of pyridostigmine or placebo. The flight profile included navigation, rapid ascent, 360-deg turns, and instrument landing. Each flight lasted approximately 20 min. Flight parameters measured included indicated air speed, true heading, barometric altitude, vertical velocity and bank. The mean whole blood cholinesterase inhibition level was 29 percent. There was not decrement in performance under treatment with pyridostigmine in the percent of deviation time from the prescribed limits or in the average duration or magnitude of the deviation in each of the flight parameters.

Author

A90-33661

BLOOD PRESSURE RESPONSE TO EXERCISE IN NORMOTENSIVE AND HYPERTENSIVE YOUNG MEN

ELLIOT ROSENBERG, PAUL FROOM, MOSHE GROSS, JOSEPH RIBAK (Israel Air Force, Aeromedical Centre, Ramat Gan), BASIL S. LEWIS (Lady Davis Carmel Hospital, Haifa, Israel) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 433-435. refs
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The optimal cut-off value of blood pressure defining a hypertensive response to exercise testing was measured in 90 asymptomatic Israeli candidates for flight training with casual resting blood pressure of 140/90 mm Hg or more, and 72 age-matched normotensive controls tested in the Israel Air Force Aeromedical Center. Exercise testing (Bruce protocol) was performed using a calibrated treadmill and a three-channel ECG recording system. Recordings were made at 3-min intervals. At 3 min of exercise 14 percent of the hypertensive subjects had a SBP of above 210, compared to only 1 percent of the control group. At 12 min of exercise, 53 percent of the hypertensives and 16 percent of the controls had similar elevations of SBP. At 6 min of exercise, 13 percent of hypertensives had SBP above 220, whereas none of the normal controls had SBPs elevated to that degree. It is concluded that an increase in SBP to 210 mm Hg or more after 3 min or to 220 mm Hg after 6 min of exercise testing by the Bruce protocol best separates the hypertensive group from the control group.

Author

A90-33662

SIXTEEN YEARS WITH THE DANISH SEARCH AND RESCUE HELICOPTER SERVICE

F. WEGMANN, B. KROMANN-ANDERSEN, T. STAEHR JOHANSEN, and K. JESSEN (Royal Danish Air Force, Vedbaek, Denmark) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, May 1990, p. 436-439.
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The Danish helicopter rescue service in its present form was founded in 1966. The use of the Sikorsky (S-61) helicopter has generally been satisfactory. In 1973, the crew was supplemented by an aerospace-medically-educated and helicopter-trained physician. From 1973 to 1989, there were 5733 missions, of which direct medical intervention occurred in 2075 cases; 94 percent of the missions supported the civilian public health service in Denmark. Many sorts of diseases and injuries have been seen, but especially trauma, abdominal, and cardiopulmonary diseases. Experience has shown the benefit of having a designated physician, specially trained in aerospace medicine and acute medicine/surgery, as a permanent crewmember.

Author

A90-33716* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

HEAD-DOWN BED REST IMPAIRS VAGAL BAROREFLEX RESPONSES AND PROVOKES ORTHOSTATIC HYPOTENSION
VICTOR A. CONVERTINO, DONALD F. DOERR, DWAIN L. ECKBERG, JANICE M. FRITSCH, and JOAN VERNIKOS-DANELLIS (NASA, Kennedy Space Center, Cocoa Beach, FL; NASA, Ames Research Center, Moffett Field, CA; USVA,

Medical Center; Virginia, Medical College, Richmond) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 68, April 1990, p. 1458-1464. Research supported by USVA. refs
(Contract NIH-HL-22296; NAG2-408; NAS10-10285)
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The hypothesis that baroreflex malfunction contributes to orthostatic hypotension in microgravity was tested by studying vagally mediated carotid baroreceptor-cardiac reflexes in healthy human subjects before, during, and after 30 days of 6-deg head-down bed rest. The baroreflex response relationships were provoked with ramped neck pressure-suction sequences comprising pressure elevations to 40 mm Hg followed by serial R-wave-triggered 15-mm Hg reductions to -65 mm0 Hg; each R-R interval was plotted as a function of systolic pressure minus the neck chamber pressure applied during the interval. It is shown that head-down bed rest led to an impairment of vagal baroreflex function and that it was associated with an impairment of hemodynamic adjustments to standing, indicating that baroreflex impairment may contribute to orthostatic hypotension observed in spacecrews after a flight. I.S.

A90-34278

THE EFFECTS OF MICROGRAVITY ON THE SKELETAL SYSTEM - A REVIEW

PIETER M. DROPERT (Birmingham, University, England) *British Interplanetary Society, Journal* (ISSN 0007-084X), vol. 43, Jan. 1990, p. 19-24. refs
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Exposure of astronauts to microgravity leads to the loss of calcium from weightbearing bones. Prolonged exposure, e.g., during a journey to Mars, may present problems on return to earth, with increased risk of fractures and premature osteoporosis in later life. The precise mechanisms of calcium loss have yet to be determined although a key feature is the absence of mechanical loading. Countermeasures aimed at reducing calcium loss to acceptable levels include the use of exercise, drugs, dietary modifications and inertia suits such as the Soviet 'Penguin' suit. Missions of a number of years may, however, require the development of artificial gravity on a spacecraft. The country that first solves the physiological problems of man in space and, in particular, skeletal calcium loss, will almost certainly be the first to be able to put a man on Mars. Author

N90-20616* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

HUMAN SERUM ALBUMIN CRYSTALS AND METHOD OF PREPARATION Patent

DANIEL C. CARTER, inventor (to NASA) 23 May 1989 8 p
Filed 20 Aug. 1987
(NASA-CASE-MFS-28234-1; US-PATENT-4,833,233;
US-PATENT-APPL-SN-087281; US-PATENT-CLASS-530-363;
US-PATENT-CLASS-530-362; US-PATENT-CLASS-530-364;
US-PATENT-CLASS-530-367; US-PATENT-CLASS-530-422;
US-PATENT-CLASS-427-2; US-PATENT-CLASS-428-408) Avail:
US Patent and Trademark Office CSCL 06/5

Human serum albumin (HSA) crystals are provided in the form of tetragonal plates having the space groups P4₂(sub 1)₂, the crystals being grown to sizes in excess of 0.5 mm in two dimensions and a thickness of 0.1 mm. Growth of the crystals is carried out by a hanging drop method wherein a precipitant solution containing polyethylene glycol (PEG) and a phosphate buffer is mixed with an HSA solution, and a droplet of mixed solution is suspended over a well of precipitant solution. Crystals grow to the desired size in 3 to 7 days. Concentration of reagents, pH and other parameters are controlled within prescribed limits. The resulting crystals exhibit a size and quality such as to allow performance of x ray diffraction studies and enable the conduct of drug binding studies as well as genetic engineering studies.

Official Gazette of the U.S. Patent and Trademark Office

N90-20617*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, FL.

ELEVATED CENTRAL VENOUS PRESSURE: A CONSEQUENCE OF EXERCISE TRAINING-INDUCED HYPERVOLEMIA

VICTOR A. CONVERTINO, GARY W. MACK, and ETHAN R. NADEL 1990 22 p
(NASA-TM-102965; NAS 1.15:102965) Avail: NTIS HC A03/MF A01 CSCL 06/16

Resting plasma volumes, and arterial and central venous pressures (CVP) were measured in 16 men before and after exercise training to determine if training-induced hypervolemia could be explained by a change in total vascular capacitance. In addition, resting levels of plasma vasopressin (AVP), atrial natriuretic peptide (ANP), aldosterone (ALD), and norepinephrine (NE) were measured before and after training. The same measurements of vascular volume, pressures, and plasma hormones were measured in 8 subjects who did not undergo exercise and acted as controls. The exercise training program consisted of 10 weeks of controlled cycle exercise for 30 min/d, 4 d/wk at 75 to 80 percent of maximal oxygen uptake (VO₂max). A training effect was verified by a 20 percent increase in VO₂max, a resting bradycardia, and a 370 ml (9 percent) increase in blood volume. Mean arterial blood pressure was unaltered by exercise training, but resting CVP increased. The percent change in blood volume from before to after training was linearly related to the percent change in CVP. As a consequence of elevations in both blood volume and CVP, the volume-to-pressure ratio was essentially unchanged following exercise training. Plasma AVP, ANP, ALD, and NE were unaltered. Results indicate that elevated CVP is a consequence of training-induced hypervolemia without alteration in total effective venous capacitance. This may represent a resetting of the pressure-volume stimulus-response relation for regulation of blood volume. Author

N90-20618# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

INFLUENCE OF THEOBROMINE ON HEAT PRODUCTION AND BODY TEMPERATURES IN COLD-EXPOSED HUMANS: A PRELIMINARY REPORT

ANDRE L. VALLERAND, LAWRENCE C. H. WANG, and IRA JACOBS Nov. 1989 34 p Prepared in cooperation with Alberta Univ., Edmonton
(AD-A217203; DCIEM-89-RR-50) Avail: NTIS HC A03/MF A01 CSCL 06/15

One of the most successful classes of drugs employed to enhance cold tolerance in animals appears to be the methylxanthines. Indeed, methylxanthines such as caffeine, theophylline and theobromine have been shown to increase heat production, delay hypothermia and thus improve cold tolerance in animals. In humans, theophylline and caffeine (taken in combination with ephedrine) have similarly been shown to improve cold tolerance. Whether theobromine could enhance tolerance to cold in humans, is not known. The influence of theobromine was thus investigated in eight healthy young male subjects during two semi-nude exposures to cold air (3h, 7C, 1 m/s wind speed). The ingestion of theobromine produced two different types of responses, as shown by a significant interaction between the effect of group and the effect of drug treatment on the rate of decrease in mean body temperatures. The present results are interpreted as indicating that the ingestion of theobromine in subjects capable of producing a relatively high metabolic response to the cold, significantly improves cold tolerance by increasing heat production, mainly from a greater lipid utilization. GRA

N90-20619# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

PHYSICAL PERFORMANCE AND CARBOHYDRATE CONSUMPTION IN CF COMMANDOS DURING A 5-DAY FIELD TRIAL

I. JACOBS, D. VANLOON, L. PASUT, J. POPE, and D. BELL Dec. 1989 45 p

(AD-A217204; DCIEM-89-RR-48) Avail: NTIS HC A03/MF A01 CSCL 06/10

This study evaluated the capacity of military personnel to perform maximal exercise before and after 5 days of sustained physical activity. An additional goal was to evaluate whether a carbohydrate supplement to the regular field rations would reduce the extent of any performance impairments. Subjects (Ss) were 29 male volunteers from the Canadian Forces Airborne Regiment. They were allowed 4 to 5 h sleep each 24h and 45 min per meal, but were otherwise continuously occupied with physically demanding missions in a field environment. Performance tests administered 2 days before and at the end of a the 5-day field trial included evaluations of maximal aerobic power during cycle exercise, anaerobic power, muscular strength and endurance, rate of maximal force development and reaction time. Muscle and blood tissue samples were obtained before and after the trial to clarify the relative contribution of fat and carbohydrate energy stores to meeting the metabolic cost of the field trial. The results demonstrated that the Ss were in a marked negative caloric balance by the end of the field trial. Skeletal muscle glycogen stores were markedly depleted. There were impairments maximal aerobic power, maximal dynamic strength, and anaerobic power of large muscle groups. These observations have direct implications for mission planning and physical performance expectations of military units involved in sustained operation GRA

N90-20620# Lawrence Livermore National Lab., CA.
A REVIEW OF THE LITERATURE ON THE TOXICITY OF RARE-EARTH METALS AS IT PERTAINS TO THE ENGINEERING DEMONSTRATION SYSTEM SURROGATE TESTING

P. H. WALD and V. ALAN MODE Jan. 1990 32 p
(Contract W-7405-ENG-48)
(DE90-008049; UCID-21823-REV-1) Avail: NTIS HC A03/MF A01

Considerable data on the toxicology of the rare-earth metals and their compounds via oral ingestion or injection have been collected from animal studies at relatively high exposure levels. This report includes a general introduction to the rare-earth elements, data reviews on the toxicity of the rare earths from animal studies and the relatively rare occurrences of harmful human exposure, precautions for worker protection that should be taken with use of these materials, and scientific data with Engineering Demonstration System (EDS) operations. DOE

N90-20621# George Washington Univ., Washington, DC.
DEVELOPMENT OF GAMMA-EMITTING, RECEPTOR-BINDING RADIOTRACERS FOR IMAGING THE BRAIN AND PANCREAS

R. C. REBA 1989 11 p
(Contract DE-FG05-88ER-60649)
(DE90-008314; DOE/ER-60649/T2) Avail: NTIS HC A03/MF A01

The objectives were to: (1) synthesize analogues of 4-IQNB which exhibit lower lipophilicity, preferably similar to that of QNB; (2) prepare F-18 analogues of QNB; and (3) prepare analogues of 3-quinuclidinyl benzilate (QNB) containing a lipophilic chelate Tc-99m. DOE

N90-20622# School of Aerospace Medicine, Brooks AFB, TX. Human Systems Div.

THE UNITED STATES AIR FORCE SCHOOL OF AEROSPACE MEDICINE: SPECIAL REPORT Final Report, period ending 1989

TERRY A. BENLINE Nov. 1989 28 p
(AD-A217740; USAFSAM-SR-89-6) Avail: NTIS HC A03/MF A01 CSCL 06/5

Our business is conducted in three functional areas: science and technology, operational support, and aeromedical education and training. Although we are called the USAF School of Aerospace Medicine (USAFSAM), most of what we do is science and technology--about 70 percent of our manpower and about 85 percent of our budget are invested in science and technology. We do have an operational support role for the U.S. Air Force

(USAF), and that role is primarily in aerospace medical education, hyperbarics, and epidemiology. And, of course, we have an educational facility, which is here to provide training in aeromedical specialties and subspecialties, rather than general medical education per se. The medical training for the USAF is provided at Sheppard Air Force Base in Wichita Falls, Texas--training, for example, the pharmacy technicians, laboratory technicians, and corpsmen who work on the wards. The flight surgeons, their technicians, the aerospace physiologists, the bioenvironmental engineers, and the medical support people who are more related to the operational USAF, are trained here at USAFSAM. GRA

N90-20623# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

THE +GZ PROTECTION IN THE FUTURE: REVIEW OF SCIENTIFIC LITERATURE

FRED BUICK Nov. 1989 25 p
(AD-A217887; DCIEM-89-RR-47) Avail: NTIS HC A03/MF A01
CSCL 06/5

To reduce the incidence of G-induced loss of consciousness and enable pilots to operate their aircraft at higher levels of performance, anti-G protection must be improved. A G-suit and the anti-G straining maneuver will likely remain essential components of any anti-G system, but several methods potentially increasing G-tolerance were investigated that could supplement the protection afforded by these traditional techniques. Pharmacological agents are of no benefit, while breathing carbon dioxide, shown to improve G tolerance, is impractical. Positive pressure breathing has so convincingly improved G-protection that it will become an operational procedure in the immediate future. The benefits of the G-suit were augmented through greater coverage of the lower body and efforts are also aimed at more responsive G-valves. Altering body position to shorten the heart to head hydrostatic distance adds directly to the protection offered by the other procedures but can impair vision and must wait until the cockpit is redesigned. GRA

N90-20624# Army Research Inst. of Environmental Medicine, Natick, MA.

NIACIN INGESTED AT NIGHT CAUSES SEVERE HYPOTENSION

LOU A. STEPHENSON and MARGARET A. KOLKA Nov. 1989 30 p
(Contract DA PROJ. 3E1-62787-A-879)
(AD-A217896; USARIEM-M8-90) Avail: NTIS HC A03/MF A01
CSCL 06/5

Four healthy subjects were studied during rest while in a seated posture in a moderately warm environment ($T(a) = 30\text{ C}$, $rh = 23$ percent) at 0800 h and again between 1800 and 2100 h. Evening experiments were done approximately 4 h before each subject went to bed. Esophageal temperature ($T(es)$), mean weighted skin temperature ($T\text{ bar}(sk)$), forearm blood flow (FBF, venous occlusion plethysmography), skin blood flow (SkBF, laser Doppler velocimetry), mean arterial pressure (MAP) and heart rate (HR) were measured twice each minute. After instrumentation, a 15 minute control period was initiated. $T(es)$ and $T\text{ bar}(sk)$ were 0.4 (p less than or = 0.05) and 0.6 C higher at 1800 h than 0800 h. SkBF was 47 percent higher (p less than or = 0.05) and cutaneous vascular conductance (CVC) was 43 percent greater (p less than or = 0.05) at 1800 h. Five mg niacin per kg body weight was ingested after the control period. Since onset time for niacin effects showed individual variability, the data were compared during pretreatment, the time of maximal vasodilation, and when $T(es)$ was minimal. Niacin treatment during the morning and evening resulted in decreased $T(es)$ and MAP and increased $T\text{ bar}(sk)$, SkBF, FBF, heart rate, and CVC (p less than or = 0.05). Peak HR at 1800 h was 25 b min higher than at 0800 h (p less than or = 0.05). MAP decreased an average of 12 Torr in the morning experiments and nearly 16 Torr in the evening experiments. Two of the subjects experienced severe hypotension after niacin treatment at 1800 h. A diurnal factor, presumably influencing the responsiveness of the cardiovascular system, may play a role in the hypotensive effect of niacin at night. GRA

N90-20625# Army Research Inst. of Environmental Medicine, Natick, MA. Health and Performance Div.

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

JARED B. JOBE, BARBARA SHUKITT-HALE, LOUIS E. BANDERET, and PAUL B. ROCK Dec. 1989 25 p
(Contract DA PROJ. 3E1-62787-A-879)
(AD-A217897; USARIEM-M13-90) Avail: NTIS HC A02/MF A01
CSCL 06/15

The effects were examined of dexamethasone (a potent corticosteroid) to high terrestrial altitude on cognitive performance, affect, and personality traits. Cognitive performance was evaluated by 5 cognitive tasks, affect was evaluated by the Clyde Mood Scale and the Multiple Affect Adjective Check List, and personality traits were examined using the Minnesota Multiphasic Personality Inventory. Sixteen healthy young men received either dexamethasone (4 mg every 6 h) or placebo for 48 h prior to and 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 on the first day at altitude. No adverse effects on cognitive performance, affect, or personality traits were noted after dexamethasone was discontinued on the third day at altitude. Results indicated that dexamethasone at the present dose positively influences cognitive performance and mood states at altitude, but it does not affect personality traits. GRA

N90-20626# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

THE EFFECT OF MOISTURE ABSORPTION IN CLOTHING ON THE HUMAN HEAT BALANCE Final Report

W. A. LOTENS and G. HAVENITH 6 Oct. 1989 36 p Sponsored by Organisation voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
(AD-A217899; IZF-1989-32) Avail: NTIS HC A03/MF A01
CSCL 11/5

A theory of moisture absorption in clothing, with the associated effects of heat transfer, was developed based on the assumption that clothing can be regarded as a moisture buffering capacitor enclosed between heat and vapor resistances, and covered with the adjacent air layer. The theory was checked with an experiment involving four subjects. They wore heavy woolen clothing, which was either initially dried or wetted, in both a warm and a cool environment. The experimental results confirmed satisfactorily the theoretical predictions that: (1) the dry and evaporative heat loss will change in time and will both converge for the dry and moist garments to the equilibrium condition, (2) the clothing surface temperature and humidity are bound to a straight line on the psychrometric chart, (3) dry garments cause higher heat strain than wet garments, (4) the time course is predictable from the buffering capacity of the clothing and the heat transfer coefficient, and (5) the apparent heat and moisture transfer coefficients are bound to a linear relationship, revealing the true values only during equilibrium. Contrary to the expectation the observed vapor resistance is lower in the heat than in the cold, probably due to differences in sweat distribution. GRA

N90-20627# Medical Coll. of Virginia, Richmond. Dept. of Physical Therapy.

THE RELIABILITY OF CLINICAL MEASUREMENTS OF FORWARD BENDING OBTAINED BY THE USE OF THE MODIFIED FINGERTIP-TO-FLOOR METHOD M.S. Thesis

MICHAEL GEORGE GAUVIN 18 Aug. 1989 121 p Sponsored by AFIT, Wright-Patterson AFB, OH
(AD-A217907; AFIT/CI/CIA-89-154) Avail: NTIS HC A06/MF A01 CSCL 06/5

The purpose was to examine the intra- and inter-tester reliability of measurements obtained using a modified version of the fingertip-to-floor (FTF) method of assessing forward bending. With the modified FTF (MFTF) method patients stand on a stool and forward bend so that measurements can be taken on patients who are able to reach beyond the floor. Randomly paired physical

therapists took repeated MFTF measurements on 73 patients with low back pain. Intraclass correlation coefficients (ICC) were calculated for intra- and inter-tester reliability. The ICC value for intra-tester reliability was 0.98 and the ICC value for inter-tester reliability was 0.95. The results suggest that measurements of forward bending obtained on patients with low back pain using the MFTF method are highly reliable. GRA

N90-20628# Army Research Inst. of Environmental Medicine, Natick, MA. Exercise Physiology Div.

THE EFFECTS OF HIGH INTENSITY CYCLE EXERCISE ON SYMPATHO-ADRENAL-MEDULLARY RESPONSE PATTERNS
WILLIAM J. KRAEMER, JOHN F. PATTON, HOWARD G. KNUTTGEN, CHARLES J. HANNAN, THOMAS KETTLER, SCOTT E. GORDON, JOSEPH E. DZIADOS, ANDREW C. FRY, PETER N. FRYKMAN, and EVERETT A. HARMAN 1989 33 p Prepared in cooperation with Madigan Army Medical Center, Takoma, WA and Pennsylvania State Univ., University Park.

(AD-A217962) Avail: NTIS HC A03/MF A01 CSCL 06/5

Plasma proenkephalin Peptide F immunoreactivity (ir) and catecholamines were examined before and after maximal exercise to exhaustion at four intensities 36, 55, 73 and 100 percent maximal leg power (MLP) by means of a high resistance cycle ergometer. All intensities were greater than those eliciting peak O₂ uptake for the individual subjects. Blood samples were obtained immediately after exercise and at 5 and 15 min post-exercise. Data suggest that exercise-induced increases may be the result of non-colinear storage and release mechanisms in the adrenal medulla. GRA

N90-20629# Army Research Inst. of Environmental Medicine, Natick, MA.

HYDRATION EFFECTS ON HUMAN PHYSIOLOGY AND EXERCISE-HEAT PERFORMANCE

MICHAEL N. SAWKA, ANDREW J. YOUNG, WILLIAM A. LATZKA, P. DARRELL NEUFER, and KENT B. PANDOLF Nov. 1989 72 p

(Contract DA PROJ. 3E1-162787-A-879)

(AD-A217969; USARIEM-T7-90) Avail: NTIS HC A04/MF A01 CSCL 06/10

During exercise in the heat, sweat output often exceeds water intake resulting in hypohydration, which defined as body fluid deficit. This fluid deficit is comprised of water loss from both the intracellular and extracellular fluid compartments. There is no evidence that hypohydration can benefit exercise performance; in addition, man cannot adapt to chronic dehydration. Exercise tasks that primarily require aerobic metabolism and that are prolonged will more likely be adversely influenced by hypohydration than exercise tasks that require anaerobic metabolism as well as muscular strength and power. Likewise, the warmer the environmental temperature, the greater the potential for hypohydration to cause decrements in all types of exercise performance. Hypohydration causes a greater heat storage and reduces endurance as well as maximal effort exercise performance in comparison to euhydration levels. The greater heat storage is mediated by a decreased sweating rate (evaporative heat loss) as well as by a decreased cutaneous blood flow (dry heat loss). These response decrements were attributed to both a plasma hyperosmolality and a reduced blood volume. The reduced blood volume also makes it difficult to maintain an adequate cardiac output during exercise-heat stress. Finally, preliminary data indicate that hypohydration does not alter muscle glycogen utilization during exercise or the glycogen resynthesis during recovery from exercise. GRA

N90-20630# Michigan Univ., Ann Arbor.

THREE-DIMENSIONAL MEDICAL IMAGE ANALYSIS USING LOCAL DYNAMIC ALGORITHM SELECTION ON A MULTIPLE-INSTRUCTION, MULTIPLE-DATA ARCHITECTURE Ph.D. Thesis

MARTIN ROBERT STYTZ 1989 493 p Sponsored by AFIT, Wright-Patterson AFB, OH

(AD-A218024; AFIT/CI/CIA-89-158) Avail: NTIS HC A21/MF A03 CSCL 06/4

The dissertation outlines development of a medical imaging machine which renders 3D images from voxel data within a MIMD multiprocessor architecture at interactive rates. Interactive performance is achieved using local dynamic selection of the optimum adaptive recursive hidden-surface removal algorithm. A survey of the medical imaging, graphics, and medical imaging modality literature is provided. A description of Computerized Technology, Magnetic Resonance Imaging, Positron Emission Tomography, Single Photon Emission Computed Tomography, and Ultrasound imaging modalities is presented. Previous work in 3D volume rendering graphics techniques and data models is introduced. Eleven medical imaging machines are examined with emphasis on characterization of the major innovation(s) and performance of each machine. A five stage image processing pipeline is described. GRA

N90-20631# Naval Aerospace Medical Research Lab., Pensacola, FL.

A COMPARISON OF THE MECHANISMS OF COLD- AND MICROGRAVITY-INDUCED FLUID LOSS

D. J. HERRIGAN, JR. and W. G. LOTZ 10 Aug. 1989 13 p (AD-A218098; NAMRL-TM-89-3) Avail: NTIS HC A03/MF A01 CSCL 06/10

The physiological mechanisms involved in the diuresis and overall fluid loss associated with exposure to cold or microgravity environments are compared. Although the data available to thoroughly describe these responses are yet unavailable, some similarities in the changes caused by these different stimuli are apparent. The central mechanism common to the physiological responses to both these environments is an increase in central blood volume. The common endpoint of a net loss in body fluids and electrolytes is also clear. Differences in the response patterns also exist. The differences are evaluated, and the value of additional research in both areas, with potentially mutually beneficial results, is considered. GRA

N90-20632# Air Force Inst. of Tech., Wright-Patterson AFB, OH.

DETECTION ACUITY IN THE PERIPHERAL RETINA M.S.

Thesis - Indiana Univ.

FRANK E. CHENEY, JR. 1989 164 p (AD-A218183; AFIT/CI/CIA-89-166) Avail: NTIS HC A08/MF A01 CSCL 06/4

One of the goals in exploring vision is to isolate the role each successive part of the visual system plays in transforming an external visual stimulus into a visual percept. This requires that methods be used which can separately test the pre-retinal, retinal and post-retinal contributions. New electrophysiological and psychophysical techniques are enabling us to probe more accurately these individual components. By integrating and correlating these findings with known anatomical and psychophysical findings, investigators attempt to form a consistent model which can describe how the visual system functions. However, the information gained from investigating separate components, though essential to our total understanding of the system, will frequently seem misleading until the interactions of all the other components have been determined. This certainly has been true for this experiment. GRA

N90-20633# Army Research Inst. of Environmental Medicine, Natick, MA. Exercise Physiology Div.

THE EFFECTS OF GRADED EXERCISE AT SEA LEVEL ON PLASMA PROENKEPHALIN PEPTIDE F AND CATECHOLAMINE RESPONSES

WILLIAM J. KRAEMER, JOSEPH E. DZIADOS, SCOTT E. GORDON, ANDREW C. FRY, and KATY L. REYNOLDS 1989 22 p Prepared in cooperation with Pennsylvania State Univ., University Park

(AD-A218195; USARIEM-M5-90) Avail: NTIS HC A03/MF A01 CSCL 06/10

The effects were evaluated of graded treadmill exercise on

plasma proenkephalin Peptide F immunoreactivity (ir) and catecholamine responses. Little data exists regarding the sea level responses of plasma Peptide F ir to exercise. Thirty-five healthy male subjects performed a graded exercise test on a motor-driven treadmill at the exercise intensities of 25, 50, 75, and 100 percent of VO₂max. Significant increases above rest were observed for plasma Peptide F ir and norepinephrine at 75 and 100 percent of VO₂max and at 5 min into recovery. Significant increases in plasma epinephrine were observed at 75 and 100 percent of VO₂max. Whole blood lactate significantly increased above resting values at 50, 75 and 100 percent of the VO₂max and at 5 min into recovery. These data demonstrate that exercise increases plasma Peptide F ir levels at sea level. While the exercise response patterns of Peptide F ir are similar to catecholamines and blood lactate responses, no bi-variate relationships were observed. These data show that sea level response patterns to graded exercise are similar to those previously observed at moderate altitude (2200 m). GRA

N90-20634# Army Aeromedical Research Unit, Fort Rucker, AL. Biodynamics Research Div.

SIMULATOR SICKNESS IN THE CH-47 (CHINOOK) FLIGHT SIMULATOR

DANIEL J. GOWER, JR., JENNIFER FOWLKES, and DENNIS R. BALTZLEY (Essex Corp., Orlando, FL.) Sep. 1989 72 p (AD-A218214; USAARL-89-28) Avail: NTIS HC A04/MF A01 CSCL 06/10

The principal goal in this field study was to assess the incidence of simulator sickness in the CH-47 flight simulator. The results show that this simulator produces a lower incidence of simulator sickness than the three other Army visually coupled flight simulators. Eighteen percent of the sample may be at risk for simulator-induced posteffects. Eyestrain and headache were leading symptoms of asthenopia, while fatigue and sweating were leading symptoms associated with motion sickness. Of possible impact on the results are the sample of aviators surveyed and the scenarios flown. None of the aviators sampled were in a training/qualification status. All were rated in the CH-47 and flying for continuation and proficiency. Therefore, it could be assumed the scenarios flown were less structured and flown by aviators familiar with both the aircraft that does not fly a large amount of high maneuver content missions. This could lead to lower amounts of provocative scene variables such as low-level flight, maneuvering in close proximity to the ground, and high speed turns. Forty-eight percent of the pilots' and thirty-seven percent of the copilots' missions were under instrument conditions. Such a large percentage of time spent with no scene content could account for some of the lower SSQ scores. The use of NVGs in the CH-47 simulator is associated with higher scores on the SSQ.

GRA

N90-20635# Army Research Inst. of Environmental Medicine, Natick, MA.

FIELD ASSESSMENT OF WET BULB GLOBE TEMPERATURE: PRESENT AND FUTURE Final Report, Jun. 1986 - Aug. 1989

ROBERT WHANG, WILLIAM T. MATTHEW, JOHN CHRISTIANSEN, BILLIE BROWN, GLENN THOMAS, MADELEINE S. ROSE, PATRICIA C. SZLYK, LAWRENCE ARMSTRONG, and FRANK J. SCHATZLE (Gulf Weather Corp., Bay Saint Louis, MS.) 29 Aug. 1989 17 p (AD-A218224) Avail: NTIS HC A03/MF A01 CSCL 06/10

Existing doctrinal guidance for preventing heat injury in military settings is based on measurements of the Wet Bulb Globe Temperature (WBGT) index. An existing military WBGT measurement device (NSN 6665-00-159-2218) was employed by a U.S. Army Reserve unit during field training exercises at Fort Bliss, TX in 1986, Tinker AFB, OK in 1987, and Fort Hood, TX in 1988. The majority of heat casualties seen in these three exercises (31 out of 35) occurred when the daily maximum WBGT index exceeded 85 F. Experiences of this unit suggest that a strictly enforced, WBGT-based, heat injury prevention program was effective in minimizing both the number and severity of heat-related injuries. During the exercises at Fort Hood in 1988, a preliminary

evaluation of methods to obtain WBGT information from polar orbiting weather satellites was conducted. Data from 11 satellite passes were obtained and the average error, or bias, of the satellite-derived WBGT values was found to be -1.8 F (too low) with a variation (standard deviation) of + or - 3.7 F around that bias. Work is in progress to improve this future heat stress assessment technology. GRA

N90-20636# Army Research Inst. of Environmental Medicine, Natick, MA.

EFFECTIVE CALIBRATION OF HEAT FLUX TRANSDUCERS FOR EXPERIMENTAL USE

STEPHEN KW. CHANG, THOMAS L. ENDRUSICK, JAMES E. BOGART, and RICHARD R. GONZALEZ Jan. 1990 24 p (Contract DA PROJ. 3E1-62787-A-878) (AD-A218262; USARIEM-T8-90) Avail: NTIS HC A03/MF A01 CSCL 06/12

Cutaneous heat flux data provide important information when evaluating the effectiveness of chemical protective antidotal drugs and assessing physiological responses during heat and cold environmental stress. A method of calibrating heat flux transducers (HFTs) using the USARIEM Hohenstein skin model system is described. A representative sample of the currently available types of HFTs were tested and their results confirmed that the factory supplied calibration constants should not be used for collecting experimental data. The HFT application procedure described must also be subscribed to for attaching the HFT on human subjects. The adherence to a standard procedure ensures that the newly recalibrated constants are applicable, and avoids as much as possible any extraneous steps where error could be introduced. Employing this standard attachment method, the newly calibrated HFT constants were found to deviate from the factory supplied values by as much as 24 percent. It is recommended that heat flux transducers be recalibrated before each protocol study using techniques described with the Hohenstein skin model. GRA

N90-20637# Army Research Inst. of Environmental Medicine, Natick, MA.

WHAT SHOULD ATHLETES KNOW ABOUT LOW BODY TEMPERATURE (HYPOTHERMIA)

LAWRENCE E. ARMSTRONG 30 Oct. 1989 4 p (AD-A218316) Avail: NTIS HC A01/MF A01 CSCL 06/10

Athletes exposed to cold, wet environmental conditions for a long period of time are susceptible to hypothermia. This brief article is written in an ask the expert format per request of the journal editor. This article outlines the signs of hypothermia, recommended first aid, predisposing factors, and preventative measures that can be taken. GRA

N90-21517 Pennsylvania State Univ., University Park.

KINEMATIC AND KINETIC ANALYSES OF DROP LANDINGS Ph.D. Thesis

JILL LYNN MCNITT-GRAY 1989 163 p Avail: Univ. Microfilms Order No. DA8922084

During a landing impact, large forces which create the potential for injury are applied to the human body. In particular, the risk to the lower extremities during gymnastics landings has been proven to be high. The forces experienced may be modified by the human by selectively controlling the joint motion. To determine the effect of impact velocity (2.5 to 5.0 m/s) and landing experience on the strategy selected, the preferred landing strategies used by six male collegiate gymnasts and six male recreational athletes from three drop heights (.32 to 1.28 m) were characterized using mechanical descriptors. Kinematic and kinetic 2D data were acquired simultaneously using high speed film (202.4 fps) and a force plate (1000 Hz). Reaction forces, net joint moments, lower extremity joint motion, joint work, and the generated momentum of each segment were used to characterize the strategies. Results indicated that statistically significant (ANOVA, p less than .05) increases in joint flexion (with the exception of ankle joint flexion), angular velocity, net moments, work, and impact force resulted as impact velocity increased. Gymnasts and recreational athletes demonstrated similar adjustment patterns to increases in landing

impact velocities; however, significant differences in degree of joint flexion and total landing phase time over impact velocity conditions were found. Dissert. Abstr.

N90-21518# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

SPACE ADAPTATION SYNDROME INDUCED BY A LONG DURATION +3GX CENTRIFUGE RUN Final Report

W. BLES, J. E. BOS, R. FURRER, B. DEGRAAF, R. J. A. W. HOSMAN, H. W. KORTSCHOT, J. R. KRÖL, A. KUIPERS, J. T. MARCUS, E. MESSERSCHMID (Stuttgart Univ., Germany, F.R.) et al. 31 Jul. 1989 45 p (AD-A218248; IZF-1989-25; TDCK-89-1055) Avail: NTIS HC A03/MF A01 CSCL 06/10

The three European scientists astronauts of the D1 Spacelab Mission were exposed to a 1 1/2 hours +3G centrifuge run in supine position resulting in a linear acceleration along the x-axis (3Gx). Afterwards they experienced motion sickness symptoms which were for each of the astronauts similar to the symptoms of the Space Adaption Syndrome as experienced during their space flight in 1985. These motion sickness symptoms lasted up to 6 hours. In otolith function tests following the centrifuge run, changes in visual vestibular interaction were observed which replicated findings obtained immediately after their space flight. GRA

N90-21519* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

RAPIDLY QUANTIFYING THE RELATIVE DISTENTION OF A HUMAN BLADDER Patent

JOHN A. COMPANION, inventor (to NASA), JOSEPH S. HEYMAN, inventor (to NASA), BETH A. MINEO, inventor (to NASA), ALBERT R. CAVALIER, inventor (to NASA), and TRAVIS N. BLALOCK, inventor (to NASA) (Department of Education, Washington, DC.) 1 Aug. 1989 13 p Filed 10 Nov. 1987 Continuation-in-part of US-Patent-Appl-SN-929869, filed 13 Nov. 1986, abandoned (NASA-CASE-LAR-13901-1-NP; US-PATENT-4,852,578; US-PATENT-APPL-SN-118993; US-PATENT-APPL-SN-929869; US-PATENT-CLASS-128-661.03) Avail: US Patent and Trademark Office CSCL 06/2

A device and method of rapidly quantifying the relative distention of the bladder in a human subject are disclosed. The ultrasonic transducer which is positioned on the subject in proximity to the bladder is excited by a pulser under the command of a microprocessor to launch an acoustic wave into the patient. This wave interacts with the bladder walls and is reflected back to the ultrasonic transducer, when it is received, amplified and processed by the receiver. The resulting signal is digitized by an analog-to-digital converter under the command of the microprocessor and is stored in the data memory. The software in the microprocessor determines the relative distention of the bladder as a function of the propagated ultrasonic energy; and based on programmed scientific measurements and individual, anatomical, and behavioral characteristics of the specific subject as contained in the program memory, sends out a signal to turn on any or all of the audible alarm, the visible alarm, the tactile alarm, and the remote wireless alarm.

Official Gazette of the U.S. Patent and Trademark Office

N90-21520# Australian Radiation Lab., Melbourne.

PROCEEDINGS OF A WORKSHOP ON CARCINOGENIC POTENTIAL OF EXTREMELY LOW FREQUENCY MAGNETIC FIELDS

VINCENT DELPIZZO, ed. and DONALD W. KEAM, ed. Feb. 1989 177 p Workshop held in Melbourne (Australia), 17 May 1988 (DE90-614340; ARL/TR-082; CONF-8805357) Avail: NTIS (US Sales Only) HC A09/MF A01

The debate over the suspected link between Extremely Low Frequency (ELF) magnetic fields and cancer is entering its second decade, but the end is not in sight. The epidemiological evidence is now somewhat stronger, mainly due to the Savitz study of residential exposure and childhood cancer, but far from overwhelming. The results of in-vitro studies are fragmentary,

sometimes contradictory and, overall, confusing. Well designed animal studies are virtually non-existent. A plausible biological model has not yet been established. Although scant, the present body of knowledge is very complex encompassing several disciplines and this workshop brought together researchers of vastly different backgrounds. The nine papers presented deal with an overview of ELF and cancer; the biochemistry of processes implicated in ELF carcinogenesis; possible mechanisms of cancer promotion; the status of in-vitro ELF cellular interactions; epidemiological studies, both occupational and residential, and the use of wire coding configurations as indicators of magnetic field exposures in such studies. Discussion follows each paper. DOE

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BEHAVIORAL SCIENCES

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

A90-32599

ISCHEMIA RISK FACTORS IN FLIGHT PERSONNEL AND THE FEASIBILITY OF PREDICTING CORONARY ATHEROSCLEROSIS [FAKTORY RISK A ISHEMICHESKOI BOLEZNI SERD TSA U LETNOGO SOSTAVA I VEROIATNOST' PROGNOZIROVANIJA KORONARNOGO ATEROSKLEROZA]

V. V. CHUNTUL Voenno-Meditinskii Zhurnal (ISSN 0026-9050), Jan. 1990, p. 53-56. In Russian.

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The role of risk factors in forecasting in flight personnel the possibility of developing coronary atherosclerosis were investigated in two groups of flight and engineering/technical ground-based personnel: (1) a group of 437 pilots and 96 ground-based personnel aged between 31 and 40, and (2) a group of 365 pilots and 88 ground-based personnel aged between 41 and 50. Risk factors considered included hyperlipidemia, excess body weight (EBW), smoking, hypokinesia (H), arterial hypertension, and the psychoemotional factor. Of these, the EBW, H, and arterial hypertension were found to be most informative. Subjects who had one or more of these risk factors were 1.5 to 2 times more likely to be disqualified as pilots on the basis of ischemic symptoms than subjects who had no risk factors. I.S.

A90-33062*# California Univ., Davis.

MODEL FOR HUMAN USE OF MOTION CUES IN VEHICULAR CONTROL

RONALD A. HESS (California, University, Davis) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 13, May-June 1990, p. 476-482. refs

(Contract NAG2-482)

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A feedback model for human use of motion cues in tracking and regulation tasks is offered. The motion cue model is developed as a simple extension of a structural model of the human pilot, although other equivalent dynamic representations of the pilot could be used in place of the structural model. In the structural model, it is hypothesized that proprioceptive cues and an internal representation of the vehicle dynamics allow the human to create compensation characteristics that are appropriate for the dynamics of the particular vehicle being controlled. It is shown that an additional loop closure involving motion feedback can improve the pilot/vehicle dynamics by decreasing high-frequency phase lags in the effective open-loop system transfer function. Data from a roll-attitude tracking/regulation task conducted on a moving base simulator are used to verify the modeling approach. Author

A90-33327* Georgia State Univ., Atlanta.

THE NASA/LRC COMPUTERIZED TEST SYSTEM

W. KIRK RICHARDSON, DAVID A. WASHBURN, WILLIAM D. HOPKINS, E. SUE SAVAGE-RUMBAUGH, and DUANE M.

RUMBAUGH (Georgia State University, Atlanta) Behavior Research Methods, Instruments, and Computers (ISSN 0743-3838), vol. 22, no. 2, 1990, p. 127-131. Research supported by Georgia State University and NIH. refs
(Contract NAG2-438)

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A new testing package, including apparatus and tasks for the behavioral study of a number of species in a variety of experiments is presented. The package is described with respect to the kinds of comparative psychological investigations for which it is best suited. The preliminary data generated within this new testing paradigm demonstrate that the NASA/LRC Computerized Test System provides a flexible yet powerful environment for the investigation of behavioral and psychological processes. R.E.P.

A90-33658

PERFORMANCE AND QUALITY OF SLEEP WEARING NBC PROTECTIVE CLOTHING

ALISON S. ROGERS, BARBARA M. STONE, M. B. SPENCER, and P. C. BRIDGES (RAF, Institute of Aviation Medicine, Farnborough, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, May 1990, p. 418-423. refs
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Two separate studies were carried out to investigate the effect of wearing nuclear-biological-chemical aircrew equipment assembly (NBC AEA) protective clothing on performance and on overnight sleep. Performance at a series of tasks was measured, in six male subjects, during the day (0800-2000 hours) and at night (2000-0800 hours). Wearing the NBC assembly did not lead to significant decrements in performance compared with the normal aircrew equipment assembly (AEA). The sleep of six male volunteers was recorded electroencephalographically on two consecutive nights when NBC protective clothing was worn. Sleep was both shortened and disturbed, compared with overnight control sleep. There were some improvements on the second night, suggesting that individuals may adapt to wearing the NBC assembly. Author

A90-34001* Georgia State Univ., Atlanta.

COMPARATIVE PSYCHOLOGY AND THE GREAT APES - THEIR COMPETENCE IN LEARNING, LANGUAGE, AND NUMBERS

DUANE M. RUMBAUGH (Georgia State University, Atlanta) Psychological Record (ISSN 0340-0727), vol. 40, 1990, p. 15-39. Research supported by Georgia State University and NIH. refs
(Contract NAG2-438)
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An overview of comparative studies conducted for the past three decades is presented. These studies have led to the establishment of the Language Research Center that provides facilities for research into questions of primate behavior and cognition. Several experiments conducted among chimpanzees are discussed and comparative analyses with the lesser apes, monkeys, and humans are offered. Among the primates, brain complexity varies widely and the evidence is strong that encephalization and enhanced brain complexity facilitate the learning of concepts, the transfer of learning to an advantage, and mediational and observational learning. R.E.P.

A90-34676

ELECTROPHYSIOLOGICAL INVESTIGATION OF THE FUNCTIONAL ORGANIZATION OF THE HUMAN BRAIN UNDER CONDITIONS OF SELECTIVE ATTENTION. I - NORMAL ADULTS [ELEKTROFIZIOLOGICHESKOE ISSLEDOVANIE FUNKTSIONAL'NOI ORGANIZATSII MOZGA CHELOVEKA PRI NAPRAVLENNOM VNIMANII. I - VZROSLYE V NORME]

N. O. MACHINSKII, R. I. MACHINSKAIA, and V. D. TRUSH (Akademiia Pedagogicheskikh Nauk SSSR, Nauchno-Issledovatel'skii Institut Defektologii, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 16, Mar.-Apr. 1990, p. 5-16. In Russian. refs
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The role of the prestimulus period in the functional organization of the brain during the concentration of attention, and in the subsequent analysis of relevant stimuli, was investigated by studying the electrical activity of the alpha-range EEG and evoked potentials (EPs) in various regions of the brain of human subjects tested during a single experiment. Three types of relevant stimuli, i.e., tactile, auditory, and visual, were presented in either short (10 msec) or long (15-25 msec) variants, which the subjects could perceive as either single and weak or double and strong. Results indicated that there were two processes accompanying selective attention accompanying a signal expectation: generalized shifts of the functional state of the cortex (expressed mainly in the lowering of the magnitude of basic biopotential rhythm) and localized selected changes. The spatial distribution of the local changes in electrical activity in the prestimulus period was determined by the type of expected stimulus. I.S.

N90-20638# Navy Personnel Research and Development Center, San Diego, CA.

BRAIN ACTIVITY DURING TACTICAL DECISION-MAKING.

PART 3: RELATIONSHIPS BETWEEN PROBE-EVOKED POTENTIALS, SIMULATION PERFORMANCE, AND ON-JOB PERFORMANCE Interim Report No. 3, Sep. 1988 - Oct. 1989

LEONARD J. TREJO, GREGORY W. LEWIS, and MARK H. BLANKENSHIP Jan. 1990 25 p
(AD-A217207; NPRDC-TN-90-9) Avail: NTIS HC A03/MF A01
CSCL 05/8

This report, the third in a series, addresses the use of event related potentials (ERPs) to predict the decision making performance of combat system operators. We describe the relationships between individual measures of probe-ERP amplitude, and both task and on-job performance in 30 military subjects.

GRA

N90-20639# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

THE ROLE OF CHAOS IN HEMISPHERIC PROCESS AND

ATTENTION Technical Report, Nov. 1987 - Nov. 1989

MICHAEL D. MCNEESE Nov. 1989 27 p
(AD-A217674; AAMRL-TR-89-043) Avail: NTIS HC A03/MF A01
CSCL 05/8

The recent application of chaos theory to interpret various brain functions suggests it's usefulness for understanding potentially confusing and often conflictual results in the area of hemispheric processing. There appears to be inherent relationships between elements of chaos theory and the nature of hemispheric processes especially when viewed from an attentional resources perspective. The goal is to elucidate these relations by interpreting some data on hemispheric pattern recognition in a chaos theory framework. In order to interpret such data, theoretical models as well as specific concepts in attention, hemispheric processing, and chaos is reviewed. A chaos-attentional model is proposed along with certain rules of determination that predict the appearance of chaos in hemispheric processes. In conclusion, some recent metaphors for Hofstadter (1979, 1985) that are supportive of this view of cognitive process are addressed. GRA

N90-20640# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

THE BOUNDARIES OF HEMISPHERIC PROCESSING IN VISUAL PATTERN RECOGNITION Final Report, Jan. 1987 - Nov. 1989

MICHAEL D. MCNEESE Nov. 1989 26 p
(AD-A217675; AAMRL-TR-89-042) Avail: NTIS HC A03/MF A01
CSCL 05/8

Some of the positions, theories, and experiments which compose the adaptive hemispheric processing area are discussed. This discussion addresses some of the basic questions of human learning and relates some of the assumptions that are critical for interpreting research findings. Some theoretical perspectives are examined, then some of the author's own research application in hemispheric processing within the area of face recognition and

attentional processes is studied. A neuro-cognitive systems model of results is proposed to interpret findings. GRA

N90-20641# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

LATERAL ASYMMETRY IN PATTERN RECOGNITION: UNDERSTANDING THE EFFECTS OF FAMILIARITY, DISTINCTION, AND PERSPECTIVE CHANGE Technical Report, Jan. 1987 - Nov. 1989

MICHAEL D. MCNEESE Nov. 1989 25 p
(AD-A217739; AAMRL-TR-89-049) Avail: NTIS HC A03/MF A01 CSCL 05/8

The effects of perspective change and familiarity upon lateral asymmetry for a face recognition task are analyzed based on the results of several experiments. A four choice match-to-sample procedure involved frontal target perspective faces and choice sets which contained faces in either front perspective, 3/4 perspective, or side perspective faces. The study assesses the effects of stimulus familiarity and distinctiveness. Results taken from analysis of variance, multidimensional scaling, and hierarchical cluster analysis suggests complex relationships between the sensitivity of faces and the ensuing development of familiarity. Conclusions are drawn in terms of implications for interpreting higher order cognition in laterality studies. GRA

N90-20642# Air Force Human Resources Lab., Brooks AFB, TX. Manpower and Personnel Div.

ROLE OF COGNITIVE FACTORS IN THE ACQUISITION OF COGNITIVE SKILL Interim Report, Nov. 1986 - Jan. 1989

PATRICK C. KYLLONEN and DAN J. WOLTZ Jan. 1990 36 p
Submitted for publication
(AD-A218069; AFHRL-TP-89-5) Avail: NTIS HC A03/MF A01 CSCL 05/8

Recent studies are reviewed and a theoretical framework is provided for examining the relationships between individual differences in basic cognitive abilities and performance on tasks involving the acquisition of cognitive skill. A claim made is that much of cognitive skill can be characterized as knowledge of how operators (symbols denoting an operation to be performed) in a skill domain actually work, and knowledge of when to apply operators to achieve problem solving goals. Studies of declarative learning, assumed to be the initial stage in skill acquisition, show that background knowledge and working memory capacity are primary determinants of success. Studies of cognitive skill learning per se make use of a distinction between attention capacity, which refers to how much information can be held in working memory at one time, and activation capacity, which refers to how long activation can be maintained. The success of learning by proceduralization is shown to depend on attention capacity, whereas the success of learning by composition is shown to depend additionally on activation capacity. Future research and the benefits of an individual differences approach to analyzing cognitive skill acquisition are discussed. GRA

N90-20643# Alphatech, Inc., Burlington, MA.
INFORMATION GATHERING AND DECISIONMAKING UNDER STRESS

ELLIOT E. ENTIN and DANIEL SERFATY Jan. 1990 83 p
(Contract N00014-88-K-0545)
(AD-A218233; AD-E501191; TR-454) Avail: NTIS HC A05/MF A01 CSCL 05/8

An experiment to investigate the effects of cognitive stress on decisionmaking performance is described. The paradigm involves a single decisionmaker (DM) whose job is to classify a submarine sonar return as coming from a friendly or enemy boat, on the basis of difference in average pump noise frequency between the two classes. After being given the value of the unknown submarine's measured pump frequency, the subject may classify the submarine or (for a cost) ask for more information. This information is chosen to be either another raw measurement (probe) or the opinion of an automated consultant. Cognitive stress is operationalized through time pressure and an intrusive secondary task. Two distinct subject populations are used: civilian (engineering

firm employees and college students) and military (grade 0 to 4 or above). Four independent variables manipulated: stress level, discrimination difficulty, relative information cost between measurement and opinion, and consultant expertise relative to the subject's measurement. GRA

N90-20644# Colorado Univ., Boulder. Dept. of Psychology.
A LONG-TERM RETENTION ADVANTAGE FOR SPATIAL INFORMATION LEARNED NATURALLY AND IN THE LABORATORY Ph.D. Thesis

WILLIAM THOMAS WITTMAN 1989 202 p
(Contract MDA903-86-K-0155)
(AD-A218268; AFIT/CI/CIA-89-128) Avail: NTIS HC A10/MF A02 CSCL 05/8

The long-term retention characteristics of three memory components learned both naturally and in the laboratory were investigated. Using a cued recall procedure, 48 college students were asked to recall the spatial, temporal, and item components of their own semester schedules (Experiment 2), or a fictitious schedule (Experiment 2). In completing class schedule questionnaires, students were both cued with and asked to recall these three components. GRA

N90-21521*# Essex Corp., Orlando, FL.
DEVELOPMENT OF MICROCOMPUTER-BASED MENTAL ACUITY TESTS FOR REPEATED-MEASURES STUDIES Final Report

R. S. KENNEDY, R. L. WILKES, D. R. BALTZLEY, and J. E. FOWLKES 25 Jan. 1990 73 p
(Contract NAS9-17326)
(NASA-CR-185607; NAS 1.26:185607) Avail: NTIS HC A04/MF A01 CSCL 05/9

The purpose of this report is to detail the development of the Automated Performance Test System (APTS), a computer battery of mental acuity tests that can be used to assess human performance in the presence of toxic elements and environmental stressors. There were four objectives in the development of APTS. First, the technical requirements for developing APTS followed the tenets of the classical theory of mental tests which required that tests meet set criteria like stability and reliability (the lack of which constitutes insensitivity). To be employed in the study of the exotic conditions of protracted space flight, a battery with multiple parallel forms is required. The second criteria was for the battery to have factorial multidimensionality and the third was for the battery to be sensitive to factors known to compromise performance. A fourth objective was for the tests to converge on the abilities entailed in mission specialist tasks. A series of studies is reported in which candidate APTS tests were subjected to an examination of their psychometric properties for repeated-measures testing. From this work, tests were selected that possessed the requisite metric properties of stability, reliability, and factor richness. In addition, studies are reported which demonstrate the predictive validity of the tests to holistic measures of intelligence. Author

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A90-32110* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

QUASI-CONFORMAL REMAPPING FOR COMPENSATION OF HUMAN VISUAL FIELD DEFECTS - ADVANCES IN IMAGE REMAPPING FOR HUMAN FIELD DEFECTS

RICHARD D. JUDAY (NASA, Johnson Space Center, Houston, TX) and DAVID S. LOSHIN (Houston, University, TX) IN: Optical pattern recognition; Proceedings of the Meeting, Los Angeles, CA,

Jan. 17, 18, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 124-130. Research supported by the U.S. Army and NASA.

(Contract NIH-EY-07007)

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Image coordinate transformations are investigated for possible use in a low vision aid for human patients. These patients typically have field defects with localized retinal dysfunction predominately central (age related maculopathy) or peripheral (retinitis pigmentosa). Previously simple eccentricity-only remappings which do not maintain conformality were shown. Initial attempts on developing images which hold quasi-conformality after remapping are presented. Although the quasi-conformal images may have less local distortion, there are discontinuities in the image which may counterindicate this type of transformation for the low vision application. Author

A90-33639

AUTOMATION AND ROBOTICS (A&R) ON-BOARD

MARC TOUSSAINT (ESA, Space Station and Platforms Directorate, Paris, France) (ESA, BMFT, Ministero per il Coordinamento della Ricerca Scientifica e Tecnologica, et al., Columbus Symposium on Space Station Utilization, 5th, Capri, Italy, July 3-7, 1989) Space Technology - Industrial and Commercial Applications (ISSN 0892-9270), vol. 10, no. 1-2, 1990, p. 105-108.

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The A&R development and implementation issues in the framework of the Columbus program are summarized. Automation areas in the attached laboratory and in the free flyer are described. The rationale behind the A&R and its advantages, such as an increase in mission productivity and probability of success, are discussed. The A&R preparatory activities in the Columbus program, review of user requirements for A&R, the Columbus A&R ground testbed (CAT), and the A&R in-orbit demonstration (AID) mission, are discussed. N.B.

N90-20055# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Systems Div.

DEVELOPMENT OF ACCELERATION EXPOSURE LIMITS FOR ADVANCED ESCAPE SYSTEMS

JAMES W. BRINKLEY, LAWRENCE J. SPECKER, and STEPHEN E. MOSHER (DynCorp., Wright-Patterson AFB, OH.) /n AGARD, Implications of Advanced Technologies for Air and Spacecraft Escape 14 p Feb. 1990

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Transient and angular accelerations significantly affect aircrew safety during emergency escape from aerospace vehicles. However, due to the scarcity of laboratory data on the response of the human body to transient, multiaxial acceleration, criteria for design and evaluation of escape systems were restricted to relatively simplistic limits of acceleration magnitude and rate of acceleration onset for acceleration vectors acting in three orthogonal axes, with the exception of the foot-to-head direction (+Z axis). Mathematical models were only used to assess the probability of injury for acceleration acting in the +Z axis. Limits were not specified for angular acceleration. The United States Air Force is currently engaged in an advanced development program to demonstrate the feasibility of three-dimensional thrust-vector control to provide ejection seat attitude control and trajectory steering. This program has served to stimulate the development of more comprehensive design and evaluation criteria to assure that the thrust-vector control system functions without causing an unacceptable risk of injury to the escape system occupant. A method was developed to limit acceleration exposure on the basis of the computed responses of three orthogonal dynamic models. The method was initially developed using existing data from tests with human subjects and experience with operational escape systems. More extensive research is now ongoing to evaluate and improve the method. Impact experiments with volunteers were accomplished to more precisely define the properties of the dynamic response models. Escape system test data were analyzed,

including measurements of linear acceleration and angular velocity. The acceleration exposure limit method is described, the results of recent impact tests accomplished with volunteers provided, and revised dynamic response model coefficients derived from the results of these tests. Recent applications of the acceleration exposure method include evaluation of the performance of the ACES II ejection seat, development of the CREST advanced escape system technologies demonstrator, and study of crew escape systems for hypersonic flight vehicles. Author

N90-20062# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Biodynamics and Bioengineering Div. **THE USAF ADVANCED DYNAMIC ANTHROPOMORPHIC MANIKIN (ADAM)**

ROY R. RASMUSSEN and INTS KALEPS /n AGARD, Implications of Advanced Technologies for Air and Spacecraft Escape 7 p Feb. 1990

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Ejection from aircraft at high speeds poses severe injury hazards to the crewmember. As performance characteristics of aircraft are further improved, the protection capabilities of ejection systems must also be improved to assure the safety of the crewmember. The demonstration of these ejection system improvements requires extensive testing with manikins to effectively evaluate the performance of the ejection seat and assess the injury potential to the crewmember. The United States Air Force (USAF) has embarked on a new effort to design and develop an Advanced Dynamic Anthropomorphic Manikin (ADAM) with improved human-like fidelity and data collection capability over currently available escape system testing manikins. This effort has resulted in the development and fabrication of two prototype (one small and one large) instrumented, anthropomorphic manikins for testing and evaluation and the production of ten manikins to be used in ejection and other protection system testing. Discussed will be the design objectives and resulting features of ADAM and a summary of testing results for exposure to extreme temperature and humidity environments; Gz low level vibration; and Gx, Gy and Gz whole body impacts. Author

N90-20645*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

DEVELOPMENT AND APPLICATION OF NONFLAMMABLE, HIGH-TEMPERATURE BETA FIBERS

FREDERIC S. DAWN Dec. 1989 40 p (NASA-TM-102158; NAS 1.15:102158) Avail: NTIS HC A03/MF A01 CSCL 06/11

Recent advances in fiber technology have contributed to the success of the U.S. space program. The inorganic fiber Beta, developed as a result of efforts begun in the early 1960's and heightened following the January 27, 1967 Apollo fire is unique among inorganic and organic fibers. It has been developed into woven, nonwoven, knitted, braided, coated and printed structures. All of these were used extensively for the Apollo, Skylab, Apollo-Soyuz test project, space shuttle, Spacelab, and satellite programs. In addition to being used successfully in the space program, Beta fibers are being used commercially as firesafe fabrics in homes, hospitals, institutions, public buildings, aircraft, and public transportation, wherever total nonflammability is required. One of the most unique applications of the Beta composite structure is the roofing material for the 80,000-seat Detroit Lion's Silverdome and 5 square miles of the Jeddah International Airport in Saudi Arabia. This fiber has been successfully incorporated into 165 major public construction projects around the globe. The United States alone has used more than 12 million square yards of the material. Beta fiber has been used successfully to date and has a promising future with unlimited potential for both space and commercial application. Efforts are currently underway to improve Beta fiber to meet the requirements of extended service life for the Space Station Freedom, lunar outpost, and Mars exploration missions. Author

N90-20646# Human Engineering Labs., Aberdeen Proving Ground, MD.

COMPARISON OF OCULOMETER AND HEAD-FIXED RETICLE WITH VOICE OR SWITCH AND TOUCH PANEL FOR DATA ENTRY ON A GENERIC TACTICAL AIR COMBAT DISPLAY

Final Report

CHRISTOPHER C. SMYTH and MARY E. DOMINESSY Nov. 1989 82 p
(AD-A217231; HEL-TM-21-89) Avail: NTIS HC A05/MF A01 CSCL 01/3

An experiment with 15 U.S. Army enlisted military subjects was conducted to compare the use of a head-mounted oculometer, a head-fixed reticle, and a touch panel for data entry tasks on a generic tactical air combat display. The oculometer and the fixed reticle were operated in a head-free mode and were used with either switch or voice. The fixed reticle with switch, the oculometer with switch, and the touch panel are significantly faster than the fixed reticle with voice and the oculometer with voice. The fixed reticle methods are faster than the oculometer methods of the same modality. The switch methods are faster than the voice methods. The ocular pointing methods (whether oculometer of fixed reticle, voice or switch input) require a larger display activation window (+ or - 1.1 inches at 27 inches' viewing distance) than does the touch panel, thereby limiting the number of selections that can be shown on the display. This is especially true for the oculometer with voice method which generated significantly more selection errors and may therefore require a still larger display activation window for proper operation. GRA

N90-20647# Douglas Aircraft Co., Inc., Long Beach, CA.
ASSESSMENT OF CREW WORKLOAD MEASUREMENT METHODS, TECHNIQUES AND PROCEDURES. VOLUME 1: PROCESS, METHODS AND RESULTS Final Report, Jul. 1986 - Feb. 1989

WILLIAM H. CORWIN, DIANE L. SANDRY-GARZA, MICHAEL H. BIFERNO, GEORGE P. BOUCEK, JR., and AILEEN L. LOGAN Sep. 1989 237 p Prepared in cooperation with Boeing Commercial Airplane Co., Seattle, WA
(Contract F33615-86-C-3600)
(AD-A217699; WRDC-TR-89-7006-VOL-1) Avail: NTIS HC A11/MF A02 CSCL 05/9

The primary goal was to identify assessment techniques which demonstrate evidence of validity and reliability and are suitable as measures of flightcrew workload for aircraft certification. To use a workload assessment technique with confidence for the certification of an aircraft flightdeck, the validity and reliability of the technique must be well established. Validity is the capability of the assessment technique to measure the abstract construct it is proposed to measure. Reliability is the capability of the measure to produce the same results with repeated testing. A comprehensive literature review was conducted to identify workload measures which have an empirical record of validity and reliability. All candidate workload assessment techniques had to be applicable for evaluating workload in an aircraft environment. Two workshops were conducted to bring together experts in the workload assessment field to determine candidate measures for simulation testing (aided by the literature search), and make recommendations for testing in a high fidelity simulation. Two separate simulation tests were conducted at the Man Vehicle System Research Facility at NASA-Ames Research Center using a Phase 2 B-727 motion-base simulator. GRA

N90-20648# Human Engineering Labs., Aberdeen Proving Ground, MD.

AIDING THE DECISION MAKER: PERCEPTUAL AND COGNITIVE ISSUES AT THE HUMAN-MACHINE INTERFACE

Final Report

JAMES D. WALRATH Dec. 1989 22 p
(Contract DA PROJ. 1L1-162716-AH-70)
(AD-A217862; HEL-TN-15-89) Avail: NTIS HC A02/MF A01 CSCL 05/8

Advances in weapon and sensor technologies have given rise to very complex military systems. The soldier-machine interface,

typical of such systems, is often characterized by elevated task loadings and speed stress. These conditions can combine to produce increased operator errors and degraded decision making performance. These operator performance problems are acknowledged and a general review is provided of the human judgement and decision making literature (specifically focusing on perceptual and attentional mechanisms). An abridged history of the psychological study of human decision making is provided to illuminate the domain, and four methods are discussed for improving the performance of systems that suffer because of poor human judgement and decision making. A special plea is made to consider aiding harassed decision makers by paying careful attention to principles of human perception and attention, because these mechanisms form the foundation of our ability to acquire relevant and timely problem data. GRA

N90-20649# Army Research Inst. of Environmental Medicine, Natick, MA.

COMPARISON OF LIGHT DUTY GLOVES WITH NATURAL AND SYNTHETIC MATERIALS UNDER WET AND DRY CONDITIONS

W. R. SANTEE, T. L. ENDRUSICK, and L. S. PENSOTTI Jan. 1990 9 p
(AD-A218119) Avail: NTIS HC A02/MF A01 CSCL 15/5

The performance of five volunteer test subjects wearing a standard cold weather military uniform and three different gloves was compared during treadmill walking (120 minutes), sitting (125 minutes) and hand conductance or contact (60 minutes). Chamber conditions were -6.7 C (20 F) Ta and 1.1 m.s-1 wind speed. The sitting tests were repeated at 0 C (32 F). Contact tests were repeated with wet gloves. Rectal and finger temperatures, heart rate, and endurance times were measured. The results indicate that the new leather shell is more affected by external moisture than the standard shell. GRA

N90-21522# National Aeronautical Lab., Bangalore (India). Computational and Theoretical Fluid Dynamics Div.

HUMAN FACTORS IN FIGHTER SOFTWARE DEVELOPMENT

RAJENDRA K. BERA Jan. 1990 11 p
(PD-CF-9003) Avail: NTIS HC A03/MF A01

In the development of any large scale software, human factors play a crucial role. This is even more true for fighter software which are embedded, real time, distributed, and fault tolerant. Those human factors which play an important role in the development of fighter software are examined. Author

N90-21523# Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.

THE EFFECT OF WINDSCREEN BOWS AND HUD PITCH LADDER FORMAT ON PILOT PERFORMANCE DURING SIMULATED FLIGHT Final Report, Oct. 1987 - Sep. 1988

JOHN E. DEATON, MICHAEL J. BARNES, NANCY J. LINDSEY, JANETTAROSE L. GREENE, and JONATHAN KERN (Veda, Inc., Warminster, PA.) 21 May 1989 19 p
(AD-A218139; NADC-89084-60) Avail: NTIS HC A03/MF A01 CSCL 01/3

During the upgrade of the F-14 to the F-14D, pilots have expressed their concerns regarding the obscuration of the forward field-of-view due to the new Head-Up Display (HUD) supports in conjunction with preexisting windscreen bows. An additional issue involves the proposed use of the HUD as the primary flight reference instrument. The HUD pitch ladder has been criticized for not providing enough information to enhance recovery from unusual attitudes. The purpose of the present study was, therefore, twofold: (1) to measure the levels of target detection with and without windscreen bows, and (2) to measure unusual attitude recovery performance using two different HUD pitch ladder formats - Standard versus Enhanced. During simulated flight, twelve subjects were required to make visual detections of enemy aircraft with and without the windscreen bow. Additionally, subjects were required to recover from various pitch/roll combinations. GRA

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A90-33497* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ON THE POSSIBILITY OF LIFE ON EARLY MARS

V. R. OBERBECK (NASA, Ames Research Center, Moffett Field, CA) and G. FOGLEMAN (SETI Institute, Moffett Field, CA) IN: Lunar and Planetary Science Conference, 20th, Houston, TX, Mar. 13-17, 1989, Proceedings. Houston, TX, Lunar and Planetary Institute, 1990, p. 473-478. refs

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Prebiotic reactants, liquid water, and temperatures low enough for organic compounds to be stable are requirements for the origination of life as we know it. Prebiotic reactants and sufficiently low temperatures were present on Mars before liquid water vanished. Early in this time period, however, large planetesimal impacts may have periodically sterilized Mars, pyrolyzed organic compounds, and interrupted chemical origination of life. However, the calculated time interval between such impacts on Mars was larger just before liquid water vanished 3.8 Gyr (billion years) ago than it was on earth just before life originated. Therefore, there should have been sufficient time for life to originate on Mars. Ideal sites to search for microfossils are in the heavily cratered terrain of Upper Noachian age. Craters and channels in this terrain may have been the sites of ancient lakes and streams that could have provided habitats for the first microorganisms. Author

A90-34280

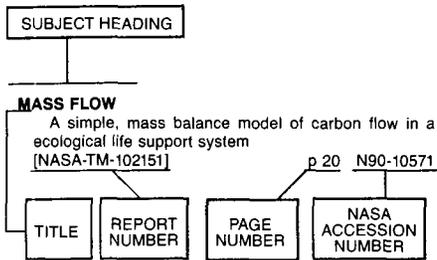
CHIRALITY AND ORIGIN OF LIFE IN SPACE AND ON PLANETS

V. I. GOLDANSKII and V. V. KUZMIN (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Jan. 1990, p. 31-37. refs

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The phenomenon of breaking of the mirror symmetry of the molecular basis of life is, apparently, the first and most dramatic example of symmetry breaking in natural sciences. It is most probable that this key property of life may serve as a criterion for the selection of various scenarios of the life's origin both on planets and in space. Author

Typical Subject Index Listing



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

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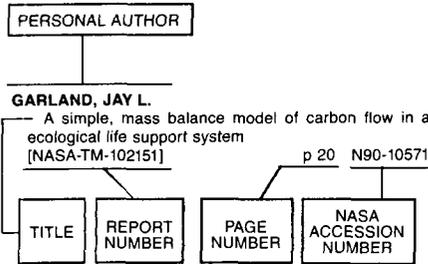
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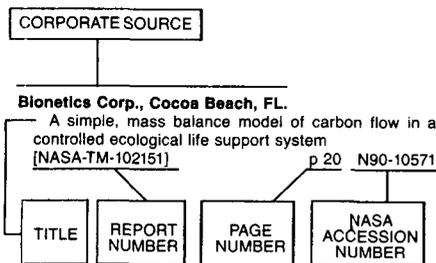
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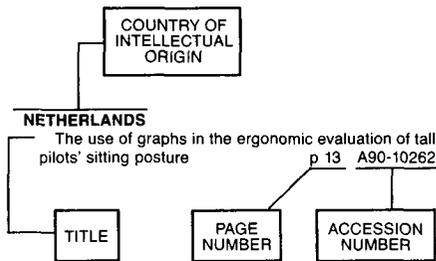
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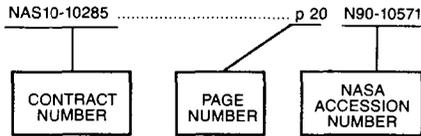
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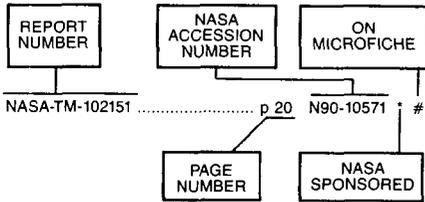
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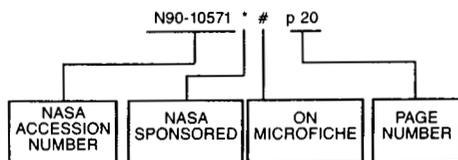


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