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Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 312)

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 June 1988 in

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

Scientific and Technical Information Division 1988
National Aeronautics and Space Administration
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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 300 reports, articles and other documents announced during June 1988 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).* The first issue of the bibliography was published in July 1964.

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

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

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

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1988 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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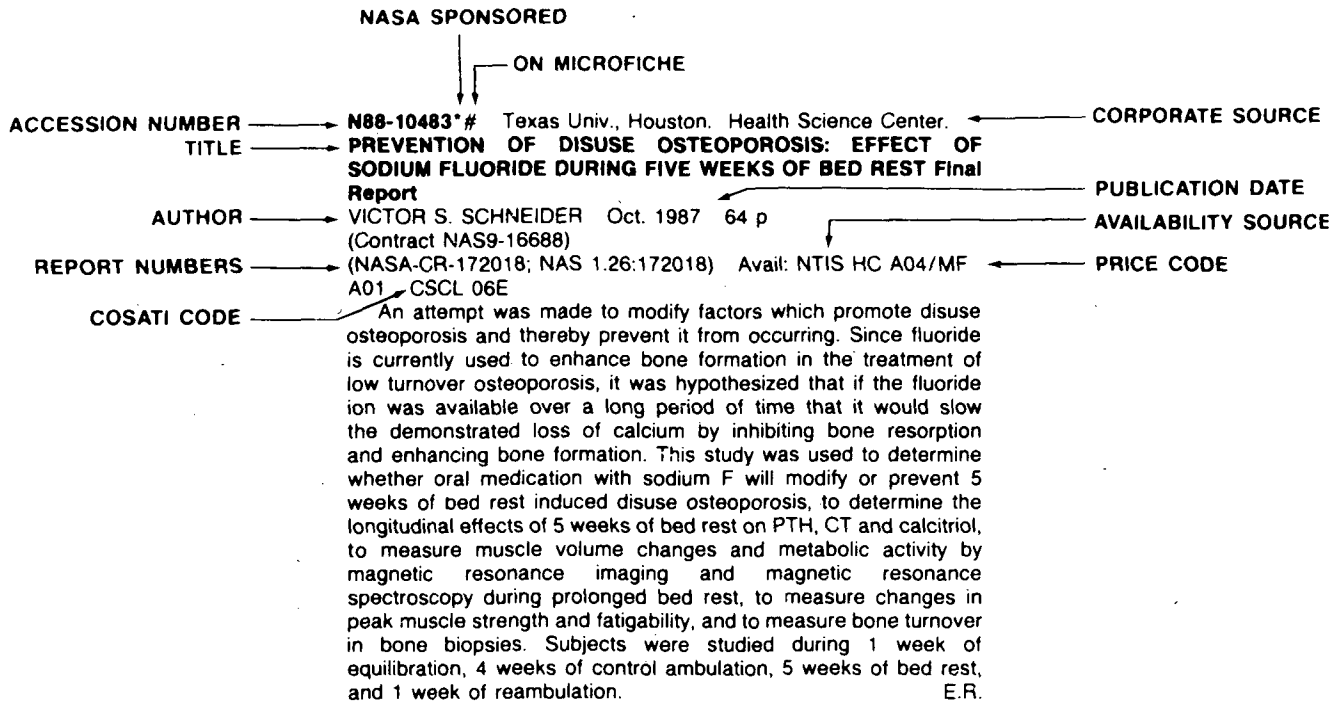
TYPICAL REPORT CITATION AND ABSTRACT



N88-10483*# Texas Univ., Houston. Health Science Center.

PREVENTION OF DISUSE OSTEOPOROSIS: EFFECT OF SODIUM FLUORIDE DURING FIVE WEEKS OF BED REST Final Report

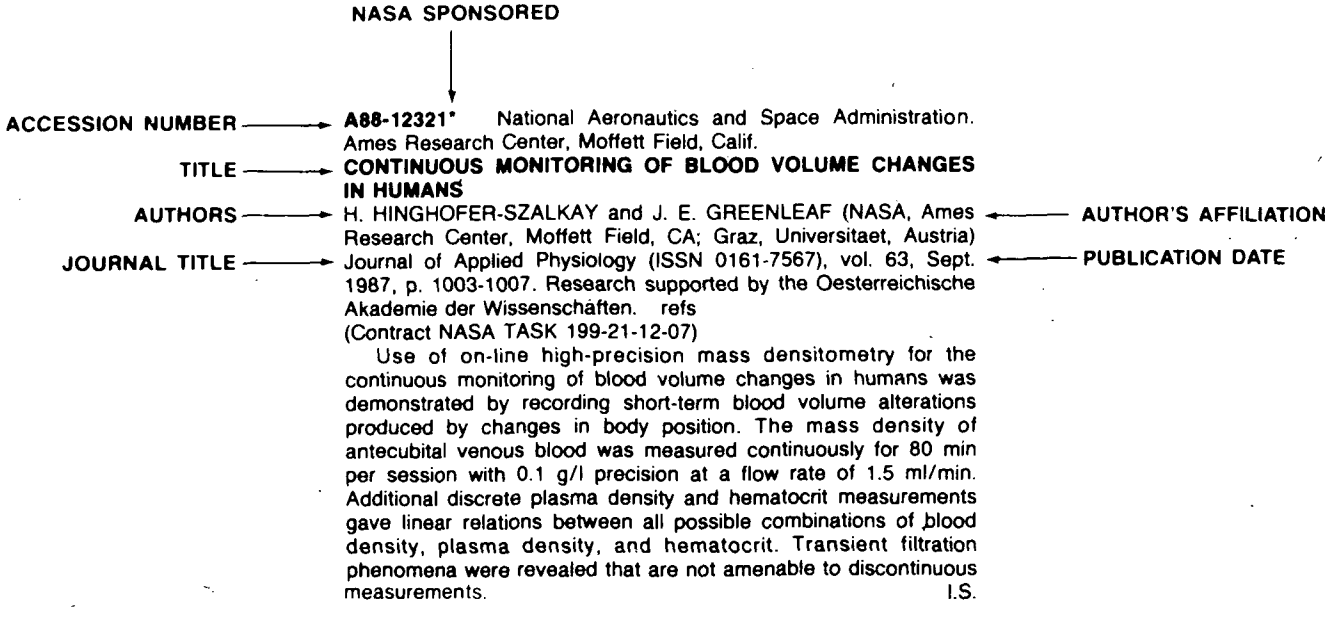
VICTOR S. SCHNEIDER Oct. 1987 64 p

(Contract NAS9-16688)

(NASA-CR-172018; NAS 1.26:172018) Avail: NTIS HC A04/MF A01 CSCL 06E

An attempt was made to modify factors which promote disuse osteoporosis and thereby prevent it from occurring. Since fluoride is currently used to enhance bone formation in the treatment of low turnover osteoporosis, it was hypothesized that if the fluoride ion was available over a long period of time that it would slow the demonstrated loss of calcium by inhibiting bone resorption and enhancing bone formation. This study was used to determine whether oral medication with sodium F will modify or prevent 5 weeks of bed rest induced disuse osteoporosis, to determine the longitudinal effects of 5 weeks of bed rest on PTH, CT and calcitriol, to measure muscle volume changes and metabolic activity by magnetic resonance imaging and magnetic resonance spectroscopy during prolonged bed rest, to measure changes in peak muscle strength and fatigability, and to measure bone turnover in bone biopsies. Subjects were studied during 1 week of equilibration, 4 weeks of control ambulation, 5 weeks of bed rest, and 1 week of reambulation. E.R.

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



A88-12321* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONTINUOUS MONITORING OF BLOOD VOLUME CHANGES IN HUMANS

H. HINGHOFER-SZALKAY and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA; Graz, Universitaet, Austria)

Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Sept. 1987, p. 1003-1007. Research supported by the Oesterreichische Akademie der Wissenschaften. refs

(Contract NASA TASK 199-21-12-07)

Use of on-line high-precision mass densitometry for the continuous monitoring of blood volume changes in humans was demonstrated by recording short-term blood volume alterations produced by changes in body position. The mass density of antecubital venous blood was measured continuously for 80 min per session with 0.1 g/l precision at a flow rate of 1.5 ml/min. Additional discrete plasma density and hematocrit measurements gave linear relations between all possible combinations of blood density, plasma density, and hematocrit. Transient filtration phenomena were revealed that are not amenable to discontinuous measurements. I.S.

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 312)

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LIFE SCIENCES (GENERAL)

A88-29103
BIOLOGICAL SCIENCES IN SPACE 1986; PROCEEDINGS OF THE 1986 INTERNATIONAL SYMPOSIUM, NAGOYA, JAPAN, NOV. 10-12, 1986
SATORU WATANABE, ED., SHIGEO MORI, ED. (Nagoya University, Japan), and GENYO MITARAI, ED. (Chukyo University, Toyota, Japan) Symposium sponsored by MOESC, Natural Space Development Agency of Japan, Japan Society of Microgravity Application, et al. Tokyo, MYU Research (International Symposium Series, No. 2), 1987, 392 p. For individual items see A88-29104 to A88-29148.

This book includes topics in space physiology and medicine, space biology and CELSS (Controlled Ecological Life Support System), space radiology, and space biotechnology. Papers are presented on the role of preventive medicine in the future of USA space life sciences and the status of space life sciences in Japan. Consideration is given to sympathetic nervous responses in man to weightlessness simulated by head-out water immersion, the effect of centrifugal force on the gain and phase of the canal-ocular reflex in rabbit, DNA damage and mutation induced by health lamp-light (UVB) in Echerichia coli, Azolla and other small vascular floating plants as a functioning agent of nitrogen fixation in CELSS, the interaction of cosmic radiation and microgravity in the development processes of Carausius morosus, and the electrofusion of plant protoplasts under microgravity conditions. I.S.

A88-29106
THE SPACE LIFE SCIENCES RESEARCH AND APPLICATION IN EUROPE
KARL E. KLEIN (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 17-24.

The space life sciences activities planned and implemented by ESA and by various West-European national space organizations focus on three domains: (1) the utilization of the space environment for basic reserach in space life sciences (LSs), (2) the development of technologies for the maintenance of physical and mental health of man in space, and (3) the utilization of microgravity for a potential commercial application. The past projects with European LS payloads on the USSR and the U.S. missions are discussed along with the LS payloads of future missions planned and the specific research activities to be carried out on these flights. I.S.

A88-29107
SPACE LIFE SCIENCES IN JAPAN
GENYO MITARAI (Chukyo University, Toyota, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 25-37. refs

Space life sciences (LSs) research activity of Japan is reviewed, and the present status of the twelve LS experiments planned for the First Materials Processing Test planned to be conducted aboard the Space Station is discussed. The experiments planned for the FMPT projects include studies on endocrine and metabolic changes and on visual stability in space, a neurophysiological study of posture control in fish, studies of the effect of microgravity on the development and formation of bone tissue, and studies on the genetic effects of HZE and cosmic radiation. Other experiments will include investigations on crystal growth in zero gravity, utrastructural changes of cells in culture, the circadian rhythm of fungus, the electrophoretic separation of cells, and the efficiency of protein electrophoresis in zero gravity. I.S.

A88-29109
BIOLOGICAL EFFECTS OF RADIATION DURING SPACE FLIGHT
MITUO IKENAGA (Kyoto, University, Japan), ISAO YOSHIKAWA, TOSHIKAZU AYAKI (Nagasaki University, Japan), and HARUKO RYO (Osaka University, Suita, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 47-52. refs

The nature of radiation encountered by spaceships from galactic cosmic rays, trapped particles, and solar particles is discussed together with the relative intensity of each radiation source at different altitudes and inclination angles. The effects of each type of radiation (at a given dose) on the rate of mutations in the wings of Drosophila were studied by observing changes in two genetic markers, the multiple wing hair, and the flare hair genes. By analyzing 600 wings at each radiation dose, the induced mutations were demonstrated with satisfactory statistical significance at doses as low as 2 rads (compared with less than 1 rem which will be received during one week flight on the Space Shuttle). I.S.

A88-29111* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMPHIBIAN DEVELOPMENT IN MICROGRAVITY
K. A. SOUZA (NASA, Ames Research Center, Moffett Field, CA) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 61-68. refs

The results of experiments performed by the U.S. Biosatellites 1 and 2 and the Gemini VIII and XII missions and by the Soviet Salyut and Soyuz missions on the effect of gravity on the development of prefertilized amphibian egg and, in particular, of the vestibular system of amphibian embryo are described. In these experiments, the condition of microgravity was reached only after the prefertilized eggs were in the early stages of first cell division or in the blastula stage. No significant changes were observed in the morphology of the embryos or in the vestibular system of embyos developed, respectively, for 2-5 days or 20 days under

conditions of microgravity. Experiments planned for future spaceflights are discussed. I.S.

A88-29112
EFFECTS OF HYPER-GRAVITY ON THE HEMOSTATIC ACTIVITY OF HAMSTER
I. SUGIE, A. ITO, S. WAKAMATSU, T. OKADA (Aichi Medical University, Japan), K. MATSUNAMI (Gifu University, Japan) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 69-75.

To investigate the effects of exposure to hypergravity on hemostatic activity, platelet, clotting and fibrinolytic activities of male golden hamsters centrifuged at -2 Gx, -3 Gx and -10 Gx for 30 min were measured. Exposure to -2 Gx and -3 Gx caused a significant shortening of r-time, the prolongation of k-time and a decrease of the maximum amplitude of a thromboelastogram. A marked decrease in the fibrinogen concentration and prolongation of the prothrombin time were also observed. Furthermore, the platelet aggregation and the antiplasmin activity in plasma were impaired. In the group exposed to -10 Gx, activated partial thromboplastin time was prolonged and plasminogen activators appeared. The number of small sized platelets increased, and the platelets showed insufficient aggregation. These results, showing the disfunction of the platelets, the consumption of coagulation factors and the activation of fibrinolysis, suggest that the condition of hemostasis induced by hypergravity would be similar to disseminated intravascular coagulation. Author

A88-29113
CHANGES IN THE CARDIAC SYSTEM OF BETA(1)-BLOCKED HAMSTERS UNDER HYPER-GRAVITY
HIROTAKA SATAKE, MASAYA NAKASHIMA, KEN'ICHI MATSUNAMI (Gifu University, Japan), and YOSHIO MIZUNO (Daido Institute of Technology, Nagoya, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 77-84. refs

The effect of centrifugal acceleration on the cardiac system of hamsters with blocked beta(1)-receptors was investigated in anesthetized animals injected with a beta(1) blocking agent atenolol before exposure to 4 and 6 G forces for 10 min, using noninjected labyrinthectomized (L) hamsters and intact animals for comparison. ECGs and impedance plethysmograms were recorded through a telemeter. During the -Gz exposure, the heart rate, the stroke volume (SV), and the cardiac output were found to decrease (as compared with control values), with the SV exhibiting the most significant changes. The responses of the cardiac function in beta-hamsters were similar to those in the L animals. This similarity suggests that cardiac responses due to -Gz acceleration might be affected through the vestibuloautonomic system. I.S.

A88-29119
EFFECTS OF HEAD-DOWN TILT SUSPENSION ON MASS AND ENZYMATIC PROFILES IN VARIOUS TYPES OF MUSCLES
YOSHINOBU OHIRA, IZUMI TABATA, HIDETARO SHIBAYAMA, and MOTOKO OHIRA (National Institute of Fitness and Sports, Kanoya City, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 129-134. refs

The effects of unloading in rat hindlimbs by head-down tilt suspension for one week on muscle mass and metabolic characteristics were investigated. Wet weight was decreased after suspension in the soleus, plantaris, gastrocnemius, tibialis anterior, and extensor digitorum longus (EDL) muscles. Data suggested that the degree of atrophy was not fiber-type specific but it was similar for a group of agonist muscles. The cause of the atrophy was a decrease in water content due to fluid shift, and in protein content, except in EDL. Beta-hydroxyacyl CoA dehydrogenase activity was lowered by suspension, but not in lactate dehydrogenase activity. It was also suggested that metabolic change might be fiber-type specific because only oxidative enzyme decreased the activity, and its decrease was greatest in the soleus muscle which is composed mainly of slow-twitch oxidative fibers. Author

A88-29122
BEHAVIOR AND BRAIN ACTIVITY OF CARP DURING PARABOLIC-FLIGHT LOW GRAVITY
SHIGEO MORI, SATORU WATANABE, AKIRA TAKABAYASHI, KAZUO KOGA (Nagoya University, Japan), MANABU SAKAKIBARA (Toyohashi Institute of Technology, Japan) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 155-162. refs

The effect of low gravity on the dorsal light tilt reaction (DLTR) of carp and on the electrical activity of carp cerebellum was investigated in several parabolic-flight experiments. A completely light-dependent DLTR was demonstrated in the intact carp during parabolic flights. Under the condition of low gravity, the tilt angle in the lateral illumination tended to overshoot beyond 90 deg; since this reaction rarely occurs in the labyrinthectomized carp on ground, the finding suggests that the otolith may not be a single organ which detects gravity. The tilt speed was high and relatively steady under low gravity. A power spectral anlysis of the cerebellar activity showed an enhancement of power at frequency ranges below 8 H and between 12 and 25 Hz. I.S.

A88-29123
POSTURAL CONTROL OF FISH DURING PARABOLIC AIRCRAFT FLIGHT
AKIRA TAKABAYASHI, SATORU WATANABE, HIROBUMI OHTA (Nagoya University, Japan), RUDOLF VON BAUMGARTEN, and JOACHIM WETZIG (Mainz, Universitaet, Federal Republic of Germany) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 163-172. Research supported by the Japan Society for the Promotion of Science. refs

The effect of hypogravity on the postural control of fish was investigated in intact and labyrinthectomized (elither unilaterally, ULT, or bilaterally, BLT) goldfish during a rollercoaster maneuver of parabolic flight. The behavioral responses of individual fish to the changes of gravity were videotaped under two illuminating conditions: a light from the top or from the side. During the hypogravity period, intact fish that were lighted from the top showed a head-down or diving response for the light. For a light from the side, the diving response followed the dorsal light response (DLR). The BLT goldfish displayed a DLR more prominently during the hypogravity period than during 1 G and hypergravity. Compared with BLT fish, the ULT fish assumed a normal stable posture under hypergravity conditions, but displayed tilting behavior even for the light from the top. The findings suggest that the visual system plays an important role in stabilizing body posture, especially during hypogravity. For the periods of weightlessness, however, vestibular imbalance between the right and left side may emphasize a postural disturbance. I.S.

A88-29124
ROLE OF HISTAMINE IN MOTION SICKNESS AND SPACE MOTION SICKNESS
NORIAKI TAKEDA, MASAHIRO MORITA, TAKESHI KUBO, ATSUSHI YAMATODANI, HIROSHI WADA (Osaka University, Japan) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 173-177. refs

The nature of neural mechanisms involved in space motion sickness was investigated in rats subjected to two kinds of rotational stimulation: (1) 'single' rotation at 80 rpm and (2) double rotation. In double rotation, rats received (for 60 min) centrifugal (at 80 rpm) and angular accelerations that changed in direction and magnitude continuously. As an index of the motion sickness, the kaolin intake (which in rats is proportional to the degree of motion-sickness-induced pica) was determined. It was found that, while single rotation did not produce pica in rats, the sensory

conflict produced by double rotation resulted in pica. In these rats, the histamine content of hypothalamus and the pons-medulla region was measured periodically and was found to increase significally over the control (with maximal concentrations occurring in both regions after 15 min of double rotation), suggesting that a substance like alpha-fluoromethylhistidine might be an effective anti-motion-sickness drug. I.S.

A88-29125* Baylor Coll. of Medicine, Houston, Tex.
VESTIBULAR-VISUAL CONFLICT TRAINING
MAKOTO IGARASHI, TETSUO HIMI, WALTER B. KULECZ (Baylor College of Medicine, Houston, TX), and KAZUTOYO KOBAYASHI (Sapporo Medical College, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 178-184. refs
(Contract NAG2-289; NIH-NS-10940)

Squirrel monkeys susceptible to vestibular-visual conflict (similar to that produced in space motion) were successfully trained to lesser sensitivity by repeated exposures to various randomly mixed patterns of vestibular-visual conflict in sagittal plane. As long as the training effect was retained, trained animals exhibited low sickness scores and no emesis. It is suggested that the adaptation maneuvers described in this study can be effective as a training routine for crew members immediately prior to their space flight missions. I.S.

A88-29126
THE EFFECT OF CENTRIFUGAL FORCE ON THE GAIN AND PHASE OF THE CANAL-OCULAR REFLEX IN RABBIT
I. KOIZUKA, T. MATSUNAGA (Osaka University, Japan), and T. KUBO (Kagawa Medical College, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 185-190. refs

The gain and the phase of the vestibuloocular reflex (VOR) of rabbits were measured under two conditions: (1) centric rotation, when the head of the rabbit was placed at the center of the rotation axis of a rotating table and (2) eccentric rotation, when the head was placed 50 cm away from the rotation center along the rostro-caudal axis. Eye movements were recorded by silver-needle electrodes placed at the outer canthi of the rabbits. Compared with the centric VOR experiment, the gain values at 0.5 and 1.0 Hz in the eccentric VOR experiment were significantly lower. On the other hand, the phase of eccentric VOR was similar to the phase of the centric VOR at each frequency. I.S.

A88-29127
FUNCTIONAL ORGANIZATION OF THE CAT UTRICULUS STUDIED WITH THE VESTIBULOOCULAR REFLEX INDUCED BY ELECTRICAL STIMULATION
HIROYASU JIJIWA, TAKAKO MOTOOKA, HIROOMI KEINO (Institute of Developmental Research, Kasugai, Japan), and SATORU WATANABE (Nagoya University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 191-198. refs
(Contract MOESC-60570059)

Functional arrangement of the utrilcula macula was investigated in cats whose left utricular macula was stimulated electrically on its undersurface, with the stimulating microelectrode being moved by a micromanipulator in the observation field of a microscope. The induced eye movements were recorded using a video tape recorder or were photographed. SEM observations of fixed macula were used to detect regional differences in the orientation of the morphological polarization of the hair cells. The results obtained were interpreted by taking into account the fact that the eye movement induced through the vestibuloocular reflex compensates for head movement, and that an excitation mechanism for the hair cell (as revealed in the saccular macula by Shotwell et al., 1981) is also operational in the utricular macula. Based on these interpretations, a functional arrangement pattern of the utricular macula is proposed. I.S.

A88-29128
BIOPHYSICAL AND BIOCHEMICAL MECHANISMS FOR LONG-TERM ADAPTIVE MODIFICATIONS OF A MOLLUSCAN VISUAL-VESTIBULAR NETWORK
MANABU SAKAKIBARA (Nagoya University, Japan; National Institute of Neurological and Communicative Disorder and Stroke, Woods Hole, MA), DANIEL L. ALKON (National Institute of Neurological and Communicative Disorder and Stroke, Woods Hole, MA), and SATORU WATANABE (Nagoya University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 199-208. refs

This paper discusses the mechanisms responsible for adaptive modifications that take place in the visual-vestibular network of Hermissenda mollusk in response to Pavlovian conditioning by paired light and rotation, when the animal learns a predictive relationship between the visual and vestibular stimuli and reacts to light alone by contracting its 'foot'. Published results implicate cumulative depolarization of the type-B cell and Ca(2+)-triggered phosphorylation as major contributors to persistent changes in type B cell ionic conductances that occur with associative learning. Other mechanisms, such as neurochemical modulation, may play a role. Thus, histochemical techniques revealed the presence of a single monoamine-containing optic ganglion cell, the staining characteristics of which were consistent with norepinephrine, suggesting a role for training-induced modulation of type B cell ionic currents by neuromodulators within the optic ganglion. I.S.

A88-29129
THE ROLE OF GRAVICEPTION IN CLASSICALLY CONDITIONED VISUAL RESPONSES OF THE MARINE SNAIL HERMISSENDA
I. IZJA LEDERHENDLER and DANIEL L. ALKON (National Institute of Neurological and Communicative Disorder and Stroke, Woods Hole, MA) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 209-216. refs

In Hermissenda snail, repeated pairings of rotation and light result in transference of influence from the graviceptive to the visual system; the conditioning is optimal when a 1.0-sec delay is introduced between the onset of the light and the rotation stimuli. Cell-by-cell analysis, using anatomical and electrophysiological methods, showed that the flow of visual and graviceptive information converges at specific cellular loci. Data from animals, that had been conditioned and from which the nervous system was removed after the training, produced evidence that the membrane of a specific photoreceptor in the eyes of Hermissenda undergoes an increase of excitability which persists for days. Conditioning-specific reductions of K(+) currents take place, which are intrinsic to single identified neurons. I.S.

A88-29130
DNA DAMAGE AND MUTATION INDUCED BY A HEALTH LAMP-LIGHT (UVB) IN ESCHERICHIA COLI
TAKEO OHNISHI (Nara Medical University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 217-224. refs

The biological effect of the health-lamp light (UVB) was investigated by measuring the rate of formation of thymine-thymine (TT) and cytosine-thymine (CT) dimers in four isogenic strains of E. coli (one of them being the wild-type parental strain of the three others) irradiated by UVB light or germicidal UV light. Two-dimensional paper chromatography was used for one-step separation of TCA-soluble pyrimidine dimers. The UVB light was found to cause cell death in all E. coli strains except the wild-type one. However, the umu gene expression was induced in all four strains, as was the mutation rate. The health-lamp light, as well as the germicidal light (254 nm), was found to produce thymine-containing dimers; however, more CT dimers (and relatively less TT dimers) were produced by the health-lamp light than by the germicidal light. I.S.

A88-29131
CELL CULTURES IN SPACE - FROM BASIC RESEARCH TO BIOTECHNOLOGY
AUGUSTO GOGOLI, BIRGITT BECHLER, GIOVANNA LORENZI, FELIX K. GMUENDER, and MARIANNE GOGOLI (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 225-232. Research supported by the Eidgenoessische Technische Hochschule Zuerich. refs
(Contract SNSF-3,382,0,82)

Changes brought about by microgravity conditions on the behavior of single cells grown in culture are discussed. Results from Biorack flown aboard Spacelab D-1 indicate that the exposure of microorganisms to microgravity resulted in increased proliferation rate (in Paramecium and B. subtilis), increased resistance to antibiotics and changed membrane permeability (E. coli), increased biomass yield (B. subtilis), and increased frequency and velocity of cytoplasmic streaming (Physarum). Human lymphocytes treated in space with concanavalin A exhibited an almost 100 percent inhibition of mitogenic activation, as compared with ground controls. Biorack will fly again on the IML-1 mission planned for 1990, carrying experiments for studies of microgravity effects on single cells. I.S.

A88-29133
MODELS OF AMPHIBIAN EMBRYONIC DEVELOPMENT AND THEIR PREDICTIONS FOR DEVELOPMENT AT MICROGRAVITY
STEVEN D. BLACK (California, University, Berkeley) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 240-246. refs

Numerous theories have been proposed to explain amphibian embryonic axis development. Two current theories, the 'sperm aster model' and the 'density compartment model', make predictions about development in microgravity. The recent developments of the two models is traced, their different predictions regarding development at microgravity are explained and new data that suggest that axis polarity will follow the position of sperm entry in space as it does on earth are discussed. Author

A88-29134* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE OPPORTUNITIES FOR SPACE BIOLOGY RESEARCH ON THE SPACE STATION
RODNEY W. BALLARD and KENNETH A. SOUZA (NASA, Ames Research Center, Moffett Field, CA) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 247-252. refs

The goals of space biology research to be conducted aboard the Space Station in 1990s include long-term studies of reproduction, development, growth, physiology, behavior, and aging in both animals and plants. They also include studies of the mechanisms by which gravitational stimuli are sensed, processed, and transmitted to a responsive site, and of the effect of microgravity on each component. The Space Station configuration will include a life sciences research facility, where experiment cyles will be on a 90-day basis (since the Space Station missions planned for the 1990s call for 90-day intervals). A modular approach is taken to accomodate animal habitats, plant growth chambers, and other specimen holding facilities; the modular habitats would be transportable between the launch systems, habitat racks, a workbench, and a variable-gravity centrifuge (included for providing artificial gravity and accurately controlled acceleration levels aboard Space Station). I.S.

A88-29138
EFFECT OF GRAVITY ON THE MORPHOGENESIS OF ORGANISMS - THE CASE OF A CELLULAR SLIME MOLD, DICTYOSTELIUM DISCOIDEUM
YUKISHIGE KAWASAKI, HIROSHI MIZUTANI (Mitsubishi-Kasei Institute of Life Sciences, Tokyo, Japan), and TAKESHI KIRIU (Toho University, Chiba, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 285-290.

The effect of microgravity on a cellular slime mold, Dictyostelium discoideum, was investigated by culturing D. discoideum spores in petri dishes placed on a clinostat or in a centrifugal machine, and measuring the height of fruiting bodies. The petri dishes were placed with the agar surface facing toward (for -g) or against (for +g) the direction of gravity. Fruiting bodies were found to form even at simulated zero g, although their height at zero g was the smallest among the experimental samples. As the gravity increased, the height of fruiting bodies increased. The height of fruiting bodies was greater in positive gravity than in negative gravity fields below 3 g, although even at negative gravity the heights were greater than at zero gravity. I.S.

A88-29139
EFFECTS OF HYPERGRAVITY ON CULTURED MAMMALIAN CELLS
YASUHIRO KUMEI, ATSUSHIGE SATO, KAZUKO OZAWA, TOHRU NAKAJIMA (Tokyo Medical and Dental University, Japan), and MASAMICHI YAMASHITA (Tokyo, University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 291-296.

The effects of hypergravity on the proliferation of cultured mammalian cells was investigated using V79, HeLa, and JTC-12 cells pregrown for 3-4 days at unit gravity and then exposed to centrifugal forces of 18, 35, or 70 x g for 3 to 4 days. The gravity effect was assessed by examining the total number of cells and the degree of H-3-thymidine incorporation in each culture flask. It was found that the numaber of cells and the degree of thymidine incorporation at 18 x g and at 35 x g were increased, in comparison to control levels, in all cells. At 70 x g, the enhancing effect on cell proliferation was reduced in HeLa and JTC-12 cells, but was increased in V79 cells. It was found that, at least in the HeLa cells, the enhancement of proliferation was mainly due to the shortening of the G1-phase duration. No changes in the morphology were detected in the phase contrast micrographs of exposed cells. I.S.

A88-29148
THE INACTIVATION OF MICROORGANISMS BY DIFFERENT HEAVY IONS
T. TAKAHASHI, F. YATAGAI, T. KATAYAMA (Institute of Physical and Chemical Research, Wako, Japan), T. DOKE (Waseda University, Tokyo, Japan), and H. OHASHI (NRI Life Science, Kamakura, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 365-372. refs

In this paper, the radiation dose around the trajectory of a heavy ion is estimated using the energy deposition algorithm for electrons developed by Tabata and Ito (1974). The sensitive element is assumed to be a short cylinder of radius 'a' whose axis is parallel to the path of the ion. The result of the density of energy delivery calculations, as well as the Butts and Katz (1967) dose, are applied to interpret inactivation cross sections of B. subtilis spores and E. coli B(s-1) for alpha-particles and heavy ions in experiments that are preliminary to the space studies of the effects of cosmic rays. Preliminary results show that the fraction of dead spores in a sample of B. subtilis spores hit by a single 35-MeV Ar ion was about 30 percent, while in the case of 20-60 MeV Xe ion, the fraction of dead spores was about 50 percent. I.S.

A88-29237
SPACE FARMING IN THE 21ST CENTURY
FRANK B. SALISBURY and BRUCE G. BUGBEE (Utah State University, Logan) Twenty-first Century Science and Technology (ISSN 0895-6820), vol. 1, Mar.-Apr. 1988, p. 32-41. refs

An account is given of the system design features and projected productivity of a fusion-powered farm on the moon, dubbed 'Luna City'. Attention is given to the rationale for nuclear fusion power and to the nutritional and cultural criteria applied to crop evaluation, as well as to plant physiological responses to the entirely artificial environment, and the cuisine that could be based on the crops in question. Legumes, salad crops, leaf and flower crops, sugar-precursors, nuts, roots and tubers, grains, fruits, oil-bearing crops, and herbs and spices, are all included in the plan for Luna City. O.C.

A88-30001
FUNCTIONAL AND MORPHOLOGICAL CHARACTERISTICS OF CARDIOVASCULAR DISORDERS DURING PROLONGED HYPERTHERMIA [FUNKTSIONAL'NAIA I MORFOLOGICHESKAIA KHARAKTERISTIKI NARUSHENII DEIATEL'NOSTI SERDECHNO-SOSUDISTOI SISTEMY PRI PRODOLZHITEL'NOI GIPERTERMII]
A. A. MOIBENKO, L. A. GRABOVSKII, L. F. POPOVICH, and E. G. BIDKOV (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Jan.-Feb. 1988, p. 17-23. In Russian. refs

A88-30002
PERMEABILITY OF THE HEMATOPARENCHYMATOUS OXYGEN BARRIER UNDER VARIABLE PARTIAL OXYGEN PRESSURE IN INHALED AIR [PRONITSAEMOST' GEMATOPARENKHIMATOZNOGO BAR'ERA DLIA KISLORODA PRI EGO RAZLICHNOM PARTSIAL'NOM DAVLENII VO VDYKHAEMOM VOZDUKHE]
V. I. NOSAR' (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Jan.-Feb. 1988, p. 59-66. In Russian. refs

The effect of partial oxygen pressure on the hematoparenchymous barrier for oxygen (HPB) was investigated in rabbits breathing (through a mask) gas mixtures containing different percentages of O2. The parameters of HPB permeability, P(HPB), and the rate of blood supply to the gastrocnemius muscle, Q(m), were calculated according to Berezovskii et al. (1984). It is shown that the inhalation of hypoxic gas mixtures results in arterial and venous hypoxemia and, in mixtures containing only 7 percent O2, in significant lowering of partial O2 pressure in muscular tissue. In rabbits inhaling a gas mixture containing 7 percent O2, the value of P(HPB) and the P(HPB)/Q(m) was almost twice as high as that under normal conditions; on the other hand, these values were lower than normal in rabbits breathing a hyperoxic gas mixture (80 percent O2), demonstrating that the hematoparenchymous barrier is one of the regulators of oxygen fluxes and of tissue respiration. I.S.

A88-30003
THE STATE OF THE RESPIRATORY CHAIN COMPONENTS OF HEPATOCYTES UNDER THE COMBINED EFFECTS OF HYPEROXYBARIA AND THE BETA-ADRENOBLOCKING AGENT OXIDAN [SOSTOIANIE KOMPONENTOV DYKHATEL'NOI TSEPI GEPATOTSITOV PRI VOZDEISTVII GIPEROKSIBARII V SOCHETANII S BETA-ADRENOBLOKATOROM OBZIDANOM]
S. L. NIKOLAI (Kishinevskii Gosudarstvennyi Meditsinskii Institut, Kishinev, Moldavian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Jan.-Feb. 1988, p. 96-100. In Russian. refs

A88-30004
THE EFFECT OF THE PROCEDURE OF ADETURON ADMINISTRATION ON THE EXTENT OF RADIATION-INDUCED DAMAGE IN MICE [RADIATSIONNOE PORAZHENIE MYSHEI V ZAVISIMOSTI OT SPOSOBOV PRIMENENIIA ADETURONA]
T. P. PANTEV, S. TS. TOPALOVA, I. T. NIKOLOV, V. B. TENCHOVA (Meditsinska Akademiia, Institut Rentgenologii i Radiobiologii, Sofia, Bulgaria), and N. I. GVOZDEVA (Institut Biofiziki, Moscow, USSR) Radiobiologiia (ISSN 0033-8192), vol. 28, Jan.-Feb. 1988, p. 104-106. In Russian. refs

The protective effect of adeturon administered in different doses and at different times on X-ray-induced damage in mice was investigated. In one series of experiments, mice were injected with 250 mg/kg adeturon 15 min before and immediately after irradiation. The second experimental group received no drug before irradiation, but 500 mg/kg of the drug was administered immediately after the exposure to X-rays. The survival rate, the leucocyte counts, the cell numbers in the bone marrow and in the spleen, and the nucleic acid content in the blood were used as the indices of damage. The results indicate that the administration of two 250 mg/kg doses of adeturon was more effective than the administration of a single 500 mg/kg dose after irradiation. I.S.

A88-30005
ON THE MECHANISM OF THE ANTIMUTAGENIC EFFECT OF DIBUNOL [K VOPROSU O MEKHANIZME ANTIMUTAGENNOGO DEISTVIIA DIBUNOLA]
L. M. BAKHITOVA and I. V. KOLONINA (AN SSSR, Institut Obshchei Genetiki, Moscow, USSR) Radiobiologiia (ISSN 0033-8192), vol. 28, Jan.-Feb. 1988, p. 111-113. In Russian. refs

The effect of a phenolic antioxidant, butylhydroxytoluol (dibunol), on the different stages of the mutation process induced by gamma rays was investigated using V-79 cultured cells irradiated with Cs-137 at 4.7 Gy/min. In one experimental series, 2.5 or 5 microg dibunol was introduced into the growth medium 2 hr before irradiation; in the second series, the same doses of dibunol were introduced after irradiation, at times varying from 0.5 to 72 h. Compared with untreated controls or with nonirradiated cells treated with dibunol, irradiated cells displayed 2 to 2.5-fold increased numbers of cells with micronuclea and fragmented nuclea. Pretreatment with dibunol resulted in decreased numbers of both micronuclea and fragmented nuclea, with decreases being proportional to the dose. In the second series, the protective effect of dibunol depended on the time of treatment. The best results were achieved with cells treated 72 hr after irradiation, i.e., during the second or third cell division. I.S.

A88-30006
CHANGES IN THE ACTIVITY AND THE CONDITIONED REFLEXES OF ALBINO RATS DURING AND AFTER CHRONIC IRRADIATION WITH MICROWAVES [IZMENENIIA AKTIVNOSTI I USLOVNO-REFLEKTORNOI DEIATEL'NOSTI BELYKH KRYS V PERIOD KHRONICHESKOGO MIKROVOLNOVOGO OBLUCHENIIA I POSLE NEGO]
M. A. NAVAKATIKIAN (Kievskii Nauchno-Issledovatel'skii Institut Obshchei i Kommunal'noi Gigieny, Kiev, Ukrainian SSR) Radiobiologiia (ISSN 0033-8192), vol. 28, Jan.-Feb. 1988, p. 120-125. In Russian. refs

The effect of chronic (1-3 months, 7 hr/day) irradiation with microwaves (2375 MHz; 1, 5, 10, 50, and 500 microW/sq cm) on the activity and the conditioned reflexes of rats was investigated using the open-field test of Navakatikian (1980) to register general activity, and the experimental arrangement described by Navakatikian (1979) to measure conditioned defence reflexes. It was found that, during exposure to microwaves, the inhibition of both the general activity and the conditioned-reflex activity decreased significantly. Upon the termination of irradiation, the general activity of rats went up, and the defense conditioned reflexes gradually normalized. I.S.

A88-30406
HYPEROXIC LUNG DAMAGE IN MICE - APPEARANCE AND BIOCONVERSION OF PEPTIDE LEUKOTRIENES
LEWIS J. SMITH, MIR SHAMSUDDIN, JAMES ANDERSON, and WEI HSUEH (Northwestern University; USVA, Lakeside Medical Center; Children's Memorial Hospital, Chicago, IL) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, March 1988, p. 944-951. Research supported by Northwestern University, Children's Memorial Hospital Research Foundation, and USVA. refs

A88-31478
NEW PROSPECTS FOR DEDUCING THE EVOLUTIONARY HISTORY OF METABOLIC PATHWAYS IN PROKARYOTES - AROMATIC BIOSYNTHESIS AS A CASE-IN-POINT
SUHAIL AHMAD and ROY A. JENSEN (Florida, University, Gainesville) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 41-57. refs
(Contract NSF PCM-83-16275)

A perspective for the evolution of the biochemical pathway for the biosynthesis of aromatic amino acids in Superfamily-B prokaryotes is developed, with the genes specifying a particular product identified. It is shown that, in terms of their amino acid makeup, contemporary prokaryotes evolved as a result of different evolutionary steps for different species. Thus, Acinetobacter is the product of only one genetic change, while the evolution of E. coli involved six steps. Generalizations that apply to three divisions of eubacteria (cyanobacteria, Gram-positive eubacteria, and Gram-negative eubacteria) are discussed. I.S.

A88-31479
ARCHAEBACTERIAL CLASS I AND CLASS II ALDOLASES FROM EXTREME HALOPHILES
WIJAYA ALTEKAR and NENOO M. DHAR (Bhabha Atomic Research Centre, Bombay, India) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 59-64. refs

Both, class I (Schiff-base forming) and class II (metal requiring) fructose biphosphate aldolases were found to be distributed among halophilic archaebacteria. The aldolase activity from Halobacterium halobium, H. salinarium, H. cutirubrum, H. mediterranei and H. volcanii exhibited properties of a bacterial class II aldolase as it was metal-dependent for activity and therefore inhibited by EDTA. In contrast, aldolase from H. saccharovorum, Halobacterium R-113, H. vallismortis and Halobacterium CH-1 formed a Schiff-base intermediate with the substrate and therefore resembled to eukaryotic class I type. The type of aldolase did not vary by changes in the growth medium. Author

A88-31480
THE DEGENERACY RULE OF GENETIC CODE
LIAO FU LUO (Inner Mongolia University, Hohhot, People's Republic of China) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 65-70. refs

the degeneracy rules of genetic code including the distribution of terminators have been deduced through the minimization of mutational deterioration (MD). The MD of a given group of codons is divided into three parts: transitional, transversional and wobbles. The averaged mutational deteriorations (AMD) of various amino acids have been proved in order of their degrees of irreplaceability. Author

A88-31482
CYBERNETIC ORIGINS OF REPLICATION
DAVID P. BLOCH (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 87-96. Research supported by the RGK Foundation and Richard Lounsbery Foundation. refs

This paper proposes a model depicting a series of evolutionary processes beginning with chemical systems and progressing toward replicating systems. The evolutionary progression is resolved into four phases: (1) the replication of RNA segments by self-priming and self-templating, (2) the replication of single-stranded molecules by elongation and controlled scission, (3) the replication of complementary duplexes, and (4) the replication of DNA. The model includes events that introduce such elements of control as are experienced during Darwinian evolution, thus providing a conceptual framework that bridges the gap between pre-Darwinian chemical processes and Darwinian evolution. I.S.

A88-31483* Texas Univ., Austin.
EVOLUTION OF E. COLI TRNA(TRP)
MARK P. STAVES (Texas, University, Austin), JAMES C. LACEY, JR. (Alabama, University, Birmingham), and DAVID P. BLOCH (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 97-105. Research supported by the RGK Foundation and Richard Lounsbery Foundation. refs
(Contract NGR-01-010-001)

It has been shown by Lacey et al. (1985) that, in general, the hydrophobicity ranking of an amino acid correlates with that of its anticodonic nucleotide, with tryptophan being one of the four amino acids for which this rule does not apply. It was proposed that this failure to correlate was due to the fact that the anticodon assignments for the four amino acids were made late, after the mutation of existing tRNAs. In this paper, the evolution of E. coli tRNA(Trp) is examined by comparing its homology with other E. coli tRNAs. The results demonstrate the presence of an evolutionary relationship between E. coli tRNA(Trp) and tRNA(Gly) or tRNA(Arg) molecules, and support the idea of the late assignment of anticodon to Trp. I.S.

A88-32014
PRECAPILLARY AND POSTCAPILLARY RESISTANCE AND TRANSCAPILLARY FLUID EXCHANGE IN THE INTESTINE UNDER THE EFFECTS OF HYPOXIC AND HYPOTHERMIC STIMULI ON THE ORGANISM [PRE- I POSTKAPILLIARNOE SOPROTIVLENIE I TRANSKAPILLIARNYI OBMEN ZHIDKOSTI V KISHECHNIKE PRI DEISTVII GIPOKSICHESKOGO I GIPOTERMICHESKOGO STIMULOV NA ORGANIZM]
A. A. NURMATOV, IU. A. KUDRIASHOV, B. I. TKACHENKO, and V. G. BOCHKOVA (AMN SSSR, Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 74, Jan. 1988, p. 70-76. In Russian. refs

The separate and combined effects of hypothermia and hypoxia on the arterial and venous precapillary and postcapillary flow resistance and on the transcapillary fluid exchange in cat intestine were investigated using small intestine preparations isolated hemodynamically from the body of an anesthetized (but breathing naturally) cat and perfused with the animal's own blood. The hemodynamic indices were determined under the conditions of normothermia and normoxia, normothermia and hypoxia (10 percent O2 in N2), and hypothermia (30 C) followed by hypoxia. It was found that, upon an increase of precapillary and postcapillary resistance due to hypothermia, hypoxia induced no significant shifts in the background values of the small intestine hemodynamics. At the same time, the postcapillary resistance changes, induced by hopoxia alone, were different in value and direction from those induced by hypoxia in combination with hypothermia. I.S.

A88-32015
THE EFFECT OF ADAPTATION TO COLD ON THE ENERGY-DEPENDENT ION TRANSPORT IN THE SKELETAL MUSCLE FIBERS OF RATS [VLIIANIE ADAPTATSII K KHOLODU NA ENERGOZAVISIMYI IONNYI TRANSPORT VOLOKON SKELETNYKH MYSHTS KRYSY]
G. P. BELOUSOVA, A. D. PSHEDETSKAIA, and I. N. ZVIAGINA (Petrozavodskii Gosudarstvennyi Universitet, Petrozavodsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 74, Jan. 1988, p. 137-142. In Russian. refs

The resting membrane potential (RMP) of fast and slow skeletal-muscle fibers (from m. gastrocnemius medialis and m. soleus, respectively) were measured in control and cold-adapted rats before and 15 and 30 min after an injection with strophanthin. The sensitivity of fast and slow fibers to the depolarizing effect of strophanthin was found to differ in both control and cold-adapted animals: in control rats, the effect was stronger in the gastrocnemius fibers than it was in the soleus, whereas in cold-adapted rats, the opposite was true. Thus, the process of adaptation to cold appears to induce a redistribution of the metabolic constituent of RPMs differently in different types of muscle fibers. I.S.

N88-19061# School of Aerospace Medicine, Brooks AFB, Tex.
LASER FLASH EFFECTS ON CHROMATIC DISCRIMINATION IN MONKEYS Final Report, Apr. 1986 - Jun. 1987
ELMAR T. SCHMEISSER Oct. 1987 26 p
(AD-A187703; USAFSAM-TR-87-17) Avail: NTIS HC A03/MF A01 CSCL 06D

Detecting a camouflaged target in a visually noisy background depends on the ability of the observer to discriminate the target from the surrounding terrain. Visible laser irradiation at less than damage levels can act as a masking source by compromising or reducing the observer's ability to resolve differences in the visual scene. Previous research has examined this concept by investigating laser flash effects on: acuity (size discrimination); tracking (motion discrimination); visual sensitivity (color); and contrast sensitivity functions (luminance contrast). In all cases, flashes from continuous-wave (CW) sources have proven more effective visually than pulsed (Q-switched) sources, when compared on peak energy criterion (i.e., MPE), even though Q-switched lasers induce damage at lower energy doses. Additionally, the inherent safety of ultra-short laser pulses has been questioned. Past animal research has shown that, on the measures of acuity, sensitivity, tracking, and contrast detection, the animals recover to baseline if the exposure has remained below the MPE. The one measure that has not been investigated is color discrimination. The major conclusions from this investigation are: (1) red and green colored laser flashes shift the color balance transiently in the visual system, and yellow flashes do so to a lesser extent; thus targets may change both hue and brightness after an observer receives colored flashes; and (2) Q-switched lasers, at non-lesioning levels, when equated for time averaged perceptual brightness, have comparable effects to flashes with longer time courses. GRA

N88-19062# Army Research Inst. of Environmental Medicine, Natick, Mass.
CARBAMATES, ATROPINE, AND DIAZEPAM: EFFECTS ON PERFORMANCE IN THE RUNNING RAT
CANDACE B. MATTHEW, ROGER W. HUBBARD, RALPH P. FRANCESCONI, and GLENN J. THOMAS 21 Oct. 1987 9 p
(AD-A188009) Avail: NTIS HC A02/MF A01 CSCL 06O

We have reported that when rats (500 g, male) are exercised to exhaustion on a treadmill, pretreatment with the centrally acting carbamate physostigmine reduced endurance (run time, RT) and increased the rate of rise of core temperature (Tc+). Both RT and Tc+ were restored to control levels by pretreatment with either or a combination of atropine (A), and diazepam (D). Our objective in the present work was to determine whether A+D could also restore the performance and thermoregulatory decrements induced by the peripherally acting carbamate pyridostigmine (PY). After drug administration, rats were run (11m/min, 60 elevation, Ta= 26 C) to exhaustion. PY treatment resulted in a reduced RT and an increased heat gain that neither A nor D alone (A+PY and D+PY) could restore to control levels. On the other hand, a combination of both A and D restored these variables to control levels. On the other hand, a combination of both A and D restored these variables to control levels. In conclusion, A+D can restore the performance and thermoregulatory decrements resulting from the administration of either a centrally or a peripherally acting carbamate. GRA

N88-19063# Texas Univ. Health Science Center, Houston.
PSYCHOPHYSICAL, BIOCHEMICAL AND HISTOLOGICAL STUDIES OF SPECTRALLY SELECTIVE PHOTIC DAMAGE TO PRIMATE RETINA Annual Report, Final Report, 1 Nov. 1982 - 1 Feb. 1987
H. G. SPERLING and A. A. WRIGHT 25 Feb. 1987 38 p
(Contract DAMD17-83-C-3003; DA PROJ. 3M1-61102-BS-10)
(AD-A188115) Avail: NTIS HC A03/MF A01 CSCL 06G

Spectral sensitivity and hue discrimination data are presented which show an irrecoverable loss of blue sensitive cone (B-cone) response following as little as 64. milliwatts per square cm of 458.5nm argon-ion laser exposure to rhesus monkey central retina over 4 hours of intermittent exposure. If reciprocity of intensity and exposure is linear, blue-blindness and attendant loss of discrimination colored signals could result from fewer than 240 brief exposures to blue laser light over a several hour period. Evidence is also shown for green lights. During the current contract period, success was obtained in destroying the B-cone response in single sessions under anaesthesia and in obtaining spectral sensitivity measures from the focal ERG which are sufficiently stable and detailed to measure the response of R-, G- and B-cones, rods and the interactions between them. Evidence is presented, from the focal ERG, that the color-opponent type neural inhibition exists in rhesus, as in fish and amphibia, in the out-plexiform layer of the retina, since it is detectable in the late receptor potential (a-wave). GRA

N88-19064# Science Applications International Corp., McLean, Va.
CRITICAL PHENOMENA AND ELECTROMAGNETIC EFFECTS IN BIOLOGICAL MEMBRANES Annual Report, Nov. 1986 - Oct. 1987
JAMES D. BOND, N. C. WYETH, and CAROL A. JORDAN 30 Oct. 1987 12 p
(Contract N00014-83-C-0008; PROJ. RR0-4108)
(AD-A188156; SAIC-87/1167) Avail: NTIS HC A03/MF A01 CSCL 06J

A physical basis is established whereby external electromagnetic fields can interact with biological membranes. The mechanism discussed, based on the membrane residing in a thermodynamic state near critical point, can accommodate very low field strengths. Numerical estimates of field strengths required to drive the membrane system close enough to a critical point, assuming it does not initially reside there, are presented. GRA

N88-19065 New South Wales Univ., Sydney (Australia).
MOTOR CONTROL IN MAN AND MONKEY Abstract Only. Ph.D. Thesis
J. G. COLEBATCH Nov. 1986 211 p
Avail: Issuing Activity

Aspects of motor control were studied in both human subjects and monkeys. Normal subjects were tested for their ability to keep constant either the position of the arm or the force exerted without external feedback. There was a period prior to conscious awareness of the applied disturbance during which stiffness due to intrinsic muscle properties plus reflex responses to stretch were measured. The relative strength of elbow extension and flexion on the normal and weak sides of hemiparetic patients were compared. It was found that the flexors were relatively more weakened that the extensors. Two monkeys were trained to accept percutaneous vibration over muscle tendons and one of them also to accept tendon percussion. The effects of these stimuli on individual precentral neurons was compared with the effects of passive movement. Neurons excited by passive elbow flexion or extension were equally likely to respond to vibration or percussion

of the triceps tendon. This lack of selectivity may account for some of the properties of the long-latency reflex response to stretch. In the final series of experiments a cooling plate was implanted over area 2 of the postcentral gyrus of a monkey, thus allowing synaptic transmission to be blocked reversibly. Short-latency excitation of area-4 neurons from passive limb movements was not affected by cooling, indicating that cortico-cortical afferents from area 2 were not responsible. The general implication of these findings and possible further investigations are discussed. Author

N88-19066*# National Aeronautics and Space Administration, Washington, D.C.
GENETIC RESEARCH IN SPACE
N. L. DELONE, V. V. ANTIPOV, and YE. A. ILYIN Mar. 1988 10 p Transl. into ENGLISH of Geneticheskiye Issledovaniya v Kosmose (Moscow, USSR), Inst. for Medical-Biological Problems, Ministry of Health USSR, Scientific Council, 1987 p 1-11 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASW-4307)
(NASA-TT-20216; NAS 1.77:20216) Avail: NTIS HC A02/MF A01 CSCL 06B

The role of the genetic apparatus in the adaptation of the organism to conditions of weightlessness is studied. The investigation includes studies at the gene, chromosome, cell, tissue, and organism levels, as well as studies at the population level. Author

N88-19883*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE STATION HUMAN FACTORS RESEARCH REVIEW. VOLUME 3: SPACE STATION HABITABILITY AND FUNCTION: ARCHITECTURAL RESEARCH
MARC M. COHEN, ed., ALICE EICHOLD, ed., and SUSAN HEERS, ed. Oct. 1987 211 p Workshop held at Moffett Field, Calif., 3-6 Dec. 1985
(NASA-CP-2426-VOL-3; A-86263-VOL-3; NAS 1.55:2426-VOL-3) Avail: NTIS HC A10/MF A01 CSCL 05H

Articles are presented on a space station architectural elements model study, space station group activities habitability module study, full-scale architectural simulation techniques for space stations, and social factors in space station interiors.

N88-19889# Joint Publications Research Service, Arlington, Va.
USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES
13 May 1987 109 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-87-010) Avail: NTIS HC A01/MF A01

Biomedical and behavioral science research in the U.S.S.R. is discussed. Topics in aerospace medicine, agriculture, biochemistry, biophysics, biotechnology, epidemology, genetics, laser bioeffects, microbiology, electromagnetic radiation, pharmacology, toxicology, physiology, public health, radiation biology and veterinary medicine are covered.

N88-19890# Joint Publications Research Service, Arlington, Va.
CHANGES IN HEMOSTASIS SYSTEM OF ANIMALS UNDER CONDITIONS OF GRANULOCYTOPOIESIS INHIBITION UNDER EFFECT OF DECREASED BAROMETRIC PRESSURE Abstract Only
N. V. LUNINA and A. F. POLTAVSKIY *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 1 13 May 1987 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 31, no. 6, Nov. - Dec. 1985 p 712-716 Original language document was announced in IAA as A86-21454
Avail: NTIS HC A01/MF A01

The establishment of the dependence of changes in the hemostatis system of the body under the effect of low barometric pressure on the neutrophil leukocytes count and the functional state of their lysosomal apparatus involved experiments on 60 rabbits of both sexes (weight 2 to 3.5 kg). In order to inhibit granulocytopoiesis, all rabbits received the cytoststic drug myelobromal perorally in a dose of 80 mg/kg for 5 to 8 days until the number of leukocytes in the peripheral blood was reduced by 70 to 80 percent in comparison with the initial level. The rabbits were kept for one hour in a ventilated pressure chamber at 304 mm of mercury (494 gPA). The single one hour effect of low barometric pressure after the use of the drug did not activate the coagulation and fibrinolytic systems of the blood. This was attributed to an insufficient reaction of the lysosomic appartus of the neutrophil leukocytes and their lowered level in the pheripheral blood to activate the regulatory systems which are dependent on the Hageman factor. Author

N88-19891# Joint Publications Research Service, Arlington, Va.
CYTOMORPHOLOGY AND ULTRASTRUCTURE OF CORN ROOT MERISTEM IN WEIGHTLESSNESS Abstract Only
M. G. TAIRBEKOV, V. G. GRIF, YE. M. BAMICHEVA, and YE. M. BALOVICH *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 2 13 May 1987 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Biologicheskaya (Moscow, USSR), no. 5, Sep. - Oct. 1986 p 680-687 Original language document was announced in IAA as A87-21800
Avail: NTIS HC A01/MF A01

The major purpose of this experiment performed on the Cosmos 1514 was to compare the energy expenditure in plants from the early phases of ontogenesis up to 7-day sprout growth. Experiments were performed on sprouting Sterling corn. The experiment involved comparative cytologic and electron microscope analysis of corn sprout cells grown in weightlessness and on earth with primary attention given to the anatomic structure, cytologic characteristics and ultrastructural organization of root meristem and cover cells. All morphological parameters of the cells were vertially identical for both groups of plants, the only difference being in the dimensions of the cells of the meristems. The differences were also observed between two control versions, however. Slight observed differences in mitotic index frequency are also not considered reliable. The cytologic and ultrastructural analyses also showed that the slight differences between experimental and control versions fall within the limits of the physiological norm of the reaction of plants to external effects. Author

N88-19892 New South Wales Univ., Kensington (Australia). Centre for Biomedical Engineering.
RESPONSE OF CORONARY BLOOD FLOW TO STEP CHANGES IN PLASMA PROTEIN CONCENTRATION IN THE ISOLATED RAT HEART Abstract Only. M.S. Thesis
DAVID E. LECHEMINANT Sep. 1986 121 p
Avail: Issuing Activity

While interstitial osmotic pressure has been suggested as a possible mechanism for autoregulation of coronary blood flow (CBF), there is a lack of confirmatory evidence with respect to response of CBF to step changes in plasma colloid osmotic pressure. The aim of this study was to measure CBF in a Langendorf preparation of isolated, paced, nonworking rat hearts, retrogradely perfused with a modified Krebs Henseleit solution. Flow response to positive and negative step changes between 1 and 3, 6 and 9 percent plasma albumin concentrations (PAC) were observed. Following perturbation in PAC flow initially increased in a negative step, and decreased with a positive step. This over/under shoot increased with increasing PAC step size, and was of a larger magnitide for a negative step change in PAC. Subsequently, steady state flow returned to within 10 percent of its control value. These findings support the hypothesis that tissue osmotic pressure has an autoregulatory function in the rat heart. The nonlinear response to step change in PAC is supported by model results based on smooth muscle response to interstitial osmolarity. Author

N88-19893# European Space Agency, Paris (France).
PROCEEDINGS OF THE 3RD EUROPEAN SYMPOSIUM ON LIFE SCIENCES RESEARCH IN SPACE
J. HUNT, ed. Dec. 1987 339 p Symposium held in Graz, Austria, 14-18 Sep. 1987; sponsored by ESA, the Austrian Solar and Space Agency, and Technische Univ., Graz, Austria
(ESA-SP-271; ISSN-0379-6566; ETN-88-91970) Avail: NTIS HC A15/MF A01

The role of ESA in life sciences, and mission opportunities; human physiology in microgravity (respiratory system, cardiovascular system, metabolic systems, neurophysiology, animal models); plant and cell biology; radiation, biophysics, and exobiology; and biotechnology were discussed. ESA

N88-19894# European Space Agency, Paris (France). Directorate of Earth Observation and Microgravity.
THE EUROPEAN SPACE AGENCY'S ROLE IN LIFE SCIENCES AND RESEARCH IN SPACE
H. OSER *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 9-12 Dec. 1987
Avail: NTIS HC A15/MF A01

The ESA spaceborne life science program, covering neurophysiology, cardiovascular and metabolic studies, immunology and cell biology, and radiation biophysics and exobiology is introduced. Experiment facilities on Spacelab, Biorack, Anthrorack, EURECA, Biocosmos, and the shuttle-borne sled are described. The role of ESA in selecting and coordinating experiments is explained. ESA

N88-19895# European Space Agency, Paris (France). Directorate of Earth Observation and Microgravity.
LIFE SCIENCES IN THE FRAMEWORK OF THE ESA MICROGRAVITY PROGRAM AND FUTURE FLIGHT OPPORTUNITIES
G. SEIBERT *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 13-18 Dec. 1987
Avail: NTIS HC A15/MF A01

The history of ESA's life science program is described, and ongoing and future programs, including cooperation with other agencies, are outlined. Microgravity facilities for EURECA are listed, and the effects of delays in the STS program are shown. Life science opportunities offered by the Columbus Space Station are summarized. ESA

N88-19898# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EXOBIOLOGY AND BOTANY FACILITIES FOR EURECA
M. GARVIN and J. KINGDON *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 27-30 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

The Exobiological and Radiation Assembly (ERA) is a multi-user life science facility designed to support investigations into the effects of the radiation environment at low Earth orbit upon living organisms. Two classes of investigation are possible with ERA; the first group concerns the effects selected bandwidths of solar radiation, and the second concerns the effects of HZE particles, upon living material. The Botany Facility is proposed as a multiuser reflyable life science facility, to support research into long term response of higher and lower plants to the microgravity and radiation environments encountered at low Earth orbit; under the appropriate circumstances these same facilities may be used to conduct entomological investigations. Both facilities are compatible with EURECA. ESA

N88-19899# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
BIOTEX, A PROJECT FOR BIOTECHNOLOGICAL BASIC EXPERIMENTS UNDER MICROGRAVITY
V. SOBICK, U. FRIEDRICH, G. H. KLEIN, and S. WALTHER (Erno Raumfahrttechnik G.m.b.H., Brémen, West Germany) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 31-34 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

Biotechnological basic Experiments under microgravity is an experiment double rack for Spacelab mission D-2. It contains multiuser facilities for electrocell fusion (EF), free flow electrophoresis (EP), and cell cultivation (CC). Hybrids of animal cells or plant protoplasts are produced in the EF unit. Cells or proteins are separated in the EP facility. Different cell types are cultivated in the CC unit, in order to study weightlessness effects on proliferation rates, productivities, and chemotactical mobilities. Experimental procedures are supported by a work bench, a microscope, incubators, a cooler, and a centrifuge. ESA

N88-19900# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
LIFE SCIENCE TECHONOLOGY
J. KINGDON and P. SCHILLER *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 35-38 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

The microgravity utilization aspects relevant to life sciences of ESA's technological research are reviewed. The history of ESA life sciences research is described. The Biosample system concept for preservation, handling, and observation of samples used in experiments dedicated to space medicine, pulmonary diffusion capacity, and applied biology in space is presented. ESA

N88-19901*# Vrije Universiteit, Brussels (Belgium). Inst. of Interdisciplinary Research.
THE RESPIRATORY SYSTEM UNDER WEIGHTLESSNESS
M. PAIVA, L. A. ENGEL, J. M. B. HUGHES, H. J. GUY, G. K. PRISK, and J. B. WEST (California Univ., San Diego.) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 41-45 Dec. 1987
(Contract NAS9-16037; FRSM-3-4521-87; NIH-HL-26330)
Avail: NTIS HC A15/MF A01

Studies of pulmonary functions at rest to be studied on Spacelab mission D-2 are introduced. Gravity dependence of the distribution of ventilation (single breath washout, multibreath washout-washin); chest wall shape and motion; and the vascular compartment (lung blood flow, capillary volume, liquid content, diffusive capacity) are discussed. ESA

N88-19909*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES RESEARCH IN SPACE: THE REQUIREMENT FOR ANIMAL MODELS
C. A. FULLER, R. W. PHILIPS (Colorado State Univ., Fort Collins.), and R. W. BALLARD *In* ESA. Porceedings of the 3rd European Symposium on Life Sciences Research in Space p 77-82 Dec. 1987
Avail: NTIS HC A15/MF A01

Use of animals in NASA space programs is reviewed. Animals are needed because life science experimentation frequently requires long-term controlled exposure to environments, statistical validation, invasive instrumentation or biological tissue sampling, tissue destruction, exposure to dangerous or unknown agents, or sacrifice of the subject. The availability and use of human subjects inflight is complicated by the multiple needs and demands upon crew time. Because only living organisms can sense, integrate and respond to the environment around them, the sole use of tissue culture and computer models is insufficient for understanding the influence of the space environment on intact organisms. Equipment for spaceborne experiments with animals is described. ESA

N88-19910# Glasgow Univ. (Scotland). Dept. of Botany.
PLANT BIOLOGY IN SPACE
M. B. WILKINS *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 85-90 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

Free fall, Spacelab, and Columbus facilities for conducting studies on plants in orbit, and the principal areas of plant biology in which experiments can be carried out using these opportunities are reviewed. Areas of experimental plant biology that can be profitably studied in microgravity are: (1) mechanism of gravity perception in the specialized gravity-sensing cells (statocytes) of roots and shoots, (2) role of gravity in the division, growth, and differentiation of somatic cells in the plant body and their biochemical and physiological behavior, (3) role of gravity in cell to cell coordination and the functional integrity of the whole plant, especially the reproductive systems, (4) role of gravity in nutation, (5) mechanism by which plants detect and respond to other environmental stimuli such as light, and electrical and magnetic fields, (6) the effects of microgravity and absence of 24 hr periodic signals on circadian rhythmicity in enzyme activity and other phenomena in plants. ESA

N88-19911# Paris VI Univ. (France).
GRAVISENSING IN LENTIL SEEDLING ROOTS GROWN IN SPACE (SPACELAB D-1 MISSION)
G. PERBAL and D. DRISS-ECOLE *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 91-96 Dec. 1987 Sponsored by CNES
Avail: NTIS HC A15/MF A01 CSCL 06C

Cell differentiation of gravisensing cells and graviresponsiveness of roots were investigated in lentil seedlings grown on the ground, on a 1g centrifuge in space, in microgravity, and first in microgravity and then placed on the 1g centrifuge for 3 hr with the roots perpendicular to the centrifugal acceleration. In the last sample, the roots bend strongly under the effect of the acceleration. The amplitude of root curvature on the centrifuge is not significantly different from that observed on ground controls growing in the vertical position and placed in the horizontal position for 3 hr. Morphometric analysis of the statocytes shows fewer aggregates lining longitudinal walls in microgravity and that the amyloplasts are mostly distributed in the proximal half of these cells. The results obtained on the location of the nucleus in the statocyte show that the microfilaments which linked this organelle to the cell periphery can react to a centrifugal acceleration by pulling the nucleus toward the proximal wall. ESA

N88-19912# Trondheim Univ. (Norway). Dept. of Physics.
A METHOD TO DETECT AND DIGITIZE SMALL PLANT MOVEMENTS
A. JOHNSSON and T. EIDESMO *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 97-100 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

A digitized, precise and compact technique for position sensing of plant parts is described. The moving object is illuminated to cast a shadow on a photodiode array. Movements can then be monitored by the individual diode voltages from the array. Clocked, sequenced output signals from a 256 diode array were digitized and coupled to a personal computer. Results from studies of gravitropic movements of oat coleoptiles, grown under different g-levels, are presented. Resolution of 25 microns is achieved, and on-line measurement is feasible. ESA

N88-19913# Trondheim Univ. (Norway). Dept. of Botany.
PLANT CELL CULTURES IN SPACE BIOLOGY STUDIES
T.-H. IVERSEN, C. BAGGERUD, and K. DRAGET *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 101-106 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

The rate of cell wall regeneration using rape protoplasts was studied in preparatory experiments for the Spacelab Biorack IML-1 mission. Under normal ground conditions the cell wall regenerates during the first 24 hr. Results from experiments using low temperatures or immobilized protoplasts demonstrate that the regeneration can be delayed. This is important in connection with the problems of late access to the Space Shuttle before launch. The perspectives of using different types of plant cell cultures in space research are also discussed. ESA

N88-19914# Aarhus Univ. (Denmark). Inst. of Molecular Biology and Plant Physiology.
THE USE OF PLANT PROTOPLASTS IN BIOTECHNOLOGICAL SPACE RESEARCH
O. RASMUSSEN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 107-111 Dec. 1987 Sponsored by the Danish Space Board
Avail: NTIS HC A15/MF A01 CSCL 06C

Results on cultivation of plant protoplasts in a growth chamber designed for the Spacelab Biorack IML-1 mission are presented. Perspectives of application of advances in plant molecular biology for space biology programs are considered. Growth rate, DNA uptake, differentiation, reproduction, and gene transfer are discussed. ESA

N88-19915# Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Bioenergetique Cellulaire et Cytophysiologie.
ECOLOGICAL ALGAL SYSTEM IN MICROGRAVITY CONDITIONS: PRELIMINARY RESULTS
G. DUBERTRET, M. LEFORT-TRAN, and C. CHIPAUX (MATRA Espace, Paris-Velizy, France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 113-115 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

As part of a program to analyze the biological and technical problems raised by food production and regeneration of atmosphere in microgravity, an experiment of algae culture was launched. By combination of heterotrophic growth of Euglena plastid mutant (oxygen uptake and CO2 evolution) with the autotrophic growth of Nostoc (cyanobacteria, oxygen evolution, and CO2 uptake) a closed ecological algal system was studied. Results show that most of the Euglena cells and some Nostoc akinetes survive the long initial resting period in harsh conditions (darkness and anerobiosis). They germinate and produce filaments of vegetative photosynthetic cells upon illumination during orbital flight. ESA

N88-19916# Institut National de la Recherche Agronomique, Thiverval-Grignon (France).
CLOSED SYSTEM PHYSIOLOGY: ROLE OF OXYGEN IN THE DEVELOPMENT OF WHEAT
A. GERBAUD and M. ANDRE (Commissariat a l'Energie Atomique, Saint-Paul-les-Durance, France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 117-123 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

The physiological function of photorespiration and development at low O2 pressure was studied, to assess the affect of photorespiration on cultures in space conditions (food, O2 regeneration, closed ecological life support systems). The experiment consists in the cultivation of wheat in twin chambers, in one of which, by the adequate manipulation of O2 and CO2 levels, photorespiration was reduced but the biomass gain remained the same as in the control. Earing is retarded and there is no seed production. ESA

N88-19918# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.

HOW DOES PHYSARUM POLYCEPHALUM PERCEIVE AND USE GRAVITY?

W. BREIGLEB, I. BLOCK, and A. WOLKE (Bonn Univ., West Germany) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 129-132 Dec. 1987

Avail: NTIS HC A15/MF A01

Physarum polycephalum is discussed as being an ideal model for studying the regulation of amoeboid movements. The influence of gravity on this regulation is partly analyzed by describing four independent g-reactions of this acellular slime mold. Such reactions are found in connection with the regulation of the amoeboid contractions, with patterns of the nuclear mitotic time intervals, with a polar differentiation of the whole cell, and with a real geotaxis. The first three reactions are involved in a receptor mechanism of unknown purpose. ESA

N88-19923# Institute of Biomedical Problems, Moscow (USSR).

NEURO-REFLEX MECHANISMS OF CIRCULATION REGULATION IN SIMULATED MICROGRAVITY

S. F. KHOLIN and A. E. ENES *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 155-157 Dec. 1987

Avail: NTIS HC A15/MF A01

Hemodynamic responses of cats, dogs, and monkeys to head up and head down tilts were investigated using electrostimulation of afferent fibers of somatic nerves of cranial and caudal body regions. The data obtained allow conclusions related to reflex regulation of circulation during body position changes. As shown, somatic afferent impulsations are required to optimize the cardiac function and distribution of cardiac output and to reduce blood pooling in different body compartments. Afferent somatic impulsation is integrated and reflex response is formed with an involvement of sympatho-activating neurons of the neutro-lateral surface of medulla oblongata. ESA

N88-19925*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

P-31 MAGNETIC RESONANCE SPECTROSCOPY (MRS) OF LIMB MUSCLES DURING BEDREST WITH EXERCISE COUNTERMEASURES

P. BERRY, I. BERRY, S. ARNAUD, and M. MOSELEY (California Univ., San Francisco.) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 163-165 Dec. 1987

Avail: NTIS HC A15/MF A01

Nineteen volunteers in bed with head down tilt (-6 deg) for 1 month and doing or not exercise training while in bed (lido or ergometer) had their limb muscle studied by magnetic resonance spectroscopy. A protocol of repetitive exercise in the magnet was set and a wooden probe designed to support the limb and to allow exercise. Spectra were recorded continuously during the protocol. In each spectrum, inorganic phosphate, phosphocreatin, adenosin triphosphate, and pH were measured. All the subjects were studied before, after bedrest, and 6 weeks later. After 1 month, the lido group show no changes in the spectra of their leg muscles while the group doing no exercise or ergometer do. For the arms, a loss of muscle function is only seen in the group doing no exercise. ESA

N88-19926# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Oral Cell Biology.

DISUSE CONDITION STIMULATES BONE RESORPTION IN ORGAN CULTURE

J. KLEIN-NULEND, J. P. VELDHUIJZEN, M. DEJONG, and E. H. BERGER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 167-171 Dec. 1987

Avail: NTIS HC A15/MF A01

The influence of disuse condition on osteoclastic bone resorption was investigated using organ cultures of fetal mouse bone rudiments. Rudiments were cultured for 5 days under atmospheric pressure (disuse condition), or under the influence of intermittent compressive force (ICF; loading condition) of physiological magnitude. Bone resorption significantly increases under disuse condition as indicated by an increased release of Ca45 from prelabled bones. Conditioned media from cultures exposed to disuse condition (disuse-CM) also increase mineral resorption, compared to conditioned media from cultures exposed to ICF (ICF-CM). Disuse-CM increases the number of osteoclast precursor cell containing colonies in 7-day bone marrow cultures, but ICF-CM does not. Direct exposure of bone marrow cultures to disuse condition has no effect. Disuse condition may increase osteoclastic resorption by stimulating the local production of bone resorbing factors. ESA

N88-19927# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Oral Cell Biology.

AN IN VITRO MODEL SYSTEM TO STUDY THE EFFECT OF MICROGRAVITY AND LOADING CONDITIONS ON THE MINERALIZATION AND RESORPTION OF SKELETAL TISSUES

J. P. VELDHUIJZEN, J. KLEIN-NULEND, and E. H. BURGER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 173-178 Dec. 1987

(Contract ZWO-MG-004)

Avail: NTIS HC A15/MF A01

An in vitro model in which fetal mouse long bones and calvaria are used to study mineralization and resorption processes under noncompressed control conditions and under intermittent and continuous compression is described. Compression increases the osteogenic activity in the skeletal tissues resulting in an increased mineralization. At the same time mineral resorption by osteoclasts is diminished. This may indicate that control cultures are equivalent to disuse or microgravity conditions in vivo. If that assumption is true, the model is very suited to study at a cellular level the effect of disuse or microgravity on skeletal tissues. This hypothesis will be tested field in spacelab Biorack experiment IML1-02NL. ESA

N88-19928# Saint-Etienne Univ. (France). Lab. de Biologie du Tissu Osseux.

DOES 7-DAY HINDQUARTERS UNLOADING SIMULATE 7 DAYS OF WEIGHTLESSNESS EXPOSURE IN RAT TRABECULAR BONE?

L. VICO, A. V. BAKULIN, and C. ALEXANDRE *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 179-182 Dec. 1987

Avail: NTIS HC A15/MF A01

The effects of 7 days space flight and of 7 days tail suspension in trabecular bone of male rats were compared using histomorphometric analysis. Bone loss in tibial metaphysis is found to be more extensive in flight than in suspended rats. In femoral metaphysis, the trabecular bone volume was measured under muscular insertions: in flight rats no statistical change is observed while a reduction is noted in suspended rats. In microgravity, muscular tractories may have a protective effect upon the skeleton. Vertebral bodies are not affected in flight rats whereas a trend of decreasing bone mass is found in suspended rats. Bone cellular activities indicate that tibial bone loss in the 2 deg spongiosa is associated with an impairment in bone formation activity in both 0 and 1 g conditions. Bone resorption activity remains unchanged in flight rats whereas a twofold increase occurs in simulated conditions. Therefore physiological mechanisms of the bone loss are different in space flight and in suspension conditions. ESA

N88-19930# Mainz Univ. (West Germany). Inst. for Biochemistry.
SURVIVAL UNDER SPACE VACUUM: BIOCHEMICAL ASPECTS
K. DOSE, A. BIEGER-DOSE, K.-D. MARTENS, R. MEFFERT, T. NAWROTH, S. RISI, A. STEINBORN, and M. VOGEL *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 193-195 Dec. 1987
(Contract BMFT-01-Q-174/3)
Avail: NTIS HC A15/MF A01

The biophysical and biochemical processes that are responsible for the biological responses of organisms to vaccum are reviewed. Exposure to vacuum predominantly causes the removal of water. Thus hydrophobic bonds are disrupted, the B-structure of DNA is destabilized, and the metabolism practically comes to a complete halt. To most organisms these changes are lethal. Organisms exist, however, that survive long periods of dryness or vacuum in a dormant state because they are able to stabilize their water-requiring structures by the accumulation of polyols and related compounds. But at least bacterial spores and fungal conidia do not show complete recovery after long-term (several months) exposure to dynamic vaccum at room temperature because an increasing amount of their DNA becomes crosslinked to protein.
ESA

N88-19931# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.
ULTRAVIOLET (180 TO 300 NM) ACTION SPECTRA FOR INACTIVATION AND DNA PHOTOPRODUCT FORMATION OF BACILLUS SUBTILIS SPORES UNDER ULTRAHIGH VACUUM
C. LINDBERG, G. HORNECK, H. BUECKER, G. REITZ, and H. REQUARDT *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 197-200 Dec. 1987
Avail: NTIS HC A15/MF A01

Three space environment simulation conditions (suspension, air dry, ultrahigh vacuum, UHV) are shown to affect the spore specific photoproduct in a fluence dependent manner. The increased sensitivity of bacterial spores to UV irradiation in vacuum may be due to vacuum specific photoproducts like DNA-protein cross-links that cause a synergistic response of spores to the simultaneous action of UV and UHV. The singlet state of thymine is a probable precursor of (c,s) thymine dimers (TT) whereas the triplet state may be a precursor of (t,s) TT. Because of the short life time (0.01 nanosec) of the singlet state, the diffusion-controlled dimerization of (c,s) TT may be favored in dry systems, where the decreased mobility of neighboring thymines is accompanied by DNA-conformational changes. Therefore, a vacuum specific conformation dimerizes more readily to (c,s) TT. It is supposed that TDHT is a typical photoproduct, that occurs upon local dehydration during sporulation; DNA changes its conformation from the B-form to the A-form. The formation of minor thymine-derived photoproducts, not detected by the complete hydrolysis procedure, cannot be excluded.
ESA

N88-19932# Giessen Univ. (West Germany). Strahlencentrum.
SURVIVAL AND MUTATION INDUCTION OF DEHYDRATED YEAST CELLS AFTER UV EXPOSURE
K. SCHENK and J. KIETER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 201-204 Dec. 1987
Avail: NTIS HC A15/MF A01

Cells of a haploid wild strain of S. cerevisiae were vacuum-dried on glass plates or membrane filters. Different plating efficiencies were observed. Electron microscopical analysis suggests that this is due to an influence of the carrier material surface on the stability of the cell wall. The drying method was then used with three yeast strains: RAD-wildtype, photoreactivation deficient mutant, and excision deficient mutant. Survival and mutation induction after far UV irradiation is higher in dry cells compared to wet controls. Photoreactivation studies indicate that the relative importance of pyrimidine dimers is reduced in the dry state.
ESA

N88-19933# Giessen Univ. (West Germany). Strahlencentrum.
CELLULAR EFFECTS OF HEAVY IONS: EXPERIMENTAL RESULTS AND THEORETICAL APPROACHES
J. KIEFER and E. SCHNEIDER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 205-208 Dec. 1987 Sponsored by the Gesellschaft fuer Schwerionenforschung and BMFT
Avail: NTIS HC A15/MF A01

On the basis of the physical processes and their mathematical analysis the dependence of the experimentally found inactivation cross sections (sigma) for yeast cells on the linear energy transfer (LET) is discussed. The range of high LET where the unique dependence of sigma on LET is lost, is analyzed, comparing three yeast strains of different sensitivity. The experimental results are discussed distinguishing three cases: the dose approximation, the LET approximation; and the track structure case. A theoretical approach to serve as a basis to assess the role of heavy ions as a component of the space radiation environment is proposed.
ESA

N88-19935# Marburg Univ. (West Germany). Klinikum.
EFFECTS OF HEAVY IONS ON EGG-DEVELOPING SYSTEMS
E. H. GRAUL and W. RUETHER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 215-218 Dec. 1987
Avail: NTIS HC A15/MF A01

The influence of space flight environment, especially HZE-particles of cosmic radiation on two different egg-systems (Artemia salina and Carausius morosus) were studied. The passage of each single heavy ion through a mosaic egg of Artemia salina, resting in blastula stage, damages a cellular area large enough to disturb either embryogenesis of further development of the larva, or the integrity of the adult individual. Similar results are found in Carausius morosus (Spacelab mission D-1). Eggs of five stages of development were used in the experiment. Their development continued when in orbit. The hatching rate decreases to 36 percent in the flight group after HZE influence. Combined action of HZE particles and microgravity probably aggravates the damage to early embryogenesis resulting in a high rate of body anomalies of the larvae.
ESA

N88-19936# Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Botanie.
EFFECTS OF COSMIC HEAVY ION RADIATION AND SPACE MICROGRAVITY ON PLANT SYSTEMS
A. R. KRANZ *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 219-223 Dec. 1987
Avail: NTIS HC A15/MF A01

Ground and space flight results on space environment effects on plants are reviewed. Experience with biophysical and physiological studies on cosmic heavy ion and microgravity effects in higher plants and comparison with data obtained from ground-based accelerator experiments reveals that identical chromosomal and developmental aberrations are induced. Data of experiments with accelerated heavy ions on Earth (1 g) and in space (micro-g) indicate that such densely ionizing heavy particles affect both the genetic effective cells of embryonic lethality and the initial cells of gravitropic response via chromosomal and cellular target sites. Interactions of both orbital factors on cellular systems are discussed.
ESA

N88-19937# Milan Univ. (Italy). School of Medicine.
VESTIBULAR INTEGRATED FUNCTION AND MICROGRAVITY
T. GUALTIEROTTI *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 227-232 Dec. 1987
Avail: NTIS HC A15/MF A01

The resting and evoked unitary activity of the bull frog vestibule recorded comparatively in orbit and on the ground shows significant changes in zero g. Through sinusoidal variations the resting firing rate normalizes after 5 days average. The gravity dependent receptive field of vestibular statoreceptors covers 360 deg solid

angles with windows of non response of 20 deg at 90 deg from the peak response. Frequency distribution, peaks, and null points vary from unit to unit. The integrated response of the vestibular gravity dependent system consists of the sum of the single receptive fields with nearly complete overlapping. Added linear accelerations provoke responses superimposed on this pattern differentially. ESA

N88-19940# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.

SYNOPSIS OF THE SPACELAB D-1 FROG STATOLITH EXPERIMENT STATEX

J. NEUBERT, W. BRIEGLEB, A. SCHATZ, B. KRUSE, J. HERTWIG, and E. HORN (Ulm Univ., West Germany) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 241-247 Dec. 1987

Avail: NTIS HC A15/MF A01

Two different developmental stages of Xenopus laevis D. were exposed to near weightlessness for 154 hr. The eggs grew from stage 12/15 (neurola) and stage 35/36 (shortly after hatching) to 47 and 47/48 respectively. The recovered specimens were observed for general development, development and morphology of the gravity sensory system, and behavior. Xenopus can withstand near weightlessness without catastrophic events. The formation of the gravity sensory system is more or less autonomous with regard to gravity. The results are consistent with other space experiments using amphibia and rats. The dorsal brain vestibular nucleus is smaller than in controls. Gross morphology reveals an additional structure between labyrinth and medulla of uniform crystalline (perhaps) shape of unknown importance. ESA

N88-19948# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Biochemie.

CELL CULTURES IN SPACE: FROM BASIC RESEARCH TO BIOTECHNOLOGY 2

A. COGOLI *In* ESA. Proceedings fo the 3rd European Symposium on Life Sciences Research in Space p 285-290 Dec. 1987 Sponsored in cooperation with the Swiss Federal Inst. of Technol. Board

(Contract SNSF-3.382-0.82)

Avail: NTIS HC A15/MF A01

Ground-based and spaceborne experiments on cell cultures are reviewed. Experiments with single cells in culture performed on the Spacelab-1 and D-1 (Biorack) missions show that important cellular functions are altered in microgravity. These findings support hypotheses and speculations on the benefits of biotechnological processes in space based on cultures of single cells. However, most of the mechanisms regulating the adaptation of cells to microgravity are still unknown. Extensive investigations in space and on the ground are required in order to ascertain the profitability of bioprocessing in space with single cells. ESA

N88-19949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.

EXPERIMENTS CONCERNING GRAVISENSITIVITY OF PROTOZOA

R. HEMMERSBACH and W. BRIEGLEB *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 291-294 Dec. 1987

Avail: NTIS HC A15/MF A01

The behavior and ultrastructure of protozoa were investigated under 1g, inverted direction of gravity, and simulated 0g. The 0g-simulation was performed by a fast running clinostat. Compared to the 1g-controls, cyclosis, food vacuole formation, proliferation, and ultrastructure of Paramecium caudatum are not changed in cells cultivated under functional weightlessness. The swimming behavior of untreated Paramecium does not seem to be influenced by different g-conditions. Paramecium, whose swimming velocity was slowed down by a treatment with chloralhydrate, shows a clear negative geotaxis. Loxodes striatus shows a positive geotaxis and reacts immediately to changes of gravity. ESA

N88-19950# Facultes Univ. Notre-Dame de la Paix, Namur (Belgium).

CYROPRESERVATION OF ISOLATED RAT HEPATHOCYTES FOR FUTURE USE IN SPACELAB EXPERIMENTS: PRELIMINARY RESULTS

E. FEYTMANS, T. COCHE, and E. DEPIEREUX *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 295-297 Dec. 1987

Avail: NTIS HC A15/MF A01

It is shown that isolated rat hepatocytes in suspension is a suitable experimental material to study the effects of microgravity on differentiated mammal cells in the Spacelab Biorack. Cryoprotection is needed to store the cells before incubation in the Spacelab environment. Results show that partial recuperation of metabolical functions is possible after a short term storage in liquid phase at minus 13 C in the presence of DMSO as a cryoprotector. ESA

N88-19951# Academy of Sciences (USSR), Moscow. Inst. of Developmental Biology.

ORGANS AND TISSUES REGENERATION IN AMPHIBIA UNDER THE SPACE FLIGHT CONDITIONS

V. MITASHOV, E. GRIGORYAN, S. TUCHKOVA, and E. CHERDANZEVA (Institute of Biomedical Problems, Moscow, USSR) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 299-303 Dec. 1987

Avail: NTIS HC A15/MF A01

The influence of space flight upon newt lens and forelimb regeneration was studied. To determine the regeneration changes under weightlessness radioautographic analyses with routine histology were used before and after space flight. It is found that the 7 day stay of the newts on the Biosatellite influences the regeneration in the post flight time. There are no regeneration rate changes under flight conditions, but on the 9th day after the landing changes are observed. In both cases of regeneration this influence is manifested in an increase of proliferation of the cells involved in restoration, and speeding up and synchronization of regeneration. ESA

N88-19952# Centre Hospitalier Univ. Rangueil, Toulouse (France).

ANTIBIOTIC ACTIVITY IN SPACE, RESULTS AND HYPOTHESIS

L. LAPCHINE, N. MOATTI, G. RICHOILLEY, J. TEMPLIER, G. GASSET, and R. TIXADOR (Centre Hospitalier Univ. Purpan, Toulouse, France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 305-306 Dec. 1987

Avail: NTIS HC A15/MF A01

Modifications of structure and function of bacteria, particularly in response to antibiotics, induced by spacecraft environments were examined on Spacelab and Salyut. The increase of antibiotic resistance may be due to a stimulating effect on the cell multiplication in space conditions, as reported for several other microorganisms. It may also be due to changes in bacterial cell wall structure and its permeability as proposed by Tixador (1981), in a study of electrolyte content in Paramecium aurelia. It cannot be ruled out that the two hypotheses may have to be combined to explain this phenomenon of transitory increase of resistance in antibiotics. ESA

N88-19953# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

BIORACK EXPERIMENTS IN SPACELAB D-1 AND TML-1: FURTHER DEVELOPMENTS IN GRAVITATIONAL BIOLOGY

D. A. M. MESLAND *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 307-312 Dec. 1987

Avail: NTIS HC A15/MF A01

Microgravity influence on the functioning of prokaryotic and eukaryotic cells is discussed. This may be evidence for a fundamental role of gravity in establishing functional states required

by the cell, as suggested by Prigogine and Stengers (1984). This role is described as the level at which gravity acts directly on cells. Two other levels are recognized through which gravity can act on biological organisms: at the level of genes and at the level of sensors. The set of experiments scheduled to fly in Biorack on the first mission of the International Microgravity Laboratory are presented within this framework. ESA

N88-19959*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RENAL EFFECTS OF ANTI-GRAVITY SUIT INFLATION IN MAN IN RELATION TO CARDIOVASCULAR AND HORMONAL CHANGES

G. GEELEN, S. E. KRAVIK, A. HADJ-AISSA, M. VINCENT, C. W. SEM-JACOBSEN, J. GREENLEAF, and C. GHARIB (Lyon-1 Univ., France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 335-339 Dec. 1987

Sponsored by CNES, the Direction des Recherches Etudes et Techniques, and Lyon-1 Univ., Villeurbanne, France

Avail: NTIS HC A15/MF A01

It is shown that inflation for 3 hr of an antigravity suit that covered the legs and abdomen of normal standing subjects results in significant increases in urine flow, osmolar and free water clearances, total and fractional sodium excretion, and potassium excretion, while glomerular filtration rate and renal plasma flow are transiently increased. Such changes in kidney function are the consequence of the increase in thoracic blood volume induced by inflation which also results in an immediate increase in blood pressure and reflex bradycardia, together with a progressive lowering of plasma renin activity and aldosterone. The changes in kidney excretory patterns brought about by suit inflation appear to be similar in nature and magnitude to those observed during water immersion or in the early phase of bed rest, situations known to result in a headward redistribution of blood. ESA

N88-19960# Institut National de la Sante et de la Recherche Medicale, Le Vesinet (France).

THE SUSPENDED JAPANESE QUAIL AS AN ANIMAL MODEL FOR EXPERIMENTS RELATED TO MICROGRAVITY

V. H. DEMARIAPESCE, C. LEMERCERRE, M. STUPFEL, A. PERRAMON (Institut National de la Recherche Agronomique, Jouy en Josas, France), and V. GOURLET *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 341-343 Dec. 1987

Avail: NTIS HC A15/MF A01

Forty Japanese quail of both sexes were restrained and suspended for 5 to 120 day periods. Survival and several physiological parameters were measured and compared with controls of same age and origin, observed in the same environmental conditions. Survival ranges from 88 percent at 10 days to 27 percent at 120 days of suspension. However a great part of the mortality is caused by harnessing accidents. Body weight, after a 7 to 25 percent decrease in the first 5 days of suspension, remains stable during all the length of the experiments. After the first 3 to 4 days of suspension, food intake recovers to previous value. Restraint and suspension increase heart rate but do not change cloacal temperature. Continuous recording of carbon dioxide emission shows modifications in the circadian and ultradian respiratory rhythms. These results and others (Jurani et al., 1983) confirm the interest of quail restraint and suspension for life sciences experiments related to microgravity. ESA

N88-19962# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.

APPLICATION OF ARIADNE: A DATA BANK-BASED INFORMATION SYSTEM FOR HUMAN PHYSIOLOGY RESEARCH

D. PADEKEN and M. SCHUBER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 351-355 Dec. 1987

Avail: NTIS HC A15/MF A01

In order to perform a ground-based program for ESA-Anthrorack on the D-2 mission, experiment integration and optimization as well as flight operations and experiment evaluation tasks are performed with the help of an information system, based on a data bank. Off-line timelining, retimelining, and experiment evaluation are supported for the duration of the ground-based program. Post-flight, the system will provide all flight and reference data for all experimenters at the user center, and/or by remote access via official postal networks. ESA

N88-19963# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.

FISH AS A TOOL FOR TESTING FITNESS IN SPACE

D. SEIBT, A. SCHATZ, W. BRIEGLEB, and U. LEHMANN (Cologne Univ., West Germany) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 357-359 Dec. 1987

Avail: NTIS HC A15/MF A01

An elementary behavioral reaction is used to estimate alterations in fitness: the dorsal light response of fishes. Changing the direction of gravitational perception uncouples the light charging. By that the reaction can be used to investigate temporal differences in precision and velocity (expected to be in the ultradian/circadian range) of the setting response when varying the lighting angle. ESA

N88-19964*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANIMAL RESEARCH ON THE SPACE STATION

S. L. BONTING, R. D. ARNO, and S. D. CORBIN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 357-361 Dec. 1987

Avail: NTIS HC A15/MF A01

The need for in-depth, long- and short-term animal experimentation in space to qualify man for long-duration space missions, and to study the effects of the absence and presence of Earth's gravity and of heavy particle radiation on the development and functioning of vertebrates is described. The major facilities required for these investigations and to be installed on the Space Station are: modular habitats for holding rodents and small primates in full bioisolation; a habitat holding facility; 1.8 and 4.0 m dia centrifuges; a multipurpose workbench; and a cage cleaner/disposal system. The design concepts, functions, and characteristics of these facilities are described. ESA

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AEROSPACE MEDICINE

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

A88-29104
THE ROLE OF PREVENTIVE MEDICINE IN THE FUTURE OF USA SPACE LIFE SCIENCES
JAMES M. VANDERPLOEG (Keisey-Seybold Clinic, Houston, TX) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 1-8. refs

The preventive, diagnostic, and treatment capabilities of the Health Maintenance Facility (HMF) which will fly aboard the Space Station are discussed. The preventive aspects of the HMF will include facilities for fitness-maintenance exercises and for the periodic collection and evaluation of physiological data which will be used to detect early changes in physiological parameters and to institute corrective measures if needed. This data base will also help to determine the natural history of physiologic changes in space and to define the physiologic norms for microgravity. The dignostic capabilities, which will include cardiorespiratory assessment, clinical laboratory analyses, and imaging system, will enable the crew members to detect and diagnose medical problems inflight and to intitiate remedial action immediately. The treatment capabilities will include a life support module, an anesthesia and minor surgery work station, intravenous fluid generation and therapy, a hyperbaric treatment facility, and a pharmacy. I.S.

A88-29105
MAN IN SPACE: 25 YEARS OF MANNED SPACE FLIGHTS IN THE SOVIET UNION - BIOMEDICAL ASPECTS
ANATOLII I. GRIGOR'EV and INESSA B. KOZLOVSKAIA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 9-16.

Primary weightlessness-induced physiological disorders that appear soon after exposure to the conditions of space flight are identified, and measures used to maintain good health condition and high work capacity of crewmembers during prolonged space flights are discussed. Among these measures are taking countermeasures against specific symptoms and providing adequate and comfortable environment, rational work and rest cycle, sufficiently long sleep, and well balanced nutrition. Of great importance is also the proper selection of individual crew members and the proper balance of crews, as well as their physical, professional, and medical training. I.S.

A88-29108
PHYSIOLOGICAL AND MEDICAL MEASUREMENTS IN SPACE - THE ESA ANTHRORACK
FLEMMING BONDE-PETERSEN (University Hospital, Copenhagen, Denmark) and DAG LINNARSON (Karolinska Institutet, Stockholm, Sweden) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 39-46. Research supported by the Danish Space Board.

A multiuser facility called Anthrorack (AR), which is being built by ESA for the purpose of investigating man's ability to adapt to weightlessness and is scheduled for the 1991 German D-2 mission, is described. The ESA/AR, which will be powered from the Spacelab power system, consists of a double rack containing the following equipment: a facility computer; equipment for cardiovascular, pulmonary, metabolic, hormonal, and blood-flow studies and for measuring body mass and limb volume; physiological amplifiers; environment-regulating equipment; an ergometer; equipment necessary for collecting and storing blood samples; and a bus system for connecting the computer to the experimental equipment. Sixteen projects were selected from ESA member countries, with further U.S. and German experiments to be added in the near future. I.S.

A88-29110
ORBITAL WEIGHTLESSNESS AS A NEW TOOL FOR VESTIBULAR RESEARCH - EXPERIMENTS IN TWO SPACELAB MISSIONS INCLUDING EXPERIMENTS ON CALORIC NYSTAGMUS
RUDOLF VON BAUMGARTEN (Mainz, Universitaet, Federal Republic of Germany) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 53-60. refs (Contract BMFT-01-QV-223-9)

In experiments performed during two Spacelab missions, gas calorization of the outer auditory canals was performed in order to test Barany's theory, which identifies the thermoconvection of the endolymph as a driving force on the cupula during caloric nystagmus. Caloric nystagmus was demonstrated in five astronauts without exception, in spite of the fact that thermoconvection does not exist in space. This paper describes on-ground experiments designed to investigate an alternative source of caloric nystagmus in pigeons, namely, the changes in hydrostatic pressure within the semicircular canal, produced experimentally by penetrating perilymphatic or endolymphatic spaces of the horizontal semicircular canal with small glass pipettes. It was shown that an increase in hydrostatic pressure mimicks warm nystagmus, while a decrease in pressure mimicks cold nystagmus. Moreover, any such pressure-induced nystagmus reversed its direction when the position of the animal was altered. I.S.

A88-29114
SYMPATHETIC NERVOUS RESPONSES IN MAN TO WEIGHTLESSNESS SIMULATED BY HEAD-OUT WATER IMMERSION
MITSURU SAITO, TADAAKI MANO, SATOSHI IWASE, KAZUO KOGA (Nagoya University, Japan), and TOSHIYOSHI MATSUKAWA (Yokohama City University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 85-92. refs

The response of muscle sympathetic activity (MSA) to weightlessness simulated by water immersion was studied applying the microneurographic technique to seven healthy human subjects aged 19 to 64 yrs. During stepwise water immersion from a dry condition to the neck, MSA was suppressed more and more by raising the immersion level. During 2.5 hours head-out immersion, MSA was suppressed strongly at the initial phase of immersion, then began increasing slightly, but was still suppressed remarkably throughout the immersion compared to the values for the dry condition. The suppression in MSA during water immersion may be related to the cephalad body fluid shift. It may be also related to changes in somatosensory afferent activities produced by immersion. Author

A88-29115
PARTIAL LOAD OF THE CARDIOCIRCULATORY SYSTEM IN WEIGHTLESSNESS
FRIEDHELM BAISCH and LUIS BECK (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 93-100. refs

The effect of microgravity on the circulatory system of humans was investigated in subjects exposed to head-down-tilt (HDT, 6 deg for 10 days) bed rest and in the D-1 mission astronauts. In the course of the HDT phase, blood volume and the left-ventricular diastolilc volume were found to decrease; the heart rate also decreased, especially during the first night of HDT. In the space mission experiment, a 27 percent increase in cardiac output values were found with no significant changes in the heart performance, in contrast to the results from the HDT studies. It is suggested that the stress due to the space adaptation syndrome, together

with the psychic tension, might have masked a reduction of heart performance in the astronauts. I.S.

A88-29116
THE LOW PRESSURE PART OF THE CIRCULATION UNDER MICRO-G
KARL A. KIRSCH and LOTHAR ROECKER (Berlin, Freie Universitaet, Federal Republic of Germany) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 101-110. refs
(Contract BMFT-513-4001-01-QV-327-0;
BMFT-513-4001-01-QV-263-1)

The central and the peripheral venous pressures, the hematocrit values, and the body weight were measured in astronauts flying the Spacelab-1 and the D-1 missions, in order to determine whether these parameters could change due to the microgravity-induced fluid shift from the lower limbs towards the cephalad parts of the body. Against the expectations, the in-flight venous pressures in the arm vein were always lower than the preflight or the immediately-postflight values. In the beginning of the readaptation phase (45-90 min postflight), a dramatic change was observed; despite high water deficits, the venous pressures were high, as if the dimensions of the cardiovascular system had diminished in space so that the low blood volume was enough to keep the venous pressures up. Later, the widening of the limb veins obviated the discrepancy; low venous pressures prevailed 12-14 hours after landing, until the fluid volume lost in space was regained. I.S.

A88-29117
CONTROL OF BODY FLUID METABOLISM UNDER UNUSUAL ENVIRONMENTS
NOBUO MATSUI, YOSHIHIRO TAMURA, HISAO SEO, and YOSHIHARU MURATA (Nagoya University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 111-120. refs

The effects of simulated 6000-m altitude and of hyperbaric (31 ata) helium environment on the body fluid metabolism in humans were investigated. An exposure to 6000-m altitude caused water retention, an elevation of serum Na and Cl, and a fall of serum K and of the urinary Na/K ratio, accompanied by elevated levels of plasma ADH, plasma renin activity (PRA), cortisol, and aldosterone. Positive correlations were observed between aldosterone and cortisol and between ADH and cortisol, and, in some subjects, the elevations of cortisol, ADH, and aldosterone were abolished by administration of dexamethasone. An exposure to 31 ata He caused marked diuresis, an increase of hematocrit and serum protein concentration, and a decrease of body weight; the urinary excretion of K increased markedly, resulting in a decreased urinary Na/K ratio. These metabolic changes were accompanied by a fall in plasma ADH and by elevations in PRA and aldosterone, suggesting an activation of a renin-angiotensin-aldosterone system. I.S.

A88-29118
HUMAN CIRCADIAN RHYTHMS IN A TIME-CUELESS ENVIRONMENT - EFFECTS OF BRIGHT LIGHT
KEN-ICHI HONMA, SATO HONMA, and TATSUHIKO WADA (Hokkaido University, Sapporo, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 121-128. refs

The role of bright light as a zeitgeber for circadian rhythms in time-cueless environment was investigated in human subjects living alone for 2 or 3 weeks in an apartment isolated from natural (day-night) and social (schedule) periodicities, and exposed to two types of artificial bright-light cycle. The subjects were able to regulate the light from a bed lamp and the room temperature. Two types of experiments were performed. In an entrainment experiment, the subject was released into free-run for a week before the living room of the unit was illuminated daily by bright light for 8 h at 24 h intervals. In a pulse experiment, the living room was illuminated for either 3 or 6 h while the subject was free-running. The bright-light cycle of a 24-h period was found to entrain the circadian rhythms, which had been free-running with a period longer than 24 h. It is suggested that, to prevent an internal desynchronization of circadian rhythms in an isolated environment, an artificial bright-light cycle zeitgeber should be added to the scheduled routine. I.S.

A88-29120
VASOCONSTRICTION IN THE HAND HEATED LOCALLY - A MECHANISM FOR REDUCING HEAT TRANSPORTATION INTO THE BODY FROM HOT CONTACT OBJECTS
TETSUO NAGASAKA (Kanazawa University, Japan), MICHEL CABANAC (Lyon I, Universite, Oullins, France), KOZO HIRATA, and TADAHIRO NUNOMURA IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 135-144. refs

The role of the skin vasoconstriction as a mechanism for reducing heat transportation into the body from skin exposed to a high local temperature was investigated. Blood flows from fingers or forearm were mesured by venous occlusion plethysmography during immersion of the hand or forearm in water baths, the temperature of which was raised every 10 min by 2-C steps from 35 C to 41 C to 43 C; the water temperature for the control hand or forearm was kept at 35 C. The measurements were made in three environments: cool (25 C, 40 percent rh), warm (35 C, 40 percent rh) and hot (35 C and 80 percent rh), with both legs immersed in 42-C water. In the warm environment, the finger flow in the hand heated to 41 C was found to be significantly lower, compared to the control hand, although at 43 deg, vasodilation resumed. In the cool environment, no such vasoconstriction was observed. In the forearm skin, blood-flow in the heated arm increased steadily with increasing local temperature even in the warm environment. I.S.

A88-29121
APPLICATIONS OF A MASS SPECTROMETER-COMPUTER SYSTEM TO THE STUDY OF GRAVITATIONAL EFFECTS ON RESPIRATION, CIRCULATION AND METABOLISM
I. NISHI, G. TOMIZAWA, H. ISHII, A. NAGANO (Tokyo Science University, Noda, Japan), K. GAN (Nanchang Institute of Aeronautical Technology, People's Republic of China) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 145-154. refs

A mass spectrometer-computer system developed for studies of gravitational effects in space on the physiological and biochemical processes is described. The system makes it possible to make multidimensional measurements of respiration, circulation, metabolism, and body heat noninvasively and relatively easily. Application of the system is demonstrated on a few examples. I.S.

A88-29172
QUANTITATIVE STUDY OF MORPHOLOGY OF AGGREGATION OF RED CELLS IN PATIENTS' BLOOD AND IN THE RECONSTITUTED SUSPENSIONS
L. DINTENFASS, LIAO FU-LUNG (Rachel Forster Hospital, Redfern; Sydney, University, Australia; Chinese Academy of Traditional Medicine, Beijing, People's Republic of China), and A. WILLARD (New South Wales, University, Kensington, Australia) Clinical Hemorheology (ISSN 0271-5198), vol. 4, no. 2-3, 1984, p. 223-236. Research supported by the Laura Bushell Trust. refs

The kinetics and morphology of red cell aggregation were studied using the slit-capillary photoviscometer. Micro- and macrophotography were performed during flow and stasis while stereological methods were used to analyze color slides. Three morphological indices were introduced based on the standard stereological parameters of Zeiss Videomat 2. The blood samples included those obtained from different patients as well as a series of reconstituted suspensions at a standard haematocrit of 30 percent with varying concentrations of albumin, fibrinogen, and

paraproteins. Differences in the kinetics and morphology of the blood samples were observed using these parameters. K.K.

A88-29173
FIRST HAEMORHEOLOGICAL EXPERIMENT ON NASA SPACE SHUTTLE 'DISCOVERY' STS 51-C - AGGREGATION OF RED CELLS
L. DINTENFASS, P. D. OSMAN, and H. JEDRZEJCZYK (Sydney Hospital; Rachel Forster Hospital; Sydney, University, Australia) Clinical Hemorheology (ISSN 0271-5198), vol. 5, no. 6, 1985, p. 917-936. Research supported by the Bushell Trust, Esso Australia Ltd., CSIRO, et al refs

The development, instrumentation, and preliminary results of an STS 51-C experiment on the aggregation of red blood cells are discussed. An automated slit-capillary photoviscometer contained blood specimens from normal individuals and individuals with a history of a variety of disorders including coronary heart disease, cancer of the colon, and insulin-dependent diabetes. Red cells were not found to change shape under zero gravity, although zero gravity resulted in slower red cell aggregation and smaller red cell aggregates. The morphology of normal red blood cell aggregates under zero gravity was of rouleaux type. R.R.

A88-29174
SPECULATIONS ON DEPLETION OF THE RED CELL MASS IN ASTRONAUTS, AND ON SPACE SICKNESS
L. DINTENFASS (Sydney, University, Australia) Clinical Hemorheology (ISSN 0271-5198), vol. 6, no. 5, 1986, p. 435-437. refs

The bizarre changes observed in the shape of red cells in astronauts and the abnormal patterns found in parathyroid hormone levels suggest that there is a tendency for the rigidity of red blood cells to increase in astronauts. The possible link between red cell abnormality and calcium metabolism is discussed. The question of whether a removal of rigid red cells from the circulation can counteract development of space sickness and whether this can simultaneously account for space anemia is addressed. K.K.

A88-29562
A NEAR-INFRARED SPECTROPHOTOMETRIC METHOD FOR STUDYING BRAIN O2 SUFFICIENCY IN MAN DURING +GZ ACCELERATION
D. H. GLAISTER and F. F. JOBSIS-VANDERVLIET (USAF, School of Aerospace Medicine, Brooks AFB, TX; Duke University, Medical Center, Durham, NC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 199-207. refs

A technique for the noninvasive monitoring of cerebral oxygen status was evaluated on volunteer subjects on the USAF School of Aerospace Medicine centrifuge. By using multiwavelength near-infrared spectrophotometry, the instrumentation measured changes in the quantities of reduced and oxygenated hemoglobin (and their sum, an indicator of cerebral blood volume), and the quantity of oxidized cytochrome c oxidase within the forebrain. Tests used acceleration of up to 9 G with onset rates from 0.1 to 5.0 G/s, anti-G suits and straining maneuvers, and hyperoxic and hypoxic breathing mixtures. In general, +Gz acceleration produced a fall in blood volume within the cerebral microcirculation with a relative increase in the content of reduced hemoglobin and a tendency toward reduction of cytochrome c oxidase. These findings are discussed in relation to accepted changes in arterial blood pressure, cerebral blood flow, and arterial oxygen saturation caused by acceleration exposure. Author

A88-29563
HEMODYNAMIC AND SYMPATHOADRENAL RESPONSES TO ALTITUDE IN HUMANS - EFFECT OF DEXAMETHASONE
T. SCOTT JOHNSON, PAUL B. ROCK, JAMES B. YOUNG, CHARLES S. FULCO, and LAURIE A. TRAD (Beth Israel Hospital; Harvard University, Boston; U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 208-212. refs
(Contract PHS-AM-20378)

The effects of dexamethasone on the hemodynamic and sympathoadrenal responses of eight men (ages 20-26 years) subjected to a simulated altitude of 4,570 m are studied. The blood pressure, pulse rate, and catecholamine content for the eight subjects were measured as the treatment, altitude, time of exposure, and posture varied. It is observed that the mean pulse rate which is increased by altitude was less for the subjects using dexamethasone (84.1 bpm) than those taking the placebo (96.1 bpm). The data also reveal that dexamethasone does not affect aertial pressure; however, it reduces the amount of urinary epinephrine excretion from 9.41 ng/mg creatinine with the placebo to 4.16 ng/mg creatinine with dexamethasone. It is concluded that acute altitude exposure is associated with the stimulation of the adrenal medulla, but not the sympathetic nervous system, and that the dexamethasone blocks the adrenal medullary responses. I.F.

A88-29566
ASSISTED POSITIVE PRESSURE BREATHING FOR AUGMENTATION OF ACCELERATION TOLERANCE TIME
JOHN W. BURNS and ULF I. BALLDIN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 225-233. refs

The use of assisted positive pressure breathing (APPB) to improve tolerance to +Gz is studied. Seven males ranging from 21-32 years were subjected to 5-9 +Gz simulated aerial combat maneuver (SACM) and their heart rate and rhythm, blood oxygen saturation, and inspired air were monitored. It is observed that there is a decrease in the SACM related time course of O2 desaturation during APPB at 50 and 70 mm Hg compared to zero APPB; the heart rate is similar for all APPB levels; and inspiratory volume, minute volume, and peak inspiratory flow are elevated during APPB at 50 and 70 mm Hg compared to no APPB. The data reveal that there is an increase in acceleration tolerance time by 115 percent for APPB at 50 mm Hg and by 88 percent for APPB at 70 mm Hg compared to using a G-suit and anit-G straining maneuver (AGSM) without APPB; the APPB at 50 mm Hg provided the greatest protection in terms of tolerance time; and APPB at both 50 and 70 mm Hg reduces AGSM-related fatigue. I.F.

A88-29567
RUNNING-INDUCED CHANGES IN LUNG FUNCTION ARE NOT ALTERED BY ACUTE MODERATE HYPOXIA
DANIEL S. MILES and ROBERT S. SCHAEFER (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 234-238. Research supported by the American Heart Association and American Lung Association. refs

Changes in the pulmonary function and volumes caused by running in a normoxic (N) and hypoxic (H) environment are investigated. The spirometry, pulmonary diffusing capacity, lung volume, and cardiac output of eleven men, average age 25.6 + or - 1.0 yrs, before and after running 5 miles in N and H environments were measured. It is observed that there is a 7 percent reduction in forced vital capacity after N and H running; the residual volume increases 8 percent after N running and 13 percent after H running; slow vital capacity decreases after N and H running; the lung volume at which the peripheral airways closes decreases after N running, but there is no change after H running; and total lung capacity, closing volume and capacity, and pulmonary diffusing capacity are unaffected by the running. It is noted that

lung volume changes after exercises are due to expiratory limitations. I.F.

A88-29568
VENTILATORY AND GAS EXCHANGE DYNAMICS IN RESPONSE TO HEAD-DOWN TILT WITH AND WITHOUT VENOUS OCCLUSION
SCOTT K. POWERS, M. KELLY STEWART, and GREG LANDRY (Louisiana State University, Baton Rouge) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 239-245. refs

A88-29570
REFLEX HEART RATE RESPONSE TO VARIABLE ONSET +GZ
ESTRELLA M. FORSTER and JAMES E. WHINNERY (Rothe Development, Inc., San Antonio; USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 249-254. refs

Heart rate response to gradual, rapid, and very high onset to +Gz stress is studied using the electrocardiographic tracings of men exposed to +Gz stress. The resting heart rate, maximum heart rate achieved during +Gz stress, the time from resting heart rate to maximum heart rate, and the time at maximum +Gz were measured. It is observed that during gradual +Gz onset the change in the heart rate achieved at the onset of maximum +Gz (delta HRA) is equal to the change in the heart rate from resting heart rate to maximum heart rate (delta HRB); and for rapid and very high G-onset, delta HRA is less than delta HRB. It is noted that delta HRB is dependent on onset rate and time of exposure to high +Gz stress. I.F.

A88-29571
EFFECTS OF BETA-ADRENERGIC BLOCKADE ON VENTILATION AND GAS EXCHANGE DURING THE REST TO WORK TRANSITION
STEPHEN DODD, SCOTT POWERS, NANCY O'MALLEY, ELLEN BROOKS, and HOWARD SOMMERS (Louisiana State University, Baton Rouge) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 255-258. refs

A88-29572
HEAT INTOLERANCE, HEAT EXHAUSTION MONITORED - A CASE REPORT
LAWRENCE E. ARMSTRONG, ROGER W. HUBBARD, PATRICIA SZLYK, INGRID V. SILS, and WILLIAM J. KRAEMER (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 262-266. refs

The heat exhaustion symptoms exhibited by a 32 year old male during an 8-day heat acclimation investigation are examined. The heart rate, rectal temperature, and mean weighted skin temperature were measured. The three levels of salt and pure water depletion heat exhaustion as determined by Marriott (1950) are: (1) early, (2) moderately severe, and (3) very severe. It is observed that on the eighth day of the investigation the subject exhibited moderately severe salt depleted heat exhaustion. Serum enzyme concentrations were analyzed. The analysis reveals that the CPK level increased from 39.79 U/L on day 1 to 152.5 U/L on day 8; the blood beta endorphin level is 6-9 times greater on day 8 than day 1; and the cortisol level is 2 times greater compared to day 1. The fluid-electrolyte balance is evaluated, and an 8-day deficiency of -166 MEq Na(+) is detected. The role of a change in heart rate and the change in plasma volume in heat exhaustion is studied. An energy depletion model which describes the heat exhaustion observed is presented. I.F.

A88-29574
AIR ACCIDENTS, PILOT EXPERIENCE, AND DISEASE-RELATED INFLIGHT SUDDEN INCAPACITATION
PAUL FROOM, JOCHANAN BENBASSAT, MOSHE GROSS, JOSEPH RIBAK, and BASIL S. LEWIS (Israel Air Force Aeromedical Center, Ramat Gan; Hadassah University Hospital, Jerusalem; Lady Davis Carmel Hospital, Haifa, Israel) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 278-281. refs

The epidemiology of sudden death, the etiology of inflight sudden incapacitation, and the influence of pilotage and experience on air accident rates are reviewed in order to determine the aeromedical emphasis needed to minimize accidents. Sudden deaths in men over age 35 are nearly all due to coronary artery disease, whereas, in those under 35 years, they are mostly due to hypertrophic cardiomyopathy. The incidence of fatal accidents from human error is, however, far greater than that from physical illness. Since inexperienced pilots have a 2-3 times increased incidence of mishaps due to pilot error, the estimated risk of disease related in-flight sudden incapacitation should be balanced by consideration of pilot experience. Therefore, it may be preferable to grant waivers to experienced pilots with an increased incidence of disease-related inflight sudden incapacitation than to replace them with novices. It is concluded that overly strict medical criteria may paradoxically increase accident rates. Author

A88-29888
EFFECT OF REFLEXOTHERAPY ON THE FUNCTIONAL STATUS OF THE VISUAL ANALYZER OF OPERATORS [VLIIANIE REFLEKSOTERAPII NA FUNKTSIONAL'NOE SOSTOIANIE ZRITEL'NOGO ANALIZATORA OPERATOROV]
A. N. ZOLOTUKHIN Voenno-Meditsinskii Zhurnal (ISSN 0503-1265), Dec. 1987, p. 42, 43. In Russian.

The efficiency of reflex acupuncture as a protective treatment against visual fatigue was tested in normal active subjects who were treated by two varieties of acupuncture routine. The functional status of the visual analyzer was determined by measuring the excitability threshold of the eye, the attention level, and the accuracy of visual perception. It was found that, in subjects treated by acupuncture, the attention level and the speed and the accuracy of visual perception were higher than in control subjects. I.S.

A88-29889
THE STATUS OF THE CEREBRAL HEMODYNAMICS OF PILOTS UNDERGOING ORTHOSTATIC TESTS [SOSTOIANIE GEMODINAMIKI GOLOVNOGO MOZGA U LETCHIKOV PRI ORTOSTATICHESKIKH ISSLEDOVANIIAKH]
L. I. STARIKOV Voenno-Meditsinskii Zhurnal (ISSN 0503-1265), Dec. 1987, p. 44-47. In Russian. refs

Changes in the rate of brain blood supply (RBBS) were measured in healthy pilots while the subjects were carrying out orthostatic tests, using a partial-integral rheography method based on records of three synchronous rheograms to obtain the RBBS values. During the orthostatic tests, when subjects were exposed to 1, 10, and 20 min of positive-gravity loads, significant decreases were recorded for the values of total circulation volume, stroke volume, minute blood volume, and the circulation volume of the vertebrobasal pool. However, the average levels of the RBBS did not change significantly, remaining within 20-22 percent of the minute blood volume. The results of the RBBS analyses uncovered two types of cerebral circulation: a hypodynamic type and a hyperdynamic type. The values of the RBBS measured in the hyperdynamic types were more stable than in the hypodynamic types. I.S.

A88-30407
POSSIBLE MECHANISMS OF PERIODIC BREATHING DURING SLEEP
K. R. CHAPMAN, E. N. BRUCE, B. GOTHE, and N. S. CHERNIACK (Case Western Reserve University, Cleveland, OH) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, March 1988, p. 1000-1008. refs
(Contract NIH-HL-25830)

The effect of respiratory control system loop gain on periodic breathing during sleep was investigated in human subjects by examining three mechanisms potentially responsible for the development of periodic breathing during sleep. First, the effect of increased controlled system gain was examined by monitoring subjects during nonrapid-eye movement sleep under control conditions and as they wore a breathing circuit designed to magnify the effect of altered ventilation on the resulting blood gas tensions. Second, as indexes of controller gain, ventilatory responsiveness to hypercapnia and hypoxia was measured during wakefulness. Power spectrum analysis was used to detect oscillations in ventilatory pattern under control and altered gain conditions. The results indicate that increased gain of the respiratory chemical control feedback loop can produce respiratory system instability with periodic hyperventilation and apnea during light sleep. This factor may be of major importance in the development of recurrent apneas during sleep at high altitude. I.S.

A88-30408* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LEG SIZE AND MUSCLE FUNCTIONS ASSOCIATED WITH LEG COMPLIANCE
VICTOR A. CONVERTINO, DONALD F. DOERR, JOSE F. FLORES, G. WYCKLIFFE HOFFLER, and PAUL BUCHANAN (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, March 1988, p. 1017-1021. refs

The relationship between the leg compliance and factors related to the size of leg muscle and to physical fitness was investigated in ten healthy subjects. Vascular compliance of the leg, as determined by a mercury strain gauge, was found to be not significantly correlated with any variables associated with physical fitness per se (e.g., peak O2 uptake, calf strength, age, body weight, or body composition. On the other hand, leg compliance correlated with the calf cross-sectional area (CSA) and the calculated calf volume, with the CSA of calf muscle being the most dominant contributing factor (while fat and bone were poor predicators). It is suggested that leg compliance can be lowered by increasing calf muscle mass, thus providing structural support to limit the expansion of leg veins. I.S.

A88-30409
SLEEP AND THE VENTILATORY RESPONSE TO RESISTIVE LOADING IN NORMAL MEN
LAUREL WIEGAND, CLIFFORD W. ZWILLICH, and DAVID P. WHITE (Milton S. Hershey Medical Center; Pennsylvania State University, Hershey) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, March 1988, p. 1186-1195. refs
(Contract NIH-HL-01316; NIH-AG-04491)

The role of resistive loading in the genesis of sleeping hypoventilation was investigated by examining both the acute and sustained (for 4 min) ventilatory responses to the inspiratory resistive loads of 2, 8, 12, and 25 cm H2O/l sec applied during wakefulness and during both REM and non-REM (NREM) sleep to normal young men. It was found that minute ventilation was well maintained with acute and sustained resistive loading during wakefulness. In marked contrast, resistive load application during NREM sleep invariably produced a significant reduction in minute ventilation, which was directly related to the value of resistive load. This decline in ventilation was a product of a falling inspiratory flow rate and a shortened inspiratory duration. Similar observations were made during REM sleep, although the responses were less consitent. I.S.

A88-30410
ABNORMAL CONTROL OF VENTILATION IN HIGH-ALTITUDE PULMONARY EDEMA
PETER H. HACKETT, ROBERT C. ROACH, ROBERT B. SCHOENE, GINETTE L. HARRISON, and W. J. MILLS, JR. (Alaska, University, Anchorage; Washington, University, Harborview Medical Center, Seattle) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, March 1988, p. 1268-1272. refs

The role of hypoxic chemosensitivity in the development of high-altitude pulmonary edema (HAPE) was investigated by examining seven mountain climbers with HAPE and seventeen climbers without HAPE in a heated shelter at 4400 m on Mt. McKinley, determining ventilatory responses to both oxygen breathing and progressive poikilocapnic hypoxia. Hypoxic ventilatory response (HVR) was described by the slope relating minute ventilation to percent arterial O2 saturation. The results of these tests indicated that HAPE subjects were quite hypoxemic and had a high-frequency low-tidal-volume pattern of breathing. In addition, O2 was found not to decrease ventilation in these subjects. All subjects in the HAPE group had low HVR values, although six controls also displayed HVR values in the same range. It is concluded that a low HVR plays a permissive rather than causative role in the pathogenesis of HAPE. I.S.

A88-31022* Michigan Univ., Ann Arbor.
PERIPHERAL SENSORY PROCESSING IN MAMMALIAN GRAVITY RECEPTORS - OBSERVATIONS OF CILIARY TUFT CONFIGURATIONS
MURIEL D. ROSS, KATHLEEN DONOVAN, and CHARLES ROGERS (Michigan, University, Ann Arbor) IN: The vestibular system: Neurophysiologic and clinical research. New York, Raven Press, 1987, p. 119-124. refs
(Contract NAS2-10535; NAG2-325)

Scanning electron microscopy was used to study dynamic polarizations of clustered cells of the anterior part of rat saccular macula and to shed light on the possible roles of two types of hair cells integrated into the same neural circuitry: those with short stereocilia and long kinocilium (ss/lk), and those with long stereocilia and still longer kinocilium (ls/lk). It was found that the ss/lk-type cells could be further subdivided into two types, whereas the ls/lk cells consisted of four major kinds. It was also found that the kinocilium was most often fixed in a recovery stroke position (curved basally, and the upper portion projected back over the tuft) and that the kinocilia were not aligned in parallel in any given part of a macula, even though each cilium pointed in the proper direction relative to the striola line. The possibility of a relationship between the ciliary tuft morphology and the function of the hair cell of which it is a part is discussed. I.S.

A88-32016
REACTIONS OF THE CARDIOVASCULAR SYSTEM TO STATIC LOAD IN ATHLETES AND IN UNTRAINED SUBJECTS [REAKTSII SISTEMY KROVOOBRASHCHENIIA NA STATICHESKUIU NAGRUZKU U SPORTSMENOV I MALOTRENIROVANNYKH LITS]
M. A. VODOP'IANOVA, N. V. DROBOTIA, and G. S. KARAPETIAN (Rostovskii Gosudarstvennyi Meditsinskii Institut, Rostov-on-Don, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 74, Feb. 1988, p. 294-299. In Russian. refs

The effect of physical training on the cardiovascular system was investigated by measuring cardiovascular responses to a static load (a 3-kg load held with the arm outstretched) in untrained subjects (group 1) and in trained cyclists (group 2). In the group-1 subjects, the effect of the load included increases in systolic output, pulse rate, minute blood volume, rate of pulse wave propagation, and mean hemodynamic pressure. In the group-2 subjects, the load-induced responses also increased the pulse rate, minute blood volume, and mean hemodynamic pressure; however, the systolic output and peripheral vasoconstriction indices were decreased, indicating a reaction of energy economy. It is suggested that the increases in the systolic output, the rate of pulse-wave propagation, and the mean hemodynamic pressure can serve as criteria for predicting the degree of fatigue. I.S.

A88-32048
PHYSIOLOGICAL RESERVES OF THE BODY [O FIZIOLOGICHESKIKH REZERVAKH ORGANIZMA]
V. P. ZAGRIADSKII and Z. K. SULIMO-SAMUILLO Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Jan. 1988, p. 51-53. In Russian.

The demands placed on the physiology of the body by military activity and, often, by the extremal conditions of such activity rely on the mobilization of the reserves in metabolic energy and on the activation of systems that regulate energy distribution. Different mechanisms that induce the mobilization of energy under different extremal conditions, such as hypoxia or sustained physical load, are discussed together with the parameters characterizing mobilization of physiological reserves and the role played by physical training in increasing these reserves. It is shown that physical training increases the respiratory capacity, the volume of pulmonary ventilation, and, during exposure to physical load, the minute blood output and stroke output. I.S.

A88-32050
THE IMPORTANCE OF THE SPINE X-RAY IN THE PRACTICE OF AVIATION MEDICINE [ZNACHENIE RENTGENOLOGICHESKIKH ISSLEDOVANII POZVONOCHNIKA V PRAKTIKE VRACHEBNO-LETNOI EKSPERTIZY]
R. V. POLETAEV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Jan. 1988, p. 56, 57. In Russian.

The results of an X-ray examination of 150 pilots (21 to 40 years in age) who have undergone a single exposure to a dynamic overload at some time during their training are discussed. It was found that the presence of a fixed shifted nucleus pulposus in an intervertebrate disc is the most important background factor that promotes load-induced spine injuries. Shifted, but not fixed, nucleus presents only minimal risk. I.S.

A88-32133
THE CHARACTERISTICS OF THE VESTIBULAR-APPARATUS STATOKINETIC FUNCTION AND OF GASTRIC MOTOR ACTIVITY IN CHILDREN WITH FUNCTIONAL DIGESTIVE DISORDERS [OSOBENNOSTI STATOKINETICHESKOI FUNKTSII VESTIBULIARNOGO APPARATA I MOTORNOI DEIATEL'NOSTI ZHELUDKA U DETEI S FUNKTSIONAL'NYMI NARUSHENIIAMI PISHCHEVARENIIA]
A. I. KLIORIN and IU. I. STAROVEROV (Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 20-25. In Russian. refs

The relation between the functions of the vestibular analyzer and those of the GI tract were investigated by measuring the characteristics of electrogastrograms (EGGs) and electronystagmograms (ENGs) obtained during motion-sickness-inducing procedures undergone by healthy children and children suffering from gastric disorders related to secretory and motor types, biliary dyskinesia, or a combination of these two. Among children with GI disorders, symptoms of motion sickenss occurred in 40 percent of the total group, as compared with 20 percent for the control group. The results of the comparison of EGG and ENG indices among various experimental groups of children support the viewpoint that the disorders in the vestibular apparatus may lead to some functional disorders in the GI system, and vice versa. I.S.

A88-32135
CHANGES IN BLOOD CIRCULATION AFTER TWO-PERCENT WATER LOAD [IZMENENIIA V SISTEME KROVOOBRASHCHENIIA POSLE DVUKHPROTSENTNOI VODNOI NAGRUZKI]
M. D. ROIFMAN and A. IA. TERNER (AMN SSSR, Institut Fiziologii, Novosibirsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 100-107. In Russian. refs

The effect of a water intake equivalent to 2 percent of total body mass (i.e., 2-percent fluid load) on the elasticity of major arteries and on the interrelation between the cardiovascular and the renal responses of humans was investigated in resting fasting subjects. It was found that 2-percent fluid load caused a decrease of pulse rate and an increase in arterial blood pressure. The increase in pulse pressure, which was maximal at 40-min after the water intake, coincided with abrupt changes in elasticity indices. Thus, the pulse increments of blood volume decreased, while the values for the arterial-wall resistance, impedance coefficient, and exponential index of arterial elasticity dynamics increased. These reactions preceded the onset of diuresis. It is concluded that the reaction to fluid load includes not only the heart, the kidneys, and arterioles, but also the major arteries, whose increased tonus might contribute to the stability of hemodynamic homeostasis. I.S.

A88-32136
EFFECT OF ACUTE HYPOXIC HYPOXIA ON THE IMMUNE SYSTEM, HOMEOSTASIS, AND THE ACID-BASE STATUS OF BLOOD [VLIIANIE OSTROI GIPOKSICHESKOI GIPOKSII NA IMMUNNUIU SISTEMU, GEMOSTAZ I KISLOTNO-SHCHELOCHNOE SOSTOIANIE KROVI]
B. T. TULEBEKOV, T. A. PONOMAREVA, G. F. VOROB'EV, L. R. ISEEV, and V. I. CHADOV (AN KSSR, Institut Fiziologii i Eksperimental'noi Patologii Vysokogor'ia, Frunze, Kirgiz SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 115-122. In Russian. refs

The effect of hypoxia on the immune system and on blood coagulation in humans was investigated in subjects who remained for 300-min in a barometric chamber (at 5100 m altitude) conducting tests before exposure to hypoxia (control), 30-min after a stay at 5100 m, and seven days after the exposure. The parameters of the acid-base status of blood, monitored during the exposure as an index of oxygen shortage in blood, were found to be significantly altered after 60 min at 5100 m. Thirty minutes after the onset of hypoxia, changes in the coagulation parameters indicated increased activation of intravascular coagulation and fibrinolysis. On the other hand, changes in the immune system were observed only seven days after the exposure. I.S.

N88-19067*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HEMOLYSIS IN RUNNERS AS EVIDENCED BY LOW SERUM HAPTOGLOBIN: IMPLICATIONS FOR PREFLIGHT MONITORING OF ASTRONAUTS
JOYCE OWENS, DIANE L. SPITLER, and MARY ANNE BASSETT FREY Aug. 1987 16 p Prepared in cooperation with Bionetics Corp., Cocoa Beach, Fla.
(Contract NAS10-10285)
(NASA-TM-100304; NAS 1.15:100304) Avail: NTIS HC A03/MF A01 CSCL 06P

Hematological parameters and serum haptoglobin were examined in 21 male employees of the Kennedy Space Center who were at 3 levels of physical activity: 7 subjects regularly ran more than 40 km (25 miles) per week (Group I); 7 ran 13 to 24 km (8 to 15 miles) per week (II), and 7 were sedentary (III). Blood was drawn on a different day of the week for five weeks. Differences between day of the week, visit number, and activity level were examined. No differences were observed for day of week or visit number; thus mean values for each variable were calculated for each subject. Variables did not differ among groups. However, trends with level of training were observed in some critical variables. Hemoglobin (Hb) and hematocrit (Hct) conformed to a staircase effect with Group I (14.5 gm/dl and 41.3 percent) lower than Group III (15.1 gm/dl and 42.9 percent). Reticulocyte count was higher and haptoglobin levels lower in Group I (1.35% and 75.7 gm/dl) than Group III (.99 percent and 132.9 gm/dl), with haptoglobin for the high mileage Group I in the clinically abnormal range. Since haptoglobin binds free Hb following RBC destruction, these results suggest that intravascular hemolysis occurs in trained male runners. These results may have special meaning for astronauts training before long-duration spaceflights, since the further reduction in red blood cells which is reported to occur during spaceflight could become detrimental to their health and performance. Author

N88-19068# California Univ., Berkeley. Dept. of Physiology-Anatomy.
CENTER FOR NONLINEAR DYNAMICS OF THE BRAIN Final Report, 31 Jul. 1986 - 30 Sep. 1987
WALTER FREEMAN 30 Sep. 1987 4 p
(Contract AF-AFOSR-0271-86)
(AD-A187245; AFOSR-87-1565TR) Avail: NTIS HC A02/MF A01 CSCL 05H

The Center for Nonlinear Dynamics of the Brain (CNDB) studies nonlinear dynamics of large masses of nerve cells in animal and human brains as the basis for explaining the self-organization of goal-directed cognitive behaviors. We believe that this approach to the study of mass neural action will be a basic method of the neurophysiology of the twenty-first century. Our research has application to clinical neurology and psychiatry, to the measurement and enhancement of human mental capabilities and to the design of self-organizing, pattern recognition computer systems. By extending techniques and models derived from the paleocortex to animal and human neocortex, deeper understanding of the neural basis of goal-directed higher brain functions will emerge. The practical consequences of this enhanced knowledge will be better diagnosis of neurologic and psychiatric diseases. It also will result in the ability to predict decrements in higher brain functions consequent to illness, fatigue or drugs. The new models for globally parallel, self-organizing systems which result from this research also will be directly relevant to the design of VLSI architectures for pattern recognition. GRA

N88-19069# Army Research Inst. of Environmental Medicine, Natick, Mass.
MANIPULATION OF MUSCLE GLYCOGEN CONCENTRATIONS USING HIGH AND LOW CARBOHYDRATE DIETS AND EXERCISE Final Report, Aug. 1986 - Jan. 1987
JOAN C. BUCHBINDER, JULIE POCOST, LISA A. HODGESS, EDWARD T. ROCHE, and MADELEINE S. ROSE 31 Aug. 1987 57 p
(AD-A187732; USARIEM-T-32/87) Avail: NTIS HC A04/MF A01 CSCL 06J

The Influence of Muscle Glycogen Levels on Shivering and Temperature Regulation During Cold Water Immersion study was designed to investigate the effect of muscle glycogen levels on body temperature homeostasis in man acutely exposed to cold, with alterations in muscle glycogen levels experimentally induced by exercise and dietary manipulation. The results of muscle biopsies taken from each test subject after each phase indicated that the exercise and dietary manipulation were effective in depleting muscle glycogen concentrations as well as repleting levels above what would be expected as normal concentrations in untrained subjects. The results of the dietary efforts supported the findings of other investigators that muscle glycogen levels can be increased by consumption of a high carbohydrate diet (in conjunction with a reduction of physical exercise), without necessarily having to stimulate the muscle for supercompensation via a depletion phase immediately preceding the loading phase as has been recommended for glycogen loading in the past. A series of practical high and low carbohydrate diets were developed using foods that can be easily obtained from commercial supermarket sources. These diets require minimal preparation and can be effectively utilized in metabolic ward studies or by athletes preparing for endurance events requiring replete muscle glycogen levels prior to completion. GRA

N88-19070# Illinois Univ., Chicago. Coll. of Medicine.
ROLE OF ADENOSINE ANALOGS AND GROWTH HORMONE IN WAKING AND SLEEP Annual Report, 15 Sep. 1986 - 15 Sep. 1987
MIODRAG RADULOVACKI 16 Oct. 1987 5 p
(Contract AF-AFOSR-0349-85)
(AD-A187897; AFOSR-87-1687TR) Avail: NTIS HC A02/MF A01 CSCL 06O

The role of adenosine in sleep has been further investigated using electroencephalography to document the dose response effects of newly developed specific adenosine A1 and A2 receptor stimulants and 8-cyclopropyltheophylline (CPRT), a substituted xanthine. The results with adenosine agonist suggest that both A1 and A2 receptors play a role in the hypnotic action of adenosine. The data with CPRT point out that stimulant effects of xanthines is obtained by the blockade of A1 receptors. Densensitization of adenosine A2 receptors was found following the chronic treatment of adenosine agonists L-PIA, NECA ad deoxycoformycim. Chronic administration of caffeine up-regulates A1 receptors in cerebral cortex in a manner similar to that following deprivation of REM sleep. This suggests the existence of an endocaffeine whose normal role is to block adenosine receptors during prolonged sleep deprivation- a mechanism that could be responsible for the increased number of adenosine receptors. GRA

N88-19071# Smith-Kettlewell Inst. of Visual Sciences, San Francisco, Calif. Eye Research Foundation.
VISUAL EVOKED POTENTIALS Annual Technical Report, 1 Sep. 1986 - 31 Aug. 1987
KEN NAKAYAMA 3 Nov. 1987 5 p
(Contract AF-AFOSR-0320-83)
(AD-A187942; AFOSR-87-1831TR) Avail: NTIS HC A02/MF A01 CSCL 06D

Progress over the past year has been rapid and wide ranging, covering two primary areas. First, in the area of visual attention, we have shown both the existence of a sustained and a transient component of enhanced pattern recognition. This cannot be explained by visual transients or eye movements. Second, we have examined a wide range of issues related to partial visibility (occlusion) using stereoscopic displays. In particular, we have shown that pattern recognition of partially hidden objects is superior if the pattern is in a rear vs. front stereoscopic plane, that the solution to the aperture problem for motion is dictated by whether line terminators are seen as real terminators or the result of occlusion by other surfaces, and finally, we have shown that the depth interpretation of untextured stereograms requires that the visual system classify edges before evaluating their depth. GRA

N88-19072# Northrop Services, Inc., Dayton, Ohio. Environmental Sciences.
TOXIC EFFECTS OF MAN-MADE MINERAL FIBERS WITH PARTICULAR REFERENCE TO CERAMIC FIBERS Technical Report, Dec. 1986 - Jan. 1987
ALLEN VINEGAR Sep. 1987 33 p
(Contract F33615-85-C-0532)
(AD-A187949; AAMRL-TR-87-045; NMRI-87-40) Avail: NTIS HC A03/MF A01 CSCL 06K

In order to evaluate the potential hazards of man made mineral fibers (MMMF); particularly ceramic fibers, in the Navy work environment, the following areas are considered. First, the current standards and recommendations of other agencies are presented as an overview of current concensus as to relative hazards of asbestos, MMMF, and cristobalite (a form of crystalline silica). Then, a summary of recent epidemiological evidence is presented. These data should be the most relevant for human exposure. Unfortunately, there are no data for workers in the ceramic fiber field. Then a review is presented of the data from animal experiments which employed exposure by inhalation, intratracheal instillation, and intrapleural or intraperitoneal injection. The experiments reviewed involve only non-ceramic MMMF. Some detail of the protocol and results of each experiment are presented to provide a better understanding of the non-uniformity of the protocols used. Another issue of particular importance in understanding fiber toxicity is the durability of the fiber. These data are presented for non ceramic MMMF. GRA

N88-19073# Army Research Inst. of Environmental Medicine, Natick, Mass.

GASTRIC EMPTYING DURING EXERCISE: EFFECTS OF ACUTE HEAT STRESS, ACCLIMATION AND HYPOHYDRATION

P. D. NEUFER, ANDREW J. YOUNG, and MICHAEL N. SAWKA *Oct. 1987* 31 p

(AD-A188008) Avail: NTIS HC A03/MF A01 CSCL 06J

To determine the effects of acute heat stress, heat acclimation and hypohydration on the gastric emptying rate of water (W) during treadmill exercise, ten physically fit men ingested 400 ml of W prior to each of three 15-min bouts of exercise (treadmill, about 50 percent VO2 max) on five separate occasions. Stomach contents were aspirated after each exercise bout. Before heat acclimation (ACC), experiments were performed in a neutral (18 C), hot (49 C) and warm (35 C) environment. Subjects were euhydrated for all experiments before ACC. After ACC, the subjects completed two more experiments in the warm (35 C) environment; one while euhydrated and a final while hypohydrated (5 percent of body weight). The volume of ingested water emptied into the intestines were inversely correlated (P is less than 0.01) with the rectal temperature ($r=0.76$) and heart rate ($r=0.88$) at the completion of each exercise bout. The following new observations were made: (1) exercise in a hot (49 C) environment impairs gastric emptying rate as compared to a neutral (18 C) environment; (2) exercise in a warm (35 C) environment does not consistently affect gastric emptying before or after heat acclimation; but (3) exercise in a warm environment when hypohydrated reduces gastric emptying rate. Reductions in gastric emptying appeared to be related to the severity of the thermal and cardiovascular strain induced by exercise/heat stress. GRA

N88-19074# Army Research Inst. of Environmental Medicine, Natick, Mass.

DEVELOPMENT OF A COPING STRATEGIES QUESTIONNAIRE TO ASSESS ENDURANCE PERFORMANCE

WILLIAM J. THARION and ALYSSA L. TERRY 16 Oct. 1987 7 p

(AD-A188010) Avail: NTIS HC A02/MF A01 CSCL 06J

The purpose of this study was to develop a questionnaire to assess coping strategies employed to help combat the physical and psychological stress associated with endurance activities. When assessing the performance of two individuals trained similarly for a sustained operation (an operation lasting longer than six hours) or other endurance related tasks, a question that often arises is why is one individual able to complete the mission or task while his similarly trained partner is unable to do so. This question is also frequently examined in the athletic arena, especially for long endurance events. In all of these cases, psychological explanations are often given to explain why one individual is able to successfully cope with the demands of the activity and finish it, while another individual is not able to. Understanding how successful soldiers and athletes cope with the stresses involved in endurance events should allow for a better understanding of superior performance. GRA

N88-19075# Army Research Inst. of Environmental Medicine, Natick, Mass.

OPERATION EVEREST 2: ALTERATIONS IN THE IMMUNE SYSTEM AT HIGH ALTITUDE

RICHARD MEEHAN, ULRIC DUNCAN, LAUREEN NEALE, GERALD TAYLOR, and HAROLD MUCHMORE 9 Sep. 1987 42 p

(AD-A188011) Avail: NTIS HC A03/MF A01 CSCL 06E

We investigated the effects of progressive hypobaric hypoxia simulating an ascent to 25,000 ft (7,620m) over 4 weeks on immune function. Multiple simultaneous in vitro and in vivo immunologic parameters were obtained from 7 subjects at sea level, 7,500 ft (2,286m), and 25,000 ft during a decompression chamber exposure. PHA stimulated thymidine uptake and protein synthesis in mononuclear cells were reduced at extreme altitude. An increase in monocytes without changes in B cells or T cell subsets was also observed by flow cytometry analysis. Plasma IgM and IgA but not IgG levels were increased at altitude, whereas PWM stimulated in vitro IgG, IgA and IgM secretion was unchanged. In vitro PHA stimulated interferon production and NK cytotoxicity did not change statistically but large inter-subject differences were observed during exposure to 25,000 ft. Nasal wash IgA and lysozyme levels, and serum antibodies to nuclear antigens were *not influenced by altitude exposure. These results suggest that* T cell function is blunted during exposure to severe hypoxemia, whereas B cell function and mucosal immunity are not. While the mechanism of altered in vitro immune responsiveness following exposure to various environmental stressors has not been elucidated in humans, hypoxia may induce immune dysfunction as suggested by in vitro immune effector cell function assays. GRA

N88-19076# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

VISUAL INTEGRATION AND DETECTION OF DISCONTINUITIES: THE KEY ROLE OF INTENSITY EDGES

ED GAMBLE and TOMASO POGGIO Oct. 1987 34 p

(Contract N00014-85-K-0124)

(AD-A188012; AI-M-970) Avail: NTIS HC A03/MF A01 CSCL 06C

Integration of several vision modules is likely to be one of the keys to the power and robustness of the human visual system. The problem of integrating early vision cues is also emerging as a central problem in current computer vision research. This paper suggests that integration is best performed at the location of discontinuities in early processes, such as discontinuities in image brightness, depth, motion, texture and color. Coupled Markov Random Field models, based on Bayes estimation techniques, can be used to combine vision modalities with their discontinuities. These models generate algorithms that map naturally onto parallel *fine-grained architectures such as the Connection Machine.* A scheme was derived to integrate intensity edges with stereo depth and motion field information and show results on synthetic and natural images. The use of intensity edges to integrate other visual cues and to help discover discontinuities emerges as a general and powerful principle. GRA

N88-19077# Veterans Administration Hospital, San Francisco, Calif.

NEUROPEPTIDES IN EXPERIMENTAL HEAD INJURY Annual Report, 1 Mar. 1986 - 28 Feb. 1987

ALAN I. FADEN and TRACY K. MCINTOSH 28 Feb. 1987 39 p

(Contract DA PROJ. 3S1-62772-A-874)

(AD-A188067) Avail: NTIS HC A03/MF A01 CSCL 06E

Much of the damage resulting from ischemic or traumatic insults to the central nervous system appears to result from secondary injury mechanisms relating to the release of endogenous factors. Endogenous opioids may represent one such class of pathophysiological factors, and have been implicated in traumatic spinal cord injury, ischemic spinal cord injury and ischemic brain injury. The studies covered under the present contract examine the potential pathophysiological role of endogenous opioids and their receptor-mediated changes following traumatic brain injury in both cats and rats. Utilizing a fluid percussion device we have evaluated the effects of graded levels of injury on outcome *measures, including mean arterial pressure, intracranial pressure,* electroencephalographic (EEG) activity, and cerebral blood flow in the cat. In a continuation of studies begun during the first year of the present contract, we have compared the effectiveness of the opiate antagonist WIN44, 441-3, which has enhanced activity at the kappa-opiate receptor, with its inactive stereoisomer WIN44, 441-2, saline, and dopamine hydrochloride. Finally, we have initiated pilot studies utilizing nuclear magnetic resonance spectroscopy (MRS) to evaluate the dynamic in vivo metabolic response to traumatic brain injury in the rat. These studies have shown that transient changes in high energy phosphates and intracellular pH occur in response to traumatic brain injury. This decreased PCr/Pi ratio in the absence of hypoxis or tissue acidosis may be a reflection of mitochondrial dysfunction and may thus be a marker of irreversible tissue injury. GRA

N88-19078# Northeastern Univ., Boston, Mass.
CENTER FOR THE STUDY OF RHYTHMIC PROCESSES Annual Report, 1 Oct. 1986 - 1 Oct. 1987
NANCY KOPELL, AVIS H. COHEN, EVE MARDER, and KAREN A. SIGVARDT 20 Oct. 1987 36 p
(Contract F49620-87-C-0013)
(AD-A188204; AFOSR-87-1657TR) Avail: NTIS HC A03/MF A01 CSCL 06D

The Center for the Study of Rhythmic Processes began operation in the academic year 1986 to 1987. It brought together mathematicians and biologists to work on problems of mutual interest. During the first year, the Center focused on two sets of problems. The first involved the structure and function of the intersegmental coordinating system of the vertebrate spinal cord, for which the lamprey provides an excellent model system. A broadly applicable mathematical framework was constructed for analyzing this system, and new mathematical techniques were invented. A new technology was put into use which has the potential of providing information not previously obtainable. Many of the major researchers working on this preparation were consolidated under the auspices of the center, and many new collaborations were formed. The other involved small neural networks, such as the stomatogastric ganglion of the lobster. Detailed mechanisms of function and control were investigated, and mathematical tools were applied to investigate how the circuits change under modulation. GRA

N88-19079# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
12 Feb. 1988 65 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-88-001) Avail: NTIS HC A04/MF A01

Articles and summaries of articles from the open literature are presented in the areas of aerospace medicine, agricultural science, biochemistry, biotechnology, epidemiology, genetics, laser bioeffects, microbiology, molecular biology, pharmacology and toxicology, physiology, public health, radiation biology, and virology.

N88-19080# Joint Publications Research Service, Arlington, Va.
BALLISTOCARDIOGRAPHY IN WEIGHTLESSNESS RESEARCH Abstract Only
R. M. BAYEVSKIY, I. I. FUNTOVA, and M. D. ZAKATOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 12 Feb. 1988 Transl. into ENGLISH from Vestnik Akademii Meditsinskikh Nauk SSSR (Moscow, USSR), no. 6, Jun. 1987 p 77-84
Avail: NTIS HC A04/MF A01

A review is presented of advances in ballistocardiographic studies during weightlessness aboard Salyut-6 and -7 space ships, as well as in controlled ground experimentation. The latter involved ten 19 to 20-year-old males subjected to antiorthostatic kinesia for prolonged periods of time to simulate weightlessness. In general, the results of both series were in agreement. Over a 90-day period three basic phases of changes in cardiac contractility were identified. The initial stage was a diminished mechanical activity of the right heart. The second stage consisted of enhanced contractility of the right ventricle with simultaneous reduction in the contractility of the left heart. The final stage was a reversal of the phenomenon in the second stage, i.e., enhanced contractility of the left ventricle with concomitant reduction in contractility of the right heart. Further developments in ballistocardiographic techniques and equipment will lead to an expanded use of this technology in clinical medicine, following its initial development for space physiology. Author

N88-19081# Joint Publications Research Service, Arlington, Va.
CENTRAL HEMODYNAMICS IN ANTIORTHOSTATIC HYPOKINESIA AND IMMERSION MODELS OF WEIGHTLESSNESS Abstract Only
V. YE. KATKOV, L. I. KAKURIN, V. V. CHESTUKHIN, and E. M. NIKOLAYENKO *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 12 Feb. 1988 Transl. into ENGLISH from Vestnik Akademii Meditsinskikh Nauk SSSR (Moscow, USSR), no. 6, Jun. 1987 p 71-77
Avail: NTIS HC A04/MF A01

A comparative study was conducted on the physiological effects of antiorthostatic hypokinesia (15 deg body angle) and dry immersion on central hemodynamics in weightlessness simulation research. The experiments were conducted over a period of 7 days with 17 healthy males (33 years old) divided into two groups. The central hemodynamic parameters were more affected by immersion in the initial hours of the experiment, presumably due to the primary effects of immersion. Stabilization of the various hemodynamic parameters was seen in 2 to 3 days in both experiments, and within 7 days there were no significant differences between the groups. These observations were interpreted to indicate that both experimental approahces lead to essentially identical data on the effects of weightlessness and are equally suitable for onboard experimentation in space stations. This is particularly applicable to monitoring of central venous pressure, whereas the other hemodynamic parameters still require additional studies. Within 1 day of the experiment the central venous pressure fell from a control value of 4.1 mmHg to 2.1 mmHg, decreasing to 1.7 mmHg by day 7. Similar results had been obtained aboard Space Lab-1. Author

N88-19082# South African Association of Physicists in Medicine and Biology, Pretoria.
SOUTH AFRICAN ASSOCIATION OF PHYSICISTS IN MEDICINE AND BIOLOGY: 26TH ANNUAL CONGRESS
1986 48 p In AFRIKAANS and ENGLISH Congress held at Pretoria, South Africa, 18 Mar. 1986
(DE88-700824; INIS-MF-11084; CONF-8603229) Avail: NTIS (US Sales Only) HC A03/MF A01

The Twenty-Sixth Annual Congress of the South African Association of Physicists in Medicine and Biology was held from 18 to 26 March 1986 in Pretoria. Papers delivered covered subjects like medical physics, radiotherapy, radiation protection, calibration of radiation monitors, radiation detectors, radiation doses and dosimetry. DOE

N88-19083 New South Wales Univ., Kensington (Australia). School of Mechanical and Industrial Engineering.
CAUSES AND PREVENTION OF OCCUPATIONAL REPETITION STRAIN INJURIES (RSI) Abstract Only. Ph.D. Thesis
KESHABA N. BAIDYA 1986 494 p
Avail: Issuing Activity

The incidence of repetition strain injuries (RSI) has greatly increased in recent years. There is no effective treatment. To prevent RSI, it is essential to understand the causes, and then to develop guidelines for work design based on the causes. The statistics indicated a correlation between RSI cases and the extent of industrialization. It was shown that females are more prone to RSI than males. To help in identifying causes of RSI, a survey was designed to correlate personal and work factors associated with the incidence of RSI. The survey of a sufferer and control group showed that the members of the sufferer group tended to be heavier, to spend more of their leisure time in indoor activities, to be in their thirties and to be engaged in more tense, repetitive work at a less adjustable pace than their counterparts. Local Muscle Fatigue (LMF) is considered to be a common precursor of RSI. The power density spectrum of EMG signals from the muscles concerned was shown to be the best indicator of LMF. The center frequency of the spectrum decreases with fatigue. To examine causes of fatigue, EMG signals of the extensor muscles were examined during repetitive wrist extension against a load. The degree of wrist extension, ulnar deviation during extension and the sex of the operator were the variable factors in the first

experiment. In the second experiment, the rest period after half an hour exercise was varied, with the other variables fixed. Alternative methods were compared and the results supported the use of EMG frequency analysis for measuring LMF. Author

N88-19084# Health Effects Research Lab., Research Triangle Park, N. C.
EFFECTS OF BREATHING AIR CONTAINING CONTAMINANTS SUCH AS CO2, CO AND HYDROCARBONS AT 1 AND 5 ATMOSPHERES
V. A. BENIGNUS Nov. 1987 69 p
(PB88-132915; EPA-600/D-87/348) Avail: NTIS HC A04/MF A01 CSCL 06T

The neural and behavioral effects of air contaminants such as CO2, CO and hydrocarbons are reviewed. Each contaminant or contaminant class is reviewed separately and then an attempt is made to estimate effects of combinations of contaminants. The effects are reviewed for both normobaric and hyperbaric conditions. Rough dose effects curves were constructed from data found in the literature. Author

N88-19085*# National Aeronautics and Space Administration, Washington, D.C.
REGULATION OF CALCIUM METABOLISM DURING PROLONGED ANTIORTHOSTATIC HYPOKINESIA
A. I. GRIGORYEV, B. V. MORUKOV, B. R. DOROKHOVA, and L. A. RUSTAMYAN Mar. 1988 11 p Transl. into ENGLISH from Fiziologiya Cheloveka, Akademiya Nauk SSSR (Moscow, USSR), v. 7, Jul. - Aug. 1981 p 705-709 Original language document was announced in IAA as A81-44897 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASW-4307)
(NASA-TT-20219; NAS 1.77:20219) Avail: NTIS HC A03/MF A01 CSCL 06S

Characteristics of the regulation of calcium exchange in healthy persons exposed to 182 days of antiorthostatic hypokinesia are investigated. Total calcium concentrations, ionized calcium activities and parathyroid hormone concentrations in blood serum were determined, before, during, and up to 15 days after a 182-day period of strict bed rest at a head down tilt of 4 deg; and tests of blood urine responses to a calcium lactate stress were performed to study the role of the kidneys. An increase in calcium ion activity is observed during the period of hypokinesia, while total calcium concentrations changed to a lesser degree. Plasma parathyroid hormone levels are found to significantly exceed background levels during hypokinesia and in the recovery period immediately following. Finally, the increase in calcium excretion in the urine during prolonged limitations of muscular activity is found to be connected with both an enhancement of calcium filtration and a decrease in its reabsorption in the kidneys, possibly due to changes in hormonal regulation. Author

N88-19896# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ESA'S FACILITY FOR RESEARCH IN HUMAN PHYSIOLOGY IN SPACE: ANTHRORACK
B. ELMANN-LARSEN *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 19-20 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06P

Anthrorack is a Spacelab double rack for research into human physiology in space, built around the whole-system analysis philosophy to achieve as many important physiological parameters as possible at the same point in time. The rack contains equipment for monitoring cardiovascular adaptation and deconditioning, pulmonary adaptation, blood sampling and processing, and acquisition of the following signals: ECG, EMG, EOG, EEG, blood pressure, body temperature, force, ambient pressure and temperature. The experiment complement consists of 21 different European experiments integrated into 3 major groups for cardiovascular, pulmonal, and hormonal research. The Anthrorack hardware is in the building phase. The first prototype of the rack, the Training Model, will be delivered late 1988. As an integrated part of Spacelab, Anthrorack will be flown on the Shuttle on Spacelab mission D-2. ESA

N88-19902# Mainz Univ. (West Germany). Dept. of Physiology.
RESPIRATORY PARAMETERS ABOARD AN AIRCRAFT PERFORMING PARABOLIC FLIGHTS
J. WETZIG and R. VONBAUMGARTEN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 47-50 Dec. 1987
(Contract BMFT-01-QV-223-9)
Avail: NTIS HC A15/MF A01 CSCL 06S

Respiration was recorded during parabolic flight in an aircraft with a closed system spirometer. The subjects were positioned in turn in a sitting, lying, and head down attitude during the high-g phases of the flight. Shifts of mean tidal volume and of mean thoracic circumference were determined manually from strip chart recordings. A net inspiratory shift of mean tidal volume is present in more than 50 percent of all parabolas investigated during the low-g phase while 12.5 percent show the opposite result. Of all 10 parabolas with shifts of mean tidal volume, 80 percent show a decrease of mean thoracic circumference, as measured by strain gage transducer. ESA

N88-19903# Deutsche Sporthochschule, Cologne (West Germany).
INFLUENCE OF A 6 HR HEAD-OUT WATER IMMERSION ON DIFFERENT TESTS OF ENDURANCE PERFORMANCE CAPACITY
U. HOFFMANN, K. BAUM, F. M. BAER, D. ESSFELD, and J. STEGEMANN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 51-54 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06S

The effect of short-time weigthtlessness, simulated by 6 hr water immersion, on maximum power and V'O2 max, heart rate at submaximum power levels, whole blood lactic acid concentration at submaximum power levels, and V'O2 kinetics in light exercise was studied. In contrast to submaximum heart rate and V'O2 max, submaximum V'O2, lactic acid concentrations and V'O2 kinetics are not significantly affected by the immersion. This combination of results suggests that dehydration is the major cause for a reduced performance capacity following immersion. Since V'O2 max is relatively sensitive to fluid volume changes, this parameter appears less suited to study the effects of weightlessness on muscular metabolism and performance capacity in submaximum exercise. ESA

N88-19904# Deutsche Sporthochschule, Cologne (West Germany). Physiologisches Inst.
THE EFFECT OF ORTHOSTATIC CHANGES IN CENTRAL BLOOD VOLUME ON THE HEART RATE RESPONSE TO GRADED VALSALVA MANEUVERS
J. STEGEMANN, F. M. BAER, U. HOFFMANN, K. BAUM, and D. ESSFELD *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 55-58 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06P

In order to determine if the Valsalva exercise may be used as an indicator of fluid shift during space flight, 21 healthy young men conducted the maneuvers against expiratory pressures of 20, 30, and 40 mm Hg, each lasting 30 sec at body positions of vertical, horizontal, and 6 deg head down tilt (HDT). Heart rate was continuously recorded beat by beat together with the expiratory pressure. The increase in heart rate at equal intrathoracic pressures is maximal in the vertical position, significantly lower (p less than 0.001) in the horizontal position and lowest (p less than 0.05) in the HDT position. The blood volume shift in the horizontal and HDT position partly compensates the impaired venous return during the Valsalva exercise. The Valsalva exercise can thus serve as a noninvasive indicator for central blood volume shift by comparing maximum heart rates during the straining period. ESA

N88-19905# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro Studi Fisiologia Lavoro Muscolare.
BREATH-BY-BREATH MEASUREMENT OF ALVEOLAR GAS EXCHANGE
C. L. LAFORTUNA and P. E. DIPRAMPERO *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 59-61 Dec. 1987 Sponsored in cooperation with a CNR-NATO Science Fellowship
(Contract SNSF-3.383.0-82)
Avail: NTIS HC A15/MF A01 CSCL 06P

The methodology of breath-by-breath (BB) pulmonary gas exchange measurements is discussed. Assessment of BB alveolar gas transfer implies knowledge of alveolar volume at the beginning of the breath (VA(i-1)), a quantity which escapes direct measurement on a BB basis and is therefore given a constant value. It is shown that the value assigned to VA(i-1) (from 0 to 5 liters) does not affect the average alveolar transfer of oxygen and CO2 calculated over 100 consecutive breaths; it greatly inflences, however, the BB variability of alveolar gas exchange. It is concluded that precise calculation of BB alveolar gas transfer is prevented unless a method is devised for assessing VA(i-1) on a single breath basis. ESA

N88-19906# Karolinska Inst., Stockholm (Sweden). Dept. of Baromedicine and Medical Engineering.
SECOND-GENERATION RESPIRATORY MONITORING SYSTEM FOR MICROGRAVITY STUDIES IN MAN
D. LINNARSSON, H. LARSSON, and T. RIBBE *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 63-64 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06P

For measurements of the metabolism and the lung function in studies of the human adaptation to microgravity, a respiratory monitoring system was designed for Spacelab. A further optimization of mass, power dissipation, calibration gas requirement, and foreign gas pollution is desirable for future space station applications. This should be performed without compromising the accuracy and the safety of the system. A device with breath-through analysis of metabolic and indicator gases is presented. Indicator gases can be dispensed and analyzed in trace concentrations. ESA

N88-19907# Institute of Biomedical Problems, Moscow (USSR).
LUNG FUNCTION IN SIMULATED MICROGRAVITY
A. M. GENIN and V. M. BARANOV *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 65-69 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06S

Ground-based microgravity simulation studies show variations in lung volumes, respiration biomechanics, and gas exchange which reduce the efficiency of lung ventilation. They demonstrate differences in the pattern and amount of changes in the respiratory parameters which occur in head-down tilt and water immersion, upright and supine water immersion, and simulated and real space flight. The data obtained indicates that due to the anatomical and physiological peculiarities of the lungs the Earth gravitational field acts in a nonuniform manner on their compartments. This emphasizes the necessity of investigating the lung function in real space flights. ESA

N88-19908# Technische Univ., Graz (Austria). Dept. of Thoracic and Hyperbaric Surgery.
LIQUID VENTILATION: NEW DATA AND POSSIBLE USE IN SPACE MEDICINE
F.-M. JUETTNER, H. HINGHOFER-SZALKAY, P. REHAK, H. PINTER, H. POPPER, J. SMOLLE, and W. PETEK (Technische Univ., Graz, Austria) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 71-75 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06S

Liquid ventilation of the lungs to diminish acceleration/deceleration stresses was studied. Since ions permeating the alveolo capillary barrier might induce serious electrolyte disturbances in the serum, the permeability of the alveolo-capillary membrane during unilateral continuous isotonic liquid ventilation in the pig was studied. Data suggest that the permeability of the barrier for ions and large molecules ranges in the same order of magnitude as that of peripheral capillaries. There is no substantial loss of fluid into the organism. Serum electroyltes remain unchanged. ESA

N88-19919# Technische Univ., Graz (Austria). Inst. fuer Physiologie.
FLUID VOLUME CHANGES IN ASTRONAUTS: HOW THEY FIT OUR UNDERSTANDING OF PHYSIOLOGY
H. HINGHOFER-SZALKAY *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 135-142 Dec. 1987
Avail: NTIS HC A15/MF A01

Body fluid and electrolyte responses to microgravity are reviewed, and questions regarding spaceflight induced changes in the fluid-electrolyte system are discussed. Compartments from which the unexpectedly large volume of fluid which is rapidly lost from the legs at the onset of microgravity originates, and the forces which drive it into the upper parts of the body are unknown. It is not clear if this fluid is eventually excreted from the body, or if a residual volume remains. If so, it may provide a long-term stimulus to volume receptors, or these receptors may adapt. The magnitude and time-course of the losses of water, sodium and potassium, which are the most significantly altered components of intake and output also need to be elucidated. The higher excretion rates of fluids and major electrolytes after several days of flight could either represent a continuous net loss from the body, or reflect altered intake or sweat secretion. The neuro-hormonal mechanisms reducing, e.g., plasma osmolality while increasing it in the urine, and depressing urine output during the first week and elevating it later inflight should be studied. ESA

N88-19920# Tours Univ. (France). Lab. de Biophysique Medicale.
CARDIOVASCULAR ADAPTATION TO ZERO-G DURING A LONG TERM FLIGHT (237 DAYS) ON BOARD THE SALYUT 7 SOVIET SPACE STATION (1984)
PH. ARBEILLE, J. M. POTTIER, F. PATAT, M. BERSON, A. RONCIN, CH. LETOULLEC, P. MIGNE, L. POURCELOT, A. KATOVSKAYA, O. ATKOV (Institute of Biomedical Problems, Moscow, USSR) et al. *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 143-146 Dec. 1987
Avail: NTIS HC A15/MF A01

Cardiovascular examinations were performed on three astronauts during a long term flight (234 days). The multimode ultrasound device includes a real-time B mode imaging, a time motion mode, a Doppler and a duplex mode echo-Doppler. This system was used to study the cardiac function and the peripheral circulation. The main hemodynamic parameters (cardiac output, carotid and femoral blood flow, vascular resistances) were measured several times preflight, inflight, and during the recovery period. The individual variations are presented as percentage of the basal preflight value. It is concluded that the hemodynamic changes observed during the flight concern physiological and reversible reactions of the cardiovascular system (e.g., a 20 to 40 percent reduction of left ventricle size). ESA

N88-19921# Tours Univ. (France). Lab. de Biophysique Medicale.
CARDIAC AND PERIPHERAL CIRCULATION ASSESSMENT BY ULTRASOUND ON 3 ASTRONAUTS DURING TWO 7-DAY SPACE FLIGHTS (1982 SALYUT-7 - 1985 STS 51G)
J. M. POTTIER, F. PATAT, PH. ARBEILLE, A. RONCIN, M. BERSON, and L. POURCELOT *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 147-149 Dec. 1987
Avail: NTIS HC A15/MF A01

Cardiovascular function was examined by echography on board Salyut 7 and the Space Shuttle. During short flights a moderate

increase (maximum + 30 percent) of the left ventricle and the cardiac output followed one day or a few days later by the decrease (maximum - 15 percent) of these parameters are noted. Cerebral circulation remains quite stable whereas the femoral circulation changes with cardiac output. After landing, all the hemodynamic parameters were transiently increased but show large oscillations all along the recovery period. The cardiovascular parameters return to their basal value within a few days. The variations of the main hemodynamic parameters, presented as a percentage of the basal value are compared inflight and postflight. ESA

N88-19922# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.
LOAD AND CONTROL OF THE CARDIOCIRCULATORY SYSTEM IN WEIGHTLESSNESS
F. BAISCH and L. BECK *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 151-154 Dec. 1987
Avail: NTIS HC A15/MF A01

The theory of adaptation of the circulatory system to microgravity which postulates an increased blood volume stress in the upper body segments is discussed. It also supposes a direct impact on the heart muscle apart from the decreased workload of the striated musculature. If the fluid shift leads to a permanent preload increase of right and left ventricle, the demands on contractility might be reduced. Bed rest studies seem to support this view: with equal inotropic stimulation, the analogon of ventricular function curves downwards from control after 7 days head down tilt. The ventricular function curves obtained during the D-1 mission on Spacelab and in the recovery period do not reveal any significant changes compared to control. The first inflight days reveal an increase of cardiac output as well as a decrease of heart rate. ESA

N88-19924# Institute of Biomedical Problems, Moscow (USSR).
PHYSIOLOGICAL REACTIONS UPON CONTROLLED CHANGES OF BLOOD DISTRIBUTION IN HUMANS
I. D. PESTOV and V. S. PANCHENKO *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 159-162 Dec. 1987
Avail: NTIS HC A15/MF A01

In short-term experiments, using standard techniques to induce blood distribution relative to longitudinal body axis, the cardiorespiratory system, water-electrolyte metabolism, and orthostatic tolerance were studied. Results show that the aspects studied can be regulated by the controlled blood distribution relative to the longitudinal body axis. Physical means and techniques employed to induce this controlled blood distribution if utilized at zero-g, might reproduce physiological reactions similar to reactions in terrestrial gravity. Inasmuch as a forced relationship is revealed between parameters of physical exposures, which affect both blood distribution and intensity of organism response, it is possible to select from a broad variety of these physical exposures values which reproduce in weightlessness effects of interest, e.g., physiological reactions typical for upright posture under terrestrial gravity. Among criteria which can be utilized to grade such physical exposures, is the blood volume in pulmonary capillaries. ESA

N88-19938# Marburg Univ. (West Germany). Inst. fuer Physiologie.
NECK RECEPTOR STIMULATION IN 0 AND 1 G
J. R. KASS, H. VOGEL, and R. J. VONBAUMGARTEN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 233-236 Dec. 1987
Avail: NTIS HC A15/MF A01

The effect of neck-receptor stimulation on orientation and eye movement in 0 g was studied on humans. Stimulation involved cervical, vestibular, and combination of both sets of receptors in a roll axis. Eye rotation was measured, as well as orientation perception. Results show cervico-ocular compensatory eye torsion in 0 g and very poor perception of the relative head and trunk positions as compared with the ground tests. Combined otolith and neck-receptor stimulation on the ground causes more ocular counter-torsion than otolith stimulation alone. The results of neck-receptor activity on the ground is directed against the Aubert phenomenon and in space causes counter-rotation of a head-fixed horizontal luminous line. ESA

N88-19939# Freie Univ., Berlin (West Germany).
VESTIBULAR RESPONSE TO CALORIC STIMULATION DURING ORBITAL FLIGHT
H. SCHERER and A. H. CLARKE *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 237-239 Dec. 1987
Avail: NTIS HC A15/MF A01

Caloric testing was performed in weightlessness in vestibular tests on Spacelab SL-1 mission and D-1 mission. Results show that, contrary to the thermoconvective theory for the basic caloric mechanism, the inflight 0 g responses are comparable to those measured in 1 g conditions on Earth. Besides confirming the results of the first orbital experiment, the D-1 experiment utilized the vestibular sled facility to examine the effect of linear acceleratory stimulation on an ongoing caloric nystagmus. Vestibular response to simultaneous stimulation of both the angular and linear acceleration receptors could be measured. Evaluation of the caloric response over the course of the pre, in, and postflight periods yields interesting results on the adaptation and readaptation processes associated with extended orbital flight missions. ESA

N88-19941# Stirling Univ. (Scotland).
THE RATE OF ADAPTATION TO ALTERED G IN THE HUMAN CENTRIFUGE: IMPLICATIONS FOR SIMULATIONS OF MASS-DISCRIMINATION IN SPACE FLIGHT
H. ROSS and E. SCHWARTZ (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, West Germany) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 249-254 Dec. 1987 Sponsored by ESA and the United Kingdom Royal Society
Avail: NTIS HC A15/MF A01

Thirty six subjects were tested for weight discrimination under continuous (5 min) and alternating (30 sec) exposure to 1.05 and 2.0 g. Performance is poorer at 2.0 than at 1.05 g, due to the altered force environment. It is also poorer under alternating than continuous exposure, but only when the alternating condition is first. Poor performance during repeated parabolas in flight may be partly due to the use of novice fliers, who have not acquired contingent adaptation. Other factors, such as the rapid and extreme changes in g level, may also impair such performance in comparison with space flight or the centrifuge. ESA

N88-19942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.
IMPLICATIONS OF SHIFTWORK IN SPACE FOR HUMAN PHYSIOLOGY EXPERIMENTS
H. M. WEGMANN, A. GUNDEL, K. E. KLEIN, and A. SAMEL *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 255-258 Dec. 1987
Avail: NTIS HC A15/MF A01

The consequences of double-shift operations during Spacelab missions where crew members are required to work at unusual times of their habitual 24 hr cycles are discussed. In addition to this shift-work condition, astronauts are exposed to a zeitgeber ensemble that is substantially altered in comparison with their normal routine on Earth. Most likely, these two factors cause permanent changes in the circadian regulatory system. Computer simulations and extrapolations from jet-lag studies demonstrate that the instable circadian state may cause serious problems for human physiology experiments. ESA

N88-19943# Institute of Biomedical Problems, Moscow (USSR).
THE INFLUENCE OF SPACE FLIGHT ON WATER-SALT HOMEOSTASIS IN MAN AND ANIMALS
YU. V. NATOCHIN, A. I. GRIGORIEV, and L. V. SEROVA *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 259-261 Dec. 1987
Avail: NTIS HC A15/MF A01

Water-salt homeostasis in space flights lasting up to 175 days is described. During short-term space flights changes in water-salt homeostasis in cosmonauts are connected mainly with volumoregulation; during long-term flights, in addition, hypokalemia and hypercalcimia develop. In weightlessness a decreased content of K in the renal medulla of rats can be one of the causes responsible for a change of osmo- and ionregulatory renal function. During space flights the body weight of pregnant rats does not increase, the content of Ca in the liver and kidney decreases, as does the fetus weight, but the content of Na, K, Ca, Mg is unchanged. ESA

N88-19944# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).
EFFECTS OF ANTI-G SUIT INFLATION ON RENIN AND ALDOSTERONE RESPONSE PHYSICAL EXERCISE
C. Y. GUEZENNEC, F. LOUISY, F. X. GALEN, and M. LARTIGUES (Limoges Univ., France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 263-267 Dec. 1987
Avail: NTIS HC A15/MF A01 CSCL 06C

In order to verify the stimuli involved in renin secretion and the consequences on aldosterone concentration, six healthy male subjects executed four experimental procedures. Two tests were upright posture with and without anti-g suit. Two tests were arm cranking with and without anti-g suit. The blood sample performed before and at the end was used to measure atrial natriuretic factor (ANF), plasma renin activity (PRA), aldosterone concentrations, and corticotrophin. Results show that ANF increase is more influenced by physical exercise than by anti-g suit inflation, while PRA increase under effect of upright posture is abolished by anti-g suit inflation and exercise. It is concluded that the enhanced venous return under the effect of anti-g suit inflation influences PRA more than ANF secretion. ESA

N88-19945# Lyon-1 Univ. (France). Faculte de Medecine.
IS ANF IMPLIED IN THE NIGHT ATTENUATED RENAL RESPONSE TO CENTRAL HYPERVOLEMIA?
G. GAUQUELIN, B. ROUSSEL, J.-O. FORTRAT, G. GEELEN, PH. ARBEILLE, L. POURCELOT, A. GUELL (Centre National d'Etudes Spatiales, Toulouse, France), J. GUTKOWSKA, M. CANTIN, and C. GHARIB *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 269-272 Dec. 1987
Sponsored in cooperation with Lyon Univ., France and Universite Claude Bernard
(Contract DRET-87-086; CNES-87-1242)
Avail: NTIS HC A15/MF A01

Plasma levels of atrial natriuretic factor (ANF) were measured during a 4 hr head-down tilt at -6 deg in 5 healthy male volunteers (aged 20 to 22 yrs). Experiments took place from 08.00 hr to 14.00 hr, (day), and from 22.00 hr to 07.00 hr (night). The control period was 1 hr in a seated position (08.00 hr to 09.00 hr for day and 22.00 hr to 23.00 hr for night). Blood samples were collected at 09.00 hr and 23.00 hr and every 20 min during the first hour, and every hour thereafter. Electroencephalograms were continuously recorded during night. Results show a similar significant increase in ANF under both experimental conditions. At night there is no correlation between ANF and sleep stages. Differences observed in renal responsiveness to central volume expansion during day or night can not be explained by a difference in renin, aldosterone, vasipressin (previously demonstrated in several studies) or ANF secretion. ESA

N88-19946# Institute of Biomedical Problems, Moscow (USSR).
MEDILAB: A PROJECT OF A MEDICAL LABORATORY IN SPACE
O. G. GAZENKO, A. I. GRIGORIEV, E. A. ILYIN, and S. F. KHOLIN *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 275-277 Dec. 1987
Avail: NTIS HC A15/MF A01

A medical laboratory for the Mir Space Station is proposed. Physiological studies concentrate on sensory systems, respiration and circulation regulation, hormonal and fluid-electrolyte metabolism, musculoskeletal system, digestive system, and psychophysiological status. It is planned to study neuro-reflex and neuro-humoral mechanisms of regulation of physiological systems at different time intervals of exposure to microgravity using invasive methods that cannot be applied to man as well as to investigate subtle morphofunctional changes in animals. Biological experiments concentrate on cell biology and population biology to clarify the specific function and evolution of living systems in the absence of gravity and to ascertain the general pattern of gravity effects on living systems. Animal experiments to develop the principles and tactics of surgical manipulations and treatment of pathologies such as local inflammation and wounds, and bone regeneration are planned. ESA

N88-19955# Tours Univ. (France). Lab. de Biophysique Medicale.
GASTRIC EMPTYING ASSESSMENT BY ECHOGRAPHY AFTER A STRESS (ROTATING CHAIR)
R. VALMALLE, PH. ARBEILLE, F. PATAT, J. M. POTTIER, C. GHARIB (Lyon-1 Univ., France), and L. POURCELOT *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 319-321 Dec. 1987
Avail: NTIS HC A15/MF A01

The gastric emptying time for a calibrated meal was measured by ultrasound imaging on subjects at rest and on subjects after a rotating chair test 20 min after the meal. Rotation was stopped when the subject mentioned clinical signs of discomfort before any vomiting occurred. At rest, the mean gastric emptying time is 157 + or - 22 min. After the rotating chair test, the gastric emptying time is significantly increased: 255 + or - 28 min ($p = 0.001$). This method makes possible the quantification of gastric emptying disturbances induced by motion sickness and is of interest to study gastric emptying in space and to appreciate the effect of drugs against space motion sickness. ESA

N88-19956# Lyon-1 Univ., Villeurbanne (France). Chimie Appliquee et Genie Chimique.
ESTIMATION OF BODY FLUID SHIFT BY ELECTRICAL IMPEDANCE IN VARIOUS POSTURES
A. THOMASSET, J. LENOIR, P. JENIN, and C. GHARIB (Lyon-1 Univ., France) *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 323-325 Dec. 1987
Avail: NTIS HC A15/MF A01

The electrical impedance method was used to measure the hydratation state and volume disturbance in man during change in body position. With respect to an initial sitting posture, the maintenance of this posture (4 hr) results in a blood accumulation more important in the lower limbs than in the arms. A slight extracellular edema is established in the distal parts (hand and feet). With 9 deg inclination for 4 hr, the phenomenon is inversed. Whatever the case, scatter in data is more important in the lying posture than in the sitting posture. ESA

N88-19957# Mainz Univ. (West Germany). Abteilung fuer Sportphysiologie.
A NEW ISODYNAMICALLY-BRAKED ARM ERGOMETER INCLUDING THE DEMONSTRATION OF A PROTOTYPE
TH. HOFFMANN and H.-V. ULMER *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 327-330 Dec. 1987
Avail: NTIS HC A15/MF A01

For simulating arm exercise in space, an arm ergometer was developed based on frictioned hydraulic cylinders, enabling performances for push/pull exercise with both arms between 10 and 30 W. Tests with 23 subjects show suitability of the prototype, substantiated by: systematic increases of heart rate, ventilation, and perceived exertion with increasing load. Due to the gathered experimental knowledge further improvements will be discussed. ESA

N88-19958# Technische Univ., Graz (Austria). Inst. fuer Physiologie.
ASSESSMENT OF INTERCOMPARTMENT FLUID SHIFTS BY BLOOD DENSITOMETRY IN ASTRONAUTS
H. HINGHOFER-SZALKAY and G. HAAS *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 331-333 Dec. 1987 Sponsored by the Austrian Academy of Sciences
Avail: NTIS HC A15/MF A01

A method which allows rapid and precise determination of the mass densities of human blood and plasma is discussed. The density of antecubital venous samples was measured using the mechanical oscillator technique in tilt-table experiments with 0.01 g/l precision, along with hemoglobin and plasma protein concentrations and hematocrit using conventional methods. Postural fluid shifts are indicated by accompanying changes in all variables. There are highly significant linear relations between all possible combinations of measured variables. Alterations in hemoglobin/hematocrit and plasma protein concentrations can be directly computed from changes in blood and plasma density, respectively. Blood density can also be monitored continuously with high precision and reveals the individual time-course of spontaneous and postural capillary fluid shifts. Erythrocyte density does not change with body position and is closely regulated to an individual set point over time frames of up to several weeks. ESA

N88-19961# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
SOME REFLECTIONS ON THE STANDARDIZATION OF BED-REST PROCEDURES FOR WEIGHTLESSNESS SIMULATION (CARDIOVASCULAR AND ENDOCRINE APSECTS)
A. GUELL, CL. GHARIB (Lyon-1 Univ., France), and M. VISO *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 345-350 Dec. 1987
Avail: NTIS HC A15/MF A01

Bed rest and other standard weightlessness simulation procedures are reviewed. The influence of angle of inclination in head down tilt is discussed. The best posture to obtain basic hormonal and hemodynamic data is considered, and tests after 1 hr in sitting position are recommended. Diet, age, sex, group homogeneity, and physical fitness of subjects are considered. Analytical techniques and statistical analysis of data are treated. ESA

N88-19965# General Accounting Office, Washington, D. C. Resources, Community and Economic Development Div.
NUCLEAR HEALTH AND SAFETY: RADIATION EXPOSURES FOR SOME CLOUD-SAMPLING PERSONNEL NEED TO BE REEXAMINED
Sep. 1987 91 p
(PB88-130497; GAO/RCED-87-134; B-222195) Avail: NTIS HC A05/MF A01 CSCL 06R

An attempt was made to determine how many personnel were involved in the manning or decontaminating aircraft that flew through nuclear clouds during operations Tumbler-Snapper (1952), Redwing (1956), and Dominic I (1962), and how much radiation was received. Author

N88-19966# Joint Publications Research Service, Arlington, Va.
USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES
27 Apr. 1987 99 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-87-008) Avail: NTIS HC A05/MF A01

Topics related to U.S.S.R. research efforts in the biomedical and behavior sciences are discussed. Aerospace medicine, agrotechnology, biochemistry, biophysics, biotechnology, human factors, radiation effects, pharmacology, physiology, public health, psychology, and radiation medicine are among the topics covered.

N88-19967# Joint Publications Research Service, Arlington, Va.
NITROGEN'S BIOLOGICAL EFFECT ON OXYGEN TRANSPORT THROUGH HEMATOPARENCHYMAL BARRIER
V. A. BEREZOVSKIY and V. I. NOSAR *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 1-7 27 Apr. 1987 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 31, no. 6, Nov. - Dec. 1985 p 641-645
Avail: NTIS HC A05/MF A01

A study is made of the effect of a nitrogen-free gas mixture on oxygen tension in arterial blood and tissues, local circulation, and oxygen mass transfer through the hematoparenchymal barrier (HPB) at low oxygen partial pressure and at normal atmospheric pressure. Author

N88-19968# Joint Publications Research Service, Arlington, Va.
DESYNCHRONIZATION OF HEART RATE AND BREATHING FREQUENCY AFTER TRANSMERIDIONAL FLIGHT ACROSS THREE TIME ZONES Abstract Only
A. A. PUTILOV *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 8 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 6, Nov. - Dec. 1985 p 915-922 Original language document was announced in IAA as A86-22533
Avail: NTIS HC A05/MF A01

Postflight desynchronization of the heart beat frequency/respiratory frequency (HBF/RF) biorhythms observed in individuals who have flown through one or three time zones is discussed. In the case of the one hour zone, the rhythm deviations were small and disappeared after the first two post flight days. A small increase in variation in the circadial rhythm was observed. After the three hour zone passage, internal desynchronization was observed during the first ten post flight days, with continued shift in deviations from integral to fractional HBR/RF ratios during the total 10 day long adaptation period, reaching a maximum after the first two to three postflight days. Author

N88-19969# Joint Publications Research Service, Arlington, Va.
CHANGES IN BLOOD CONDUCTIVITY DURING IMMERSION
V. G. KOZLOVA and YE. A. ALEKSANDROVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 8-9 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 6, Nov. - Dec. 1985 p 1028-1030 Original language document was announced in IAA as A86-22543
Avail: NTIS HC A05/MF A01

Determinations were made of specific electrical resistance of blood to assess the information obtained in this manner as an indicator of the level of hydration. The study of the effects of water immersion on blood conductivity were carried out on twelve healthy men, 25 to 35 years of age. Baseline values of blood resistance ranged from 180 to 230 ohm cm. Within six to ten hours of immersion, blood resistance increased by 18 to 20 percent, reaching maximum values of over 240 ohm cm by day seven. Thereafer, immersion blood resistance returned rapidly to baseline values. The changes in resistance were correlated with plasma electrolytes and degrees of hydration, demonstrating the utility of measuring blood resistance as an indicator of hydration. Author

N88-19971# Joint Publications Research Service, Arlington, Va.
EFFECTS OF WHOLE-BODY IRRADIATION WITH LOW-INTENSITY MICROWAVES ON MORPHOLOGICAL, FUNCTIONAL AND CYTOCHEMICAL CHARACTERISTICS OF LEUKOCYTES Abstract Only
M. I. RUDNEV and N. M. GONCHAR *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 33 27 Apr. 1987 Transl. into ENGLISH from Radiobiologiya (Moscow, USSR), v. 25, no. 5, Sep. - Oct. 1985 p 645-649 Original language document was announced in IAA as A86-18150
Avail: NTIS HC A05/MF A01

Outbred rats and guinea pigs were employed to assess the effects on leukocytes of microwave exposure and to expand the body of knowledge pertaining to the radiobiological aspects of this form of radiation. A statistically significant elevation in eosinophils was evident in the rats by day 30, which persisted for 90 days after irradiation was terminated. Monocytes and lymphocyte counts were depressed, while those of neutrophils were elevated. In guinea pigs, recovery of a normal blood formula was seen within 30 days. Cytochemical and functional studies also demonstrated species differences. In rats, neutrophil digestive function was enhanced but phagocytic activity remained unaffected, while in guinea pigs both the digestive and phagocytic activities of neutrophils were enhanced. The 500 micron W/cubic cm dose was uniformly inhibitory. The observed effects were interpreted to reflect adaptive changes in response to low level (5 to 50 micron W/square cm) electromagnetic exposure. Author

N88-19972# Joint Publications Research Service, Arlington, Va.
MECHANISMS OF EARLY LIGHT AND DARK ADAPTATIONS Abstract Only
A. B. KRAVTSOV and S. V. KULIKOVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 44 27 Apr. 1987 Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSR Imeni I. M. Sechenova (Leningrad, USSR), v. 71, no. 8, Aug. 1985 p 965-970
Avail: NTIS HC A05/MF A01

A tachiscopic study was conducted to assess the role of movement (phasic) and form (tonic) analyzers in early light and dark adaptation. The study involved the presentation of illuminated triangular images differing in brightness with a test stimulus of 30 msec, and 10 to 800 msec for integration time analysis. The responsiveness of the visual system was largely predicated on the movement analyzer, with differences among the subjects in responding to an increase or decrease in baseline brightness due to individual differences in balance of on- and off-inputs into the visual system. Altering the light stimulus may change the relationship between the two types of analyzers. In the case of a sudden change in the adaptation field, the sensitivity of the movement analyzer deteriorates. The increase in the threshold sensitivity of the latter leads to the appearance of well-defined peaks of early light and dark adaptation. Temporal integration under such conditions is prolonged and the form analyzer assumes the dominant role. The interaction of the form and movement analyzers may, therefore, determine the adaptability of the visual system.
Author

N88-19973# Joint Publications Research Service, Arlington, Va.
STATUS OF MICROCIRCULATION IN HIGH-ALTITUDE BLOOD LOSS Abstract Only
N. D. UMRALIEYEVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 45 27 Apr. 1987 Transl. into ENGLISH from Izvestiya Akademii Nauk Kirgizskoy SSR (Frunze, USSR), no. 4, Jul. - Aug. 1986 p 58-62
Avail: NTIS HC A05/MF A01

A histological study was conducted on outbred, albino rats to assess the effects of high altitude adaptation (3200 m) on the microcirculatory responsiveness to a 30 percent blood loss. Adaptation was performed for 3 to 30 days prior to hemorrhage, with a systemic assessment of the angioarchitectonics. The data showed that adaptation itself placed a serious strain on the physiological reserves and diminished the ability of the body to cope with the additional stress of blood loss, with the net hemodynamic adjustments showing deterioration in going from 3 day to 15 day high altitude adaptation. By 30 days of adaptation, blood loss was accompanied by less deleterious microcirculatory responsiveness to blood loss as affected by physiological changes induced by an altitude of 3200 m. Author

N88-19974# Joint Publications Research Service, Arlington, Va.
INTERRELATIONSHIP OF HEART RHYTHM INDICATORS AND RESISTANCE TO HYPOXIA IN ANTARCTIC POLAR WORKERS Abstract Only
A. L. MAKSIMOV and T. B. CHERNOOK *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 46 27 Apr. 1987 Transl. into ENGLISH from Izvestiya Akademii Nauk Kirgizskoy SSR (Frunze, USSR), no. 4, Jul. - Aug. 1986 p 63-66
Avail: NTIS HC A05/MF A01

Seventeen Antarctic workers were evaluated for correlation between heart rhythm indicators and hypoxic resistance. The workers were differentiated into a group with high resistance (8 individuals, Group 1) and moderate resistance (9 individuals, Group 2). Evaluation of the parameters and factors of interest demonstrated that, in Group 2, sympathetic activity was characterized by an inadequate reduction in activity during daytime and increase in activity in the evening, night and early morning. These facts indicated that Group 2 individuals were characterized by a less well developed automatism and required more frequent involvement of higher centers. Group 1 individuals demonstrated adequate automatism in conjunction with a higher metabolic rate. As a result, the involvement of the higher centers was at a minimum in Group 1 subjects and the parasympathetic system predominated in the regulatory process. In the final analysis, the physiological regulatory systems were under less stress in Group 1 individuals. A daytime pulse rate of 65 beats per minute or less, and a nighttime rate of at least 50 beats per minute were found to indicate satisfactory automatic homeostatis in both groups. Author

N88-19975# Joint Publications Research Service, Arlington, Va.
EFFECTS OF INTENSE, TIME-CONSTRAINED MENTAL EFFORT ON HEMODYNAMICS AND CARDIOVASCULAR FUNCTION Abstract Only
B. M. FEDOROV, YE. N. STRELTSOVA, T. V. SEBEKINA, and T. M. SINITSYNA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 46-47 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 12, no. 1, Jan. - Feb. 1986 p 65-71 Original language document was announced in IAA as A86-30895
Avail: NTIS HC A05/MF A01

A variety of cardiovascular and hemodynamic parameters were monitored in a group of healthy men subjected to time-constrained intellectual effort in order to assess the effects of such stress on blood supply to the brain. The study involved a group of 25 young and middle aged men required to perform mathematical operations or to demonstrate syntactical skills within a given time frame. The demands on mental acuity in this situation represented a highly stressful situation accompanied by pronounced cardiovascular and hemodynamic sequelae. Rheoencephalographic studies provided unequivocal evidence of diminished blood supply to regions of the brain uninvolved in the mental effort (frontomastoidal areas), and enhanced blood flow to the inferior areas (Brodman's area 40). These observations demonstrate the need to vary intellectual activities in order to ensure adequate blood supply to all the brain formations on a unified basis. Author

N88-19976# Joint Publications Research Service, Arlington, Va.
FACILITORY EFFECTS OF VOLUNTARY MOVEMENTS ON VESTIBULOMOTOR REACTION Abstract Only
B. N. SMETANIN, V. YU. SHLYKOV, and M. P. KUDINOVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 48-49 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 12, no. 1, Jan. - Feb. 1986 p 133-140 Original language document was announced in IAA as A86-30898
Avail: NTIS HC A05/MF A01

The effects of various arbitrary movements on manisfestations of the vestibulomotor reaction were studied in human subjects receiving electrical stimuli to the vestibular apparatus. Certain body maneuvers, such as rapid sideward head movements, forward body bending, or arm swinging, had little or no effect. On the other hand, the destabilizing movements specifically associated with spatial displacements of the body and with postural rearrangements, such as rapid squating, rapidly repeated rising on one's toes, or walking in place, increased the compensatory motor reaction and lowered the threshold of its appearance. The observed effect was not caused by induced instability per se but had to do with the volitional initiation of the destabilizing movements. Author

N88-19977# Joint Publications Research Service, Arlington, Va.
HUMAN ADAPTATION TO VARIOUS HYPERCAPNIC CONDITIONS IN RELATION TO SALIVARY ELECTROLYTE DYNAMICS AND RENAL FUNCTION Abstract Only
N. A. AGADZHANYAN, A. I. YELFIMOV, and Z. B. MININA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 49 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 12, no. 1, Jan. - Feb. 1986 p 157-164
Avail: NTIS HC A05/MF A01

The effects of various hypercapnic regimes on urinary and salivary K and Na levels were studied in 28 healthy men, 25 to 35 years old, to assess human adaptability to extreme environmental conditions in terms of water-electrolyte balance. Increasing the CO sub 2 tension in inhaled air led to elevation of K in saliva. In 2 to 7 percent CO sub 2, the increase in K was directly proportional to the level of P sub O sub 2 in the gas mixture. Salivary Na remained at baseline level at normal P sub O sub 2, but increased in hyperoxia with 1 to 4 percent CO sub 2. An increase in the Na concentration of saliva in combinations of hypoxia and hypercapnia was evident only when 2 percent CO sub 2 was present in the mixture. With an increase of CO sub 2 to 6 percent the Na/K ratio in the urine increases. The urinary Na/K value continued to increase as hypercapnia approached 8 percent CO sub 2 with concomitant hypoxia; however, in combination with normal P sub O sub 2 and hyperoxia, Na/K ratio declined. Water balance remained normal on breathing air with elevated P sub O sub 2, but became negative in normal or hypoxic P sub O sub 2. Water intake was elevated to a statistically significant degree in hypoxic conditions, while exertion was inversely related in a linear manner to the P sub O sub 2. The water-electrolyte homeostatic system was thus seen to be responsive to environmental changes in inhaled respiratory gases. Author

N88-19978# Joint Publications Research Service, Arlington, Va.
PROTECTION FROM STRESS Abstract Only
A. L. RYLOV *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 50 27 Apr. 1987 Transl. into ENGLISH from Khimiya i Zhizn (Moscow,USSR), no. 7, Jul. 1986 p 28-32
Avail: NTIS HC A05/MF A01

A review is presented of the various brain peptides and other factors involved in mediation and protection from emotional stress. Among the chemicals that receive primary attention are the endogenous opiates. These molecules are short peptides that alleviate pain by acting on the same receptors as exogenious morphine. In the latter category, the most important peptide is metenkephalin. Animals with low endogenous levels of metenkephalin are particularly susceptible to the adverse effects of stress, while those with normal or above average levels tolerate stress much better. Although peptides and other chemical factors alleviate stress, the final outcome appears to be predicated on mental or volitional ability to overcome adversity. Author

N88-19979# Joint Publications Research Service, Arlington, Va.
INDIVIDUAL FUNCTIONAL TYPOLOGY OF SYMPATHOADRENAL SYSTEM AS INDICATOR OF PHYSIOLOGICAL STATUS IN ADVERSE ENVIRONMENTS Abstract Only
N. A. NEYZHMAKOVA and L. M. SHAFRAN *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 50-51 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 6, Nov. - Dec. 1985 p 903-910
Avail: NTIS HC A05/MF A01

Determinations of urinary levels of catecholamines, dopamine, and other metabolites, as well as cardiovascular studies and psychological tests, were employed in assessing the functional typology of the sympathoadrenal (SA) system in 137 male sailors, 20 to 40 years of age. Three parameters were identified as having the greatest predictive value: urinary epinephrine levels and epinephrine/dopamine and epinephrine/norepinephrine ratios. Author

N88-19980# Joint Publications Research Service, Arlington, Va.
RISK OF HYPERTENSION AND FUNCTIONAL CEREBRAL LATERALITY IN OIL EXPEDITION WORKS IN FAR NORTH Abstract Only
V. P. LEUTIN and YE. I. NIKOLAYEVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 52 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 6, Nov. - Dec. 1985 p 923-926 Original language document was announced in IAA as A86-22534
Avail: NTIS HC A05/MF A01

Arterial blood pressure and parameters of functional sensorimotor asymmetry were measured in 306 workers employed in oil field work that involved regularly repeated long distance flight travel, with passages through several time zones, to and from the work location. Day shift drivers who lived permanently at the residential base were used as controls. The traveling workers displayed increased percentages of lefthanded and ambidextrous individuals. Moreover, in the traveling worker group, arterial hypertension occurred primarily in righthanded individuals and in those with mixed parameters of functional asymmetry. On the other hand, arterial hypertension in the traveling lefthand and ambidextrous individuals remained at the levels of the respective control groups. Author

N88-19981# Joint Publications Research Service, Arlington, Va.
HEAT ACCLIMATIZATION UNDER CONTROLLED HYPERTHERMIA Abstract Only
YU. A. IVANOV and L. A. KOROLEV *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 52-53 27 Apr. 1987 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 6, Nov. - Dec. 1985 p 952-956 Original language document was announced in IAA as A86-22538
Avail: NTIS HC A05/MF A01

Development of adaptation to a hot climate was studied in 60 nonacclimated subjects trained by periodic exposures to hyperthermia. The subjects' functional status was evaluated according to the levels of work capacity and thermal stress, electrocardiogram analysis, sweat losses, and the analysis of psychoemotional parameters. During the first 4 to 5 days of training, a deterioration of all measured functions was observed. However, after 9 to 10 days, the physical work capacity, cardiac function, and psychoemotional parameters returned to normal. After 13 to 15 days of training, the work capacity increased above control by 30.5 percent. Author

N88-19982# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
26 Feb. 1988 66 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-88-002) Avail: NTIS HC A04/MF A01

Topics related to U.S.S.R. life sciences research are discussed. Topics in biophysics, biochemistry, biotechnology, human factors engineering, immunology, laser effects, radiation medicine, microbiology, pharmacology, toxicology, physiology, public health, psychology, and veterinary medicine are covered.

N88-19983# Joint Publications Research Service, Arlington, Va.
MEASURING FUNCTIONAL FEASIBILITY OF HUMAN VISUAL SYSTEM Abstract Only
YU. YE. SHELEPIN, V. V. VOLKOV, L. N. KOLESNIKOVA, V. B. MAKULOV, and V. N. PAUK *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 35 26 Feb. 1988 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 9, Sep. 1987 p 63-72
Avail: NTIS HC A04/MF A01

In order to test visual recognition, it is necessary to use letter optotypes in which the lower spatial frequencies are absent. Such optotypes, on a gray background, permit more accurate evaluation of visual acuity, but must be used with an independent evaluation of the working range of spatial vision, using various matrices of black and white elements. Results obtained indicate that visuocontrastometry can be used for fundamental physiological investigations, for diagnosis and preventive medicine, for developing functional training methods and for quantitative evaluation of treatment effectiveness. Author

N88-19987*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STUDIES OF THE VESTIBULO-OCULAR REFLEX ON STS 4, 5 AND 6
WILLIAM E. THORNTON, SAM L. POOL, THOMAS P. MOORE, and JOHN J. URI (RCA Government Services, Houston, Tex.) Jan. 1988 44 p
(NASA-TM-100461; S-573; NAS 1.15:100461) Avail: NTIS HC A03/MF A01 CSCL 06P

The vestibulo-ocular reflex (VOR) may be altered by weightlessness. Since this reflex plays a large role in visual stabilization, it was important to document any changes caused by space flight. This is a report on findings on STS-4 through 6 and is part of a larger study of neurosensory adaptation done on STS-4 through 8. Voluntary horizontal head oscillations at 1/3 Hz with amplitude of 30 deg right and left of center were recorded by a potentiometer and compared to eye position recorded by electroculography under the following conditions: eyes open, head fixed, tracking horizontal targets switched 0, 15, and 30 degrees right and left (optokinetic reflex - OKR - and calibration); eyes open and fixed on static external target with oscillation, (vestibulo ocular reflex, eyes closed - VOR EC); eyes open and wearing opaque goggles with target fixed in imagination (vestibulo-ocular reflex, eyes shaded - VOR ES); and eyes open and fixed on a head synchronized target with head oscillation (VOR suppression). No significant changes were found in voluntary head oscillation frequency or amplitude in those with (n=5), and without (n=3), space motion sickness (SMS), with phase of flight or test condition. Variations in head oscillation were too small to have produced detectable changes in test results. Author

N88-19988# Army Research Inst. of Environmental Medicine, Natick, Mass.
AIR QUALITY AND HUMAN PERFORMANCE, CHAPTER 16
KENT B. PANDOLF Sep. 1987 62 p
(AD-A188335; USARIEM-M-67-87) Avail: NTIS HC A04/MF A01 CSCL 06J

The various air pollutants have been classified as primary or secondary pollutants. Primary pollutants are emitted directly to the environment from their source and include carbon monoxide, sulfur oxides, nitrogen oxides and primary particulates. Secondary pollutants develop from interactions of primary pollutants and include ozone, peroxyacetyl nitrate and certain aerosols. Carbon monoxide does not appear to cause decrements in submaximal exercise performance in healthy individuals; however, cardiovascularly-impaired individuals appear to be at significant risk during submaximal exercise even at low carboxyhemoglobin levels. Maximal exercise performance for healthy individuals seems to be altered by breathing carbon monoxide with the critical concentration being 4.3 percent carboxyhemoglobin. The threshold level of sulfur dioxide which effects submaximal exercise performance in healthy individuals is between 1.0 and 3.0 ppm while asthmatic individuals and possibly others with pulmonary hyperactivity are affected at a lower threshold concentration between 0.20 and 0.50 ppm. Several studies suggest that healthy and asthmatic individuals may adapt to sulfur but unfortunately no research has investigated adaptation to this pollutant during physical exercise. While no studies have been reported which evaluate maximal exercise performance, nitrogen dioxide exposure does not appear to adversely affect submaximal exercise performance in healthy individuals. GRA

N88-19989# Army Research Inst. of Environmental Medicine, Natick, Mass.
MEDICAL PROBLEMS RELATED TO ALTITUDE IN: HUMAN PERFORMANCE PHYSIOLOGY AND ENVIRONMENTAL MEDICINE AT TERRESTRIAL EXTREMES, CHAPTER 14
MARK K. MALCONIAN and PAUL B. ROCK Oct. 1987 39 p
(AD-A188340; USARIEM-M-3-88) Avail: NTIS HC A03/MF A01 CSCL 06J

This chapter discusses medical problems associated with the acute hypoxia of altitude including: acute mountain sickness, high altitude cerebral edema, high altitude pulmonary edema, high altitude retinal hemorrhages, generalized peripheral edema and disorders of coagulation. Medical problems associated with chronic hypoxia which are presented and discussed include reentry pulmonary edema and chronic hypoxia which are presented and discussed include reentry pulmonary edema and chronic mountain sickness. Preexisting medical problems aggravated by high altitude involve pulmonary disease, coronary artery disease and congestive heart failure. Cold injuries, dehydration, solar radiation injuries and nutritional problems are known to be associated with exposure to high altitude. GRA

N88-19990# Army Research Inst. of Environmental Medicine, Natick, Mass.
ACUTE MOUNTAIN SICKNESS AT 4500 M IS NOT ALTERED BY REPEATED EIGHT-HOUR EXPOSURES TO 3200-3550 M NORMOBARIC HYPOXIC EQUIVALENT
RICHARD L. BURSE and VINCENT A. FORTE, JR. 10 Sep. 1987 32 p
(AD-A188358) Avail: NTIS HC A03/MF A01 CSCL 06J

A lightweight device, designed to supply inspired air at 12.8 percent concentration (PO2 equivalent to 3900 m altitude) by recirculating a portion of each expired breath after CO2 removal was tested at sea-level for its ability to induce altitude acclimation. Twelve young men (experimental group) breathed from the device for 7.5 to 8 h each day for ten successive days. On the morning of day 1, inspired 02 concentrations averaged 12.8 percent, as intended, but increased by noontime and remained elevated thereafter. This raised the average hypoxic stimulus to 13.8 = 0.9 percent (PO2 equivalent to 3370 + or - 517 m altitude) for the entire ten-day period. Ten other young men (control group) breathed normoxic air from a placebo device of identical appearance on the same schedule. On the tenth day, both groups were exposed for two days to 4500 m altitude in hypobaric chamber to assess the effect of the treatment on acute mountain sickness (AMS). After the sea-level treatment, the experimental group showed no significant differences from control in resting ventilatory rate, respiratory frequency or end-tidal PO2, but end-tidal PCO2 was lower; there was no indication of hemoconcentration. It was clear that administering such a stimulus for 8 h each day, even for ten successive days, was not sufficient to induce any meaningful degree of acclimation to 4500 m or to induce any beneficial ventilatory or hematological responses to that altitude. GRA

N88-19991# Rochester Univ., N. Y. School of Medicine and Dentistry.
DIRECT INTERACTION BETWEEN AUTONOMIC NERVES AND THE IMMUNE SYSTEM Annual Report, 1 Nov. 1986 - 31 Oct. 1987
DAVID L. FELTEN 15 Nov. 1987 25 p
(Contract N00014-84-K-0488; PROJ. RR0-4108)
(AD-A188576) Avail: NTIS HC A03/MF A01 CSCL 06D

This project examines interactions between autonomic nerves and the immune system. Noradrenergic sympathetic nerves are present in spleen and lymph nodes, particularly in T cell and macrophage compartments, shown by light and EM immunocytochemistry during the past year. Some nerve terminals form synaptic-like contacts with T lymphocytes in splenic white pulp. Neurochemical studies have shown release and availability of micromolar concentrations of norepinephrine, and an absence of acetylcholine or choline acetyltransferase in spleen, suggesting only noradrenergic and not cholinergic innervation. Following denervation of noradrenergic nerves to spleen and lymph nodes, many immune parameters are altered, including 1 deg and 2 deg antibody responses, mitogen responses, delayed-type hyper-sensitivity responses, B lymphocyte proliferation, cytotoxic T cell activity, and NK cell activity. Cold exposure also can lead to altered immune responses. These studies indicate that the noradrenergic nerves innervating spleen and lymph nodes are necessary for immunocompetence and that norepinephrine exerts an immunomodulatory influence. GRA

N88-19992# Tennessee Univ., Memphis.
NEUROHUMORAL ASPECTS OF SLEEP Annual Report, 15 May 1986 - 14 May 1987
JAMES M. KRUEGER 30 Oct. 1987 7 p
(Contract N00014-85-K-0773; PROJ. RRO-4108)
(AD-A188653) Avail: NTIS HC A02/MF A01 CSCL 06D

Our current research focused on three general areas: (1) MPs - are they present in mammalian tissue, how do they get there, and what are their target sites; (2) how is sleep linked to the immune response; and (3) do other immune response modifiers alter sleep? GRA

N88-19993# Army Research Inst. of Environmental Medicine, Natick, Mass.
ENDOCRINE RESPONSES TO RESISTANCE EXERCISE
WILLIAM J. KRAEMER 30 Aug. 1987 24 p
(AD-A188681; USARIEM-M59-87) Avail: NTIS HC A03/MF A01 CSCL 06A

The purpose of this brief review is to examine resistance training responses of selected hormones related to acute stress and growth promoting actions. Hormonal mechanisms appear to be involved with both short-term homeostatic control and long-term cellular adaptations. Few studies have modeled the exercise stimulus in resistance training to determine the role of different exercise variables to the hormonal response. A variety of resistance exercise protocols result in increases in peripheral hormonal concentrations. It appears that single factor variables such as the intensity (percent of RM) of exercise and amount of muscle mass utilized in the exercise protocol are important determinants of hormonal responses. The volume of exercise, also appears to be an important determinant of hormonal response. Still, little is known with regard to other single and multiple factor variables (e.g., rest period length) and their relationships to peripheral hormonal alterations. Collectively, such information will allow greater understanding concerning the nature of the exercise stimulus and its relationship to training adaptations resulting from heavy resistance exercise. GRA

N88-19994# Navy Personnel Research and Development Center, San Diego, Calif.
BRAIN ACTIVITY DURING TACTICAL DECISION-MAKING. PART 2: PROBE-EVOKED POTENTIALS AND WORKLOAD Technical Note, May 1985 - Sep. 1986
LEONARD J. TREJO, GREGORY W. LEWIS, and MARK H. BLANKENSHIP Dec. 1987 30 p
(AD-A188688; NPRDC-TN-88-12-PT-2) Avail: NTIS HC A03/MF A01 CSCL 05H

The demands of many military occupations have the potential for exceeding the capacity of the human to process information, especially during times of great stress, such as those faced by combat system operators. The capacity of the human to perceive, integrate, remember, and use information may be challenged when the individual is flying aircraft, monitoring radar and sonar displays, or operating electronic warfare systems. Exceeding the capacity of the human operator in such situations may impair decision-making and could result in costly tactical errors. This report, concerned with use of neuroelectric signals to predict the decision-making performance of combat system operators, provides detailed analyses of the neuroelectric changes that occur as workload increases in combat system simulation. GRA

N88-19995# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MOTION SICKNESS: A STUDY OF ITS EFFECTS ON HUMAN PHYSIOLOGY M.S. Thesis
PIERRE J. GAUDREAULT Dec. 1987 104 p
(AD-A188821; AFIT/GE/ENG/87D-20) Avail: NTIS HC A06/MF A01 CSCL 06J

The purpose of this thesis project was to study motion sickness by including it on volunteer subjects and monitoring several of their physiological parameters. During the thesis period, the existing procedures and methods for collecting and analyzing data were revised, and data were collected on sixteen human subjects. Data and analysis of cardiograms, encephalograms, pneumograms, splanchnograms, and plethysmograms are presented in this thesis. Heart rates increased during motion sickness for all subjects, but rates slightly decreased just prior to emesis and increased again after emesis for about half of the subjects. Some encephalograms showed high amplitude low frequency activity as in previous experiments done at AFIT, but they also showed slowed alpha activity. The pneumograms showed that intake volumes at least doubled on all subjects during motion sickness signifying the occurrence of hyperventilation. Splanchnograms showed an increase in amplitudes and frequencies of electrical activity and a decrease of mechanical activity. And plethysmograms showed blood volume in the skin decreased during motion sickness. GRA

N88-19996# Naval Aerospace Medical Research Lab., Pensacola, Fla.
SELECTED ASPECTS OF TRIAZOLAM IN RELATION TO AVIATOR PERFORMANCE IN NAVAL FLIGHT OPERATIONS
M. THORNTON and W. A. MOREY Nov. 1987 10 p
(AD-A189322; NAMRL-TM-87-1) Avail: NTIS HC A02/MF A01 CSCL 06O

Benzodiazepines often are used for the management of insomnia and anxiety. Operationally, they are likely to be used to phase-shift circadian rhythm. This class of drugs enhances the tendency of gamma aminobutyrate (GABA) to decrease neuronal firing in brain centers associated with sleep. Triazolam, like other benzodiazepines, causes impairment of various central nervous system (CNS) functions, but due to its short half-life, most (but not all) CNS impairments are absent by morning. None-the-less, this review recommends exploring the possible greater value of the newer generation of short-acting benzodiazepines and discourages further consideration of triazolam for operational consideration, because of possible adverse effects on memory and the possible narrow margin of safety. GRA

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BEHAVIORAL SCIENCES

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

A88-29399
THE EFFECTS OF TARGET WAVELENGTH ON DYNAMIC VISUAL ACUITY UNDER PHOTOPIC AND SCOTOPIC VIEWING
GERALD M. LONG and PHILIP M. GARVEY (Villanova University, PA) Human Factors (ISSN 0018-7208), vol. 30, Feb. 1988, p. 3-13. refs
(Contract NIH-1-R03-EY-05846-01)

The effects of target wavelength on the resolution of moving targets were investigated over a range of target velocities under both photopic and scotopic viewing conditions. The wavelength of the photopically matched targets had no effect on dynamic acuity under the bright background condition. However, with low background luminance the wavelength of the targets had pronounced effects, with blue targets producing far superior resolution and red targets, the poorest resolution. These results were maintained over both 250- and 400-ms target durations and regardless of whether initial target position was foveal or peripheral. The likely contribution of the rod system to dynamic visual acuity under some conditions is proposed, and possible implications for applied settings are discussed. Author

A88-29400
DISPLAY PROXIMITY IN MULTICUE INFORMATION INTEGRATION - THE BENEFITS OF BOXES
BARBARA J. BARNETT and CHRISTOPHER D. WICKENS (Illinois, University, Urbana) Human Factors (ISSN 0018-7208), vol. 30, Feb. 1988, p. 15-24. Research supported by the University of Dayton. refs
(Contract F30602-81-C-0206; MDA903-83-K-0255)

This study investigates the ability of an individual to integrate probabilistic information from a number of sources, and focuses particularly on the extent to which this integration is influenced by display proximity in space, time, and object configuration. In support of the principle of compatibility of proximity, the data indicated that integration performance was clearly ordered according to the degree of display integrality: those in the more integral rectangle conditions were significantly better at integration than those in the bar graph condition. Proximity of space had little effect upon performance, whereas proximity in time significantly improved performance in all three format conditions. Speed stress significantly hindered performance in all three format conditions. Finally, memory for isolated unintegrated attributes of a cue was not harmed by the increasing integrality of the rectangle formats. Author

A88-29401* Honeywell, Inc., Phoenix, Ariz.
DISSOCIATION OF PERFORMANCE AND SUBJECTIVE MEASURES OF WORKLOAD
YEI-YU YEH (Honeywell Systems and Research Center, Phoenix, AZ) and CHRISTOPHER D. WICKENS (Illinois, University, Urbana) Human Factors (ISSN 0018-7208), vol. 30, Feb. 1988, p. 111-120. refs
(Contract NAG2-308)

A theory is presented to identify sources that produce dissociations between performance and subjective measures of workload. The theory states that performance is determined by (1) amount of resources invested, (2) resource efficiency, and (3) degree of competition for common resources in a multidimensional space described in the multiple-resources model. Subjective perception of workload, multidimensional in nature, increases with greater amounts of resource investment and with greater demands on working memory. Performance and subjective workload measures dissociate when greater resources are invested to improve performance of a resource-limited task; when demands on working memory are increased by time-sharing between concurrent tasks or between display elements; and when performance is sensitive to resource competition and subjective measures are more sensitive to total investment. These dissociation findings and their implications are discussed and directions for future research are suggested. Author

A88-29565* . National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
QUANTIFICATION OF REACTION TIME AND TIME PERCEPTION DURING SPACE SHUTTLE OPERATIONS
D. A. RATINO, D. W. REPPERGER, C. GOODYEAR, G. POTOR, and L. E. RODRIGUEZ (NASA, Johnson Space Center, Houston, TX; USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB; Systems Research Laboratories, Inc., Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 220-224. refs

A microprocessor-based test battery containing simple reaction time, choice reaction time, and time perception tasks was flown aboard a 1985 Space Shuttle flight. Data were obtained from four crew members. Individual subject means indicate a correlation between change in reaction time during the flight and the presence of space motion sickness symptoms. The time perception task results indicate that the shortest duration task time (2 s) is progressively overestimated as the mission proceeds and is statistically significant when comparing preflight and postflight baselines. The tasks that required longer periods of time to estimate (8, 12, and 16 s) are less affected. Author

A88-29569
THE EFFECT OF ALTITUDE ON TESTS OF REACTION TIME AND ALERTNESS
J. H. MACKINTOSH, D. J. THOMAS, J. E. OLIVE, I. M. CHESNER, and R. J. E. KNIGHT (Birmingham Medical Research Expeditionary Society, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 246-248. Research supported by the Arthur Thompson Trust Fund, West Midlands Regional Health Authority, Geigy Pharmaceuticals, et al. refs

Psychomotor performance was assessed in 20 subjects on each of 2 mountaineering expeditions. During the first, which reached 5008 m, simple reaction time and alertness were measured, on the second to 4790 m these were replaced by a three-choice reaction time test. In both, mean reaction times increased significantly at altitude in subjects with marked symptoms of Acute Mountain Sickness (AMS), whereas the alertness tests showed no effects. Reaction times were not affected by other environmental factors but adverse conditions increased the number of errors. The increase in reaction time may be ascribed either to the lethargy associated with AMS or alternatively may have been a direct effect of hypoxia. The latter explanation is favored because of reports by other workers of an increase in reaction time with altitude in the absence of AMS. Author

A88-29573
SIMULATOR INDUCED SYNDROME IN COAST GUARD AVIATORS
TIMOTHY J. UNGS (Wright State University, Dayton, OH; USCG, Kodiak, AK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 267-272. refs

The incidence of adverse symptoms in Coast Guard aviators undergoing flight simulator training was determined. A voluntary, multipart questionnaire was completed by 238 pilots. During the first simulator flight 64.3 percent of pilots reported at lest one adverse sympton, 39.4 percent during the last flight. Simulator induced syndrome (SIS) was present in 47.1 percent of subjects during the first simulator flight, 23.5 percent during their last flight. Most subjects reported their symptoms as mild, with some symptoms rated as moderate or severe in nature. There was no statistically significant association between the development of SIS and flight experience, simulator experience, length of simulator session, or self-determined motion sickness susceptibility. There was a significant association between SIS development and the use of simulators with computer-generated imagery (CGI). Nine

pilots experienced adverse symptoms at least 2 days after their last simulator flight. In conclusion, this study revealed that SIS occurs frequently, is more common when CGI is present, may recur, suggests an adaptative process, and may not be associated with some factors previously claimed. Author

A88-29743
QUANTUM EFFICIENCY FOR DARK-ADAPTED HUMAN VISION
P. E. HALLETT (Toronto, University, Canada) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, Dec. 1987, p. 2330-2335. Research supported by the Medical Research Council of Canada. refs

In the classic frequency-of-seeing experiment, which measures the ability of a completely dark-adapted human observer to detect a small, brief-duration flash of light presented in peripheral vision, the overall efficiency F is 0.06 in conventional long experiments and 0.09 in pooled short experiments. A theory is presented that reconciles these results by postulating higher-level effects in the long experiments, which increase variability without substantially changing the mean threshold. It is found that the quantum efficiency of dark-adapted vision is somewhat larger than is usually supposed. C.D.

A88-29744
HUMAN CONTRAST DISCRIMINATION AND THE THRESHOLD OF CORTICAL NEURONS
H. B. BARLOW, T. P. KAUSHAL (Cambridge University, England), M. HAWKEN, and A. J. PARKER (Oxford University, England) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, Dec. 1987, p. 2366-2371. Sponsorship: Medical Research Council of England. refs
(Contract UKMRC-7907/242; UKMRC-7900/491; AF-AFOSR-85-0296)

The human contrast-discrimination function has a curious shape: in addition to rising for increasing contrasts, both positive and negative, it also rises for very low contrasts on either side of zero. It is shown that this rise near zero contrast is not much affected by procedures that increase or decrease the subject's knowledge of the stimulus; this counts against uncertainty as the immediate cause of the elevation near zero contrast. The alternative explanation in terms of a genuine response threshold is shown to be promising when measurements of human contrast discrimination are compared with values calculated from records of neurons in monkey primary visual cortex. The comparison also suggests that the dynamic range of single neurons is lower than that shown psychophysically. It is suggested that having a cortical threshold may be the visual system's way of preventing false positives when there is much stimulus uncertainty. This threshold may also help to explain why quantum efficiencies calculated from detection thresholds are so poor compared with those estimated from the visual system's susceptibility to added noise. Author

A88-29745* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PUTTING THE VISUAL SYSTEM NOISE BACK IN THE PICTURE
ALBERT J. AHUMADA, JR. (NASA, Ames Research Center, Moffett Field, CA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, Dec. 1987, p. 2372-2378. refs

Computable expressions for the input-picture-equivalent contrast noise of the visual system are provided for the locally linear subclass of nonlinear models, where the internal model noise is allowed to be signal dependent. The equivalent-noise concept is thereby extended to many of the models developed to explain masking and discrimination among suprathreshold stimuli. For these models the equivalent noise depends on the masking stimulus, and its structure can be strongly determined by the representation of the masker at the level of the system at which the performance-limiting noise is generated. The expressions are applicable to the case of less-than-full-rank transformations. Pictures that have hypothetical visual-system noise projected back into them can provide insights into efficient picture-coding algorithms. Author

A88-29746* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFICIENCY OF A MODEL HUMAN IMAGE CODE
ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, Dec. 1987, p. 2401-2417. refs

Hypothetical schemes for neural representation of visual information can be expressed as explicit image codes. Here, a code modeled on the simple cells of the primate striate cortex is explored. The Cortex transform maps a digital image into a set of subimages (layers) that are bandpass in spatial frequency and orientation. The layers are sampled so as to minimize the number of samples and still avoid aliasing. Samples are quantized in a manner that exploits the bandpass contrast-masking properties of human vision. The entropy of the samples is computed to provide a lower bound on the code size. Finally, the image is reconstructed from the code. Psychophysical methods are derived for comparing the original and reconstructed images to evaluate the sufficiency of the code. When each resolution is coded at the threshold for detection artifacts, the image-code size is about 1 bit/pixel. Author

A88-29747* California Univ., Irvine.
PHOTON NOISE AND CONSTANT-VOLUME OPERATORS
JOHN I. YELLOTT, JR. (California, University, Irvine) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 4, Dec. 1987, p. 2418-2446. refs
(Contract NCA2-5)

In a previous paper, a class of constant volume (CV) operators designed to maximize spatial resolution in the presence of photon noise was introduced. In this paper, the statistical properties are derived of the output images created by CV operators applied to photon-noisy versions of input images consisting of edges, spots, and gratings. The results are used to calculate the input image parameters that would permit any test image to be discriminated from a uniform field with a given level of reliability and consequently to compare the predictions of a CV operator model with psychophysical data. These results also allow the potential usefulness of CV operators in artificial image processing applications to be assessed. C.D.

A88-30853
MODELING OF TASK-DEPENDENT CHARACTERISTICS OF HUMAN OPERATOR DYNAMICS PURSUIT MANUAL TRACKING
AIMAN ABDEL-MALEK and VASILIS Z. MARMARELIS (Southern California, University, Los Angeles) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 18, Jan.-Feb. 1988, p. 163-172. refs
(Contract NIH-RR-01861)

To model human operator (HO) dynamics in manual tracking tasks, an ensemble of models, each for a certain class of inputs, seems to be needed. By placing in a linear framework the modeling studies so far conducted, it is evident that different hypotheses have been proposed to explain the observed input dependence of the estimated HO (linear) models. Here, the authors examine these hypotheses and propose that the systemic notion of task dependence must be used to model this system. They have explored ways of deriving quantitative measures of the system task-dependent characteristics, using autoregressive moving-average (ARMA) models of input-output data obtained from a series of pursuit manual tracking experiments. These experiments utilized sum-of-sinusoids and random ternary inputs of various bandwidths. The resulting model parameters indicate significant task dependence of the HO dynamic characteristics. The effect of amplitude nonlinearities was examined and found to be statistically insignificant. I.E.

A88-32049
ASSESSMENT OF WORK CAPACITY IN OPERATORS BY USING STATISTICAL CHARACTERISTICS OF A SIMPLE VISUAL-MOTOR REACTION [OTSENKA RABOTOSPOSOBNOSTI OPERATOROV S POMOSHCH'IU STATISTICHESKIKH KHARAKTERISTIK PROSTOI ZRITEL'NO-MOTORNOI REAKTSII]
A. V. ZAKHAROV, M. P. MOROZ, and V. V. PERELYGIN Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Jan. 1988, p. 53-55. In Russian.

The relation between the distribution of the visual-motor reaction rate and the physiological parameters of the functional status of a subject after several hours of work under extremal conditions (such as time shortage, emotional pressure, unfavorable environment, or emergency situations) was investigated using procedures of chronoreflexometry. The functional status was calculated from the criteria of the functional level of the central nervous system, the test-reaction stability, and the level of functional resources. It was shown that, for every decrease in these criteria, there was a change in the statistical characteristics of visual-motor reaction. I.S.

A88-32134
INDIVIDUAL AND TYPOLOGICAL CHARACTERISTICS OF AUDITORY RESPONSE TO AN ACOUSTIC STIMULUS AS DETERMINED FROM MEAN EVOKED POTENTIALS IN THE CORTEX OF HEALTHY SUBJECTS [INDIVIDUAL'NO-TIPOLOGICHESKIE OSOBENNOSTI OTRAZHENIIA INTENSIVNOSTI AKUSTICHESKOGO STIMULA V USREDNENNYKH VYZVANNYKH POTENTSIALAKH MOZGA ZDOROVYKH ISPYTUEMYKH]
V. G. KAMENSKAIA, L. V. TOMANOV, and I. A. RAKHUBA (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 65-75. In Russian. refs

The relation between the type of personality (extrovert vs introvert) and the character of the cortical response to acoustic stimuli of different intensity was investigated in 16 healthy individuals. The subjects were evaluated with respect to their personality, using Eysenck's questionnaire, and with respect to attentiveness (characterized by the ability to concentrate and the stability of concentration), using methods described by Urbakh (1964). The auditory tests consisted in testing signal counting correctness; measuring the time of reaction to a command signal; and recording cortical potentials evoked by 20-db, 10-db, and threshold-intensity sounds. It was found that the values of the late components of mean evoked potentials, N2 and P3, change in response to acoustic stimuli in a manner which is different for extroverts from that of introverts and which corresponds to the dynamics of mental concentration in individual subjects. I.S.

A88-32137
ALTERED STATES OF CONSCIOUSNESS IN HEALTHY HUMANS (THE DEFINITION OF THE ISSUES AND THE PROSPECTS OF STUDIES) [IZMENENNYE SOSTOIANIIA SOZNANIIA U ZDOROVYKH LIUDEI /POSTANOVKA VOPROSA, PERSPEKTIVY ISSLEDOVANII/]
L. I. SPIVAK (AMN SSSR, Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 138-147. In Russian. refs

This paper discusses different states of human consciousness and the manifestations of brain activity that characterize these states and their intertransitions. Special attention is given to the phenomenology, the linguistic correlators, and the EEG correlators which are characteristic for these different states of consciousness, that include the eustress and the distress stages of wakefulness, deep and shallow sleep, and the transitions between the two, i.e., the stages of falling asleep and of awakening. Mental-activity correlators for such special states of consciousness as creative activity and hypnosis are also discussed. I.S.

A88-32138
PHYSIOLOGICAL ASPECTS OF REGULATING INTRASHIFT BREAKS AS MEANS OF OPTIMIZING THE INTENSITY OF WORK [FIZIOLOGICHESKIE ASPEKTY REGLAMENTATSII VNUTRUSMENNYKH PERERYVOV KAK SREDSTVA OPTIMIZATSII INTENSIVNOSTI TRUDA]
B. N. PETUKHOV and O. A. LIKHACHEVA (Nauchno-Issledovatel'skii Institut Truda, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 148-150. In Russian. refs

The role of intrashift breaks as the prophylactic means of lessening the fatigue and of maintaining the intensity of working was investigated. Fatigue determinants were registered in three groups of subjects (15-20 workers each) in the course of the daily and weekly dynamics of their routine 12-h-long shift (with 1 h lunch break): computer operators, telephone-information operators working through a computer display, and post-office letter sorters. Subjective and objective fatigue indexes were determined as described by Petukhov et al. (1982, 1984). Optimal work intensity was found to correlate with regulated work regiments which included at least three short breaks (20-min total) spread over definite time periods. The absence of such regulated rest periods was found to lead to maximal fatigue and a drastic fall in work capacity. Other methods of increasing work productivity for different types of activity are discussed. I.S.

A88-32139
THE ACTIVATION DYNAMICS OF CARDIOVASCULAR CENTERS DURING VARIATIONS IN GEOMAGNETIC FIELD DISTURBANCE [DINAMIKA VOZBUDIMOSTI SERDECHNO-SOSUDISTYKH TSENTROV PRI IZMENENIIAKH VOZMUSHCHENNOSTI GEOMAGITNOGO POLIA]
V. A. KUZ'MENKO (AMN SSSR, Nauchno-Issledovatel'skii Institut Normal'noi Fiziologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, Jan.-Feb. 1988, p. 160-162. In Russian. refs

The reactivity of the cardiovascular system in humans during variable disturbance levels of the geomagnetic field (GMF) was monitored in 28 healthy subjects by measuring cardiovascular-system indices at 8 A.M, 12 noon, 16 P.M, 20 P.M., and 23 P.M. The regulatory activity of the cardiovascular system was determined by measuring systolic arterial pressure (AP) before and after a simple load exercise. The degree of variation in GMF disturbance was estimated from the 3-h K-index, as described by Kuz'menko (1983). It was shown that a change in the GMF perturbation leads to gradually increasing changes in the reactivity of the AP-regulating mechanisms, which depend on the GMF state in the preceding 3-h period. Several-hour-long periods of lowered or elevated degrees of GMF disturbances result in phase-related increases in the cardiovascular regulatory activity, which are similar in type but different in degree. I.S.

N88-19086*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMARY OF PAYLOAD INTEGRATION PLAN (PIP) FOR STARLAB-1 FLIGHT EXPERIMENT, ENCLOSURE 3
PATRICIA S. COWINGS, W. TOSCANO, J. KAMIYA, N. MILLER, and J. SHARP 1988 8 p
(Contract NCC2-115)
(NASA-TM-89713; NAS 1.15:89713) Avail: NTIS HC A02/MF A01 CSCL 05I

The objectives of the Autogenic Feedback Training (AFT) are to: determine if preflight AFT is an effective treatment for space adaptation syndrome (SAS); determine if preflight improvements in motion sickness tolerance can be used to predict crewmembers' success in controlling symptoms in flight; and identify differences and similarities between the physiological data from preflight motion sickness tests and data collected during symptom episodes in space. The goal is to test the AFT on 8 trained and 8 control subjects. At present 2 trained and 2 contol subjects were tested. The testing will continue until the experimental goal of testing 16 individual is reached. B.G.

N88-19087# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
RESEARCH IN KNOWLEDGE REPRESENTATION FOR NATURAL LANGUAGE COMMUNICATION AND PLANNING ASSISTANCE Annual Report, 18 Mar. 1986 - 31 Mar. 1987
BRADLEY A. GOODMAN, A. HAAS, E. HINRICHS, H. KAUTZ, and L. POLANYI Oct. 1987 116 p
(Contract N00014-85-C-0079; ARPA ORDER 3414)
(AD-A187355; BBN-6636) Avail: NTIS HC A06/MF A01 CSCL 05G

BBN's DARPA project in Knowledge Representation for Natural Language Communication and Planning assistance has two primary objectives: (1) To perform research on aspects of the interaction between users who are making complex decisions and systems that are assisting them with their task. In particular, this research is focused on communication and the reasoning required for performing its underlying tasks of discourse processing, planning and plan recognition and communication repair; and (2) Based on the research objectives, to build tools for communication, plan recognition, and planning assistance and for the representation of knowledge and reasoning that underlie all of these processes. This report summarizes BBN's second year's activity in research in knowledge representation and natural language. In particular, the report discusses work in the areas of knowledge representation, planning, and discourse modeling. GRA

N88-19088# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
TWO ATTENTIONAL MODELS OF CLASSICAL CONDITIONING: VARIATIONS IN CS EFFECTIVENESS REVISITED Technical Report
NESTOR A. SCHMAJUK and JOHN W. MOORE 3 Apr. 1987 35 p
(Contract AF AFOSR-0182-86)
(AD-A187697; COINS-TR-87-29; AFOSR-87-1681TR) Avail: NTIS HC A03/MF A01 CSCL 05H

Attentional models offer alternatives for describing blocking, overshadowing, and many other features of classical conditioning. Two such models emphasize variations in the associability of CSs instead of variation in the effectiveness of the reinforcing event, the US. Early published variants do not always accurately portray the effects of nonreinforced CS presentations as represented in simulation experiments. In one case levels of conditioned responding under partial reinforcement are too low to reasonably approximate expectations based on the experimental literature, and extinction is too deep to produce the rapid reacquisition that typically follows extinction. These problems are corrected by changing the expressions in the model for decreasing associative strength. The revised model retains the positive features of the original, e.g., the ability to stimulate in real-time latent inhibition and compound CS effects such as blocking and conditioned inhibition. The other model is path dependent and highly nonlinear under partial reinforcement. The problem can be corrected either by modifying and restricting the rules for computing the associability of the CS, or by modifying the rules for computing associative strength. The revised model retains the original's ability to simulate latent inhibition, compound CS effects, and the transfer (positive or negative) from training with a weak US to training with stronger US. GRA

N88-19089# Dayton Univ., Ohio. Research Inst.
VISUAL CONTRAST SENSITIVITY FUNCTIONS OBTAINED FROM UNTRAINED OBSERVERS USING TRACKING AND STAIRCASE PROCEDURES Final Technical Report, Oct. 1985 - Apr. 1987
GEORGE A. GERI and DAVID C. HUBBARD Nov. 1987 26 p
(Contract F33615-84-C-0066)
(AD-A187715; AFHRL-TR-87-26) Avail: NTIS HC A03/MF A01 CSCL 06D

Two adaptive psychophysical procedures (tracking and yes-no staircase) for obtaining human contrast sensitivity functions (CSFs) were evaluated. The procedures were chosen based on their proven validity and our desire to evaluate the practical effects of stimulus transients, since tracking procedures traditionally employ gradual stimulus onsets whereas staircase procedures traditionally employ rapid stimulus onsets. The criteria for deciding which procedure was preferable for the rapid testing of large groups of untrained observers were consistent in the form of the measured CSFs across days, the subjective ease of the as judged by the observer, and the time required to obtain consistent results. Both procedures gave repeatable results across days; thus, the first CSF obtained from each subject could be taken as representative of the true CSF as determined by additional testing. However, the tracking procedure was judged easier to use by the present observers and required less time to perform. No interaction was found between any of these variables and the different stimulus onset parameters of the two procedures. GRA

N88-19090# Illinois Univ., Urbana. Model Based Measurement Lab.
MODELING INCORRECT RESPONSES TO MULTIPLE-CHOICE ITEMS WITH MULTILINEAR FORMULA SCORE THEORY
FRITZ DRASGOW, MICHAEL V. LEVINE, BRUCE WILLIAMS, MARY E. MCLAUGHLIN, and GREGORY CANDELL Aug. 1987 117 p
(Contract N00014-83-K-0397; N00014-86-K-0482; PROJ. RR0-4204)
(AD-A187887; MEASUREMENT SER-87-1) Avail: NTIS HC A06/MF A01 CSCL 05H

Multilinear Formula Score theory provides powerful methods for solving psychological measurement problems of long standing. In this paper the question of information in incorrect option selection on multiple choice items is addressed. Multilinear formula scoring (MFS) is first used to estimate option characteristic curves for the Armed Services Vocational Aptitude Battery Arithmetic Reasoning test. Accurately estimated curves are obtained for real and simulated data. Then the statistical information about ability is computed for dichotomous and polychotomous scorings of the items. Moderate gains in information are obtained for low to slightly above average abilities. The dichotomous and polychotomous models are then compared for their relative performances in appropriateness measurement. The rates of detection of some types of aberrance responding were more than 100 percent higher for optimal polychotomous model index. Consequently the MFS polychotomous model provides opportunities for better testing by allowing more accurate ability estimates, improvements in the theory and practice of item writing, and more powerful appropriateness measurement. GRA

N88-19091# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
FIRST ENCOUNTERS OF THE CLOSE KIND: THE FORMATION PROCESS OF AIRLINE FLIGHT CREWS Ph.D. Thesis
ROBERT C. GINNETT 1987 275 p
(AD-A187977; AFIT/CI/NR-87-138D) Avail: NTIS HC A12/MF A01 CSCL 05H

Members of airline cockpit crews often have never worked together or even met prior to their scheduled flight. Crewmembers report that they can determine how effective a given captain will be as a crew leader in the first few minutes of the crew's life. This research examined six captains who were effective crew leaders and four who were less than effective. Data were collected both during the time of crew information and during line operations. The effective captains created multiple conditions for team effectiveness from the moment their crews first met. In initial briefings, for example, they affirmed the boundary of the group, discussed aspects of the work that required coordination (both within the crew, and with others), and fostered norms that encouraged teamwork. They also lessened crewmembers' traditional dependence on the captain by actively engaging members in their briefings. Although each used different tactics, the team effectiveness strategies used in the briefings remained consistent throughout the life of their crews. The less effective captains did not exhibit consistent team leadership strategies. Instead, each exercised control in ways that interfered with team effectiveness. GRA

N88-19092# Colorado Univ., Boulder. Center for Research on Judgment and Policy.
EFFECTS OF STRESS ON JUDGEMENT AND DECISION MAKING IN DYNAMIC TASKS Interim Report, Sep. 1986 - Aug. 1987
KENNETH R. HAMMOND Oct. 1987 8 p
(Contract MDA903-86-C-0142; DA PROJ. 2Q1-61102-B-74-F)
(AD-A188203; ARI-RN-87-43) Avail: NTIS HC A02/MF A01
CSCL 05H

Expert weather forecasters were observed as they attempted to forecast hail, microbursts, and severe storms. Studies of judgement policies were also conducted with representations of storms. Modest agreement among forecasters was found in all three cases, but hail forecasts were found to be of low accuracy. Judgement models, an AI expert system, and seven forecasters showed about the same degree of accuracy. Current psychological theory concerning judgement and decision making was found to be sufficient for these circumstances. GRA

N88-19093# Purdue Univ., West Lafayette, Ind. EEG Signal Processing Lab.
ELECTROMAGNETIC METRICS OF MENTAL WORKLOAD Final Report, 15 Aug. 1985 - 14 Aug. 1986
J. I. AUNON, B. H. KANTOWITZ, C. D. MCGILLEM, and M. P. PLONSKI Sep. 1987 223 p
(Contract AF-AFOSR-0313-85)
(AD-A188205; AFOSR-87-1663TR) Avail: NTIS HC A10/MF A01
CSCL 05H

Mental workload has been very difficult to describe quantitatively. An excessive workload can lead to an decrease in accuracy and performance, while a sustained high level of workload can lead to mental exhaustion. Previous research has indicated that heart rate variability and evoked potentials in the EEG (electroencephalogram) may be linked to mental workload. Unfortunately most of the work to date has examined these two biocybernetic variables independently rather than jointly. Recent advances now allow one to measure the magnetic fields produced by the brain (MEG) using a SQUID magnetometer (Superconducting Quantum Interference Devices). Much of the MEG research to date has concentrated on lower order brain processes rather than the higher cognitive processes associated with workload. The current research examines all these biocybernetic variables jointly in an effort to quantify mental workload. A paradigm was developed to vary several aspects of mental workload and verify the hybrid capacity model of human information processing that was developed at Purdue. This research included constructing a data acquisition system to implement this paradigm and simultaneously record heart rate, respiration, EEG and MEG data. It is believed that this is the first time that such a varied data set was recorded simultaneously. GRA

N88-19094*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE VEHICLE APPROACH VELOCITY JUDGMENTS UNDER SIMULATED VISUAL SPACE CONDITIONS
RICHARD F. HAINES Aug. 1987 13 p
(NASA-TM-89437; A-87136; NAS 1.15:89437) Avail: NTIS HC A03/MF A01 CSCL 05I

Thirty-five volunteers responded when they first perceived an increase in apparent size of a collimated, 2-D image of an Orbiter vehicle. The test variables of interest included the presence of a fixed angular reticle within the field of view (FOV); three initial Orbiter distances; three constant Orbiter approach velocities corresponding to 1.6, 0.8, and 0.4 percent of the initial distance per second; and two background starfield velocities. It was found that: (1) at each initial range, increasing approach velocity led to a larger distance between the eye and Orbiter image at threshold; (2) including the fixed reticle in the FOV produced a smaller distance between the eye and Orbiter image at threshold; and (3) increasing background star velocity during this judgment led to a smaller distance between the eye and Orbiter image at threshold. The last two findings suggest that other detail within the FOV may compete for available attention which otherwise would be available for judging image expansion; thus, the target has to approach the observer nearer than otherwise if these details were present. These findings are discussed in relation to previous research and possible underlying mechanisms. Author

N88-19984# Joint Publications Research Service, Arlington, Va.
HYPNOSIS: POSSIBLE APPLICATIONS FOR COSMONAUTS Abstract Only
M. DMITRUK *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 50 26 Feb. 1988 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 16 Aug. 1987 p 4
Avail: NTIS HC A04/MF A01

Hypnosis can change a subject's perception of time passage and consequent productivity. Physical and matabolic acceleration and deceleration accompanied perceptual changes observed in experiments conducted by Dr. Leonid Grimak, M.D., while fatigue levels were reduced or increased. Experiments performed by psychotherapist V. Raykov indicate that hypnotic suggestion can also improve intellectual performance and creativity. While subjects with accererated time perception exhibited behavior similar to psychosis, those with decelerated time perception resembled depressives. Decelerated time perception via hypnosis may be useful for cosmonauts in interplanetary flight and for training future cosmonauts. Since weightlessness may last a month, it may be possible to suggest the perception of gravity during weightless interplanetary flight. Hypnosis also has applications in training. Hypnosis can sharply increase work efficiency, liberate personality, develop talent and elicit inspiration. Author

N88-19985# Joint Publications Research Service, Arlington, Va.
TRAINING IN TIME INTERVAL DISCRIMINATION USING VERBAL FEEDBACK Abstract Only
O. I. IVASHCHENKO and T. N. RESHCHIKOVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 51-52 26 Feb. 1988 Transl. into ENGLISH from Zhurnal Vysshey Nervnoy Deyatelnosti imeni I. P. Pavlova (Moscow, USSR), v. 37, no. 3, May - Jun. 1987 p 408-413
Avail: NTIS HC A04/MF A01

Hemispheric differences in reaction time, microinterval evaluation and influence of positive and negative reinforcement were studied in 5 males and 10 females, all 22 to 29 years old, right-handed, with normal or corrected vision. The subjects were told to compare the interval between two appearances of illuminated bands on a screen to a standard interval. Test intervals were 10, 60 and 180 msec; the standard interval was 60 msec. Trifactorial dispersion analysis of correct responses indicated that a 10 msec interval was correctly evaluated in 55 to 60 percent of the initial trials, while a 180 msec interval was correctly evaluated in 75 to 80 percent of the trials. Projection of the word 'good' after a correct response increased subsequent response accuracy by 10 percent compared with projection of the word 'error' after an incorrect response. Results indicate that the 10 msec interval is more accurately evaluated by the left hemisphere of the brain, confirming the previously reported speech mechanism for evaluating intervals up to 50 msec. The 180 msec interval was better evaluated by the right hemisphere, indicating a holistic, group perception mechanism. Negative reinforcement is accompanied by processes that worsen subsequent performance. Author

N88-19986# Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF HUMAN WORKERS AND MEANS TO INCREASE IT Abstract Only
V. A. BODROV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 53 26 Feb. 1988 Transl. into ENGLISH from Psikhologicheskiy Zhurnal (Moscow, USSR), v. 8, no. 3, May - Jun. 1987 p 107-117
Avail: NTIS HC A04/MF A01

Work efficiency may be improved by periodic medical and psychological reviews, optimization of working conditions and direct action by regulation of the worker's professional activities, recreation, and physical preparation, psychogenic, physiological-hygenic, electrophysiological, pharmacological and

physical means may be used to improve performance. Autogenic training has been used in relaxation training. Electrostimulation of nerves and muscles is recommended to to reduce discomfort during prolonged activity, and can be used to increase intellectual capacity. Available pharmaceuticals can improve work efficiency. Author

N88-19997# Navy Personnel Research and Development Center, San Diego, Calif.
VISUAL RECOGNITION TRAINING: EFFECTIVENESS OF COMPUTER GRAPHICS Report, May 1983 - Jun. 1984
BARBARA A. MCDONALD and BETTY V. WHITEHILL Apr. 1987 18 p
(AD-A188302; NPRDC-TR-87-21) Avail: NTIS HC A03/MF A01 CSCL 05I

The effectiveness of computer graphics in training Navy personnel to recognize and identify several types of radar jamming was investigated. Dynamic (moving) and static (nonmoving) computer graphics were developed to enhance the unique or distinguishing features of each type of actual radar jamming. A title and a one-sentence description of the jamming accompanied each of the graphics. The subjects, who were students at the Fleet Combat Training Center, Pacific, were assigned to one of five experimental groups for preview training consisting of static graphics with or without descriptions, dynamic graphics with or without descriptions, or jamming descriptions only or to a control group that received no preview training. Test results using videotapes of actual jamming indicate that dynamic graphics with descriptions are useful for visual recognition training. GRA

N88-19998# EEG Systems Lab., San Francisco, Calif.
NEUROCOGNITIVE PREDICTIONS OF PERFORMANCE Final Report, 24 Mar. 1984 - 23 Aug. 1987
ALAN S. GEVINS 25 Sep. 1987 67 p
(Contract F49620-84-K-0008)
(AD-A188323; AFOSR-87-1593TR) Avail: NTIS HC A04/MF A01 CSCL 05H

Our aim is to measure the functional neural networks responsible for human goal-directed behaviors. During the past three years we developed new methods for recording and analyzing the electrical activity of the brain while subjects perform simple cognitive tasks. We have sought to determine the feasibility of predicting decrements in performance associated with transient attentional lapses or operational fatigue. Using the method of Event-Related Covariance (ERC) analysis, we found distributed neural preparatory sets that predicted the accuracy of subsequent responses. In a second experiment on the effects of operational fatigue in U.S. Air Force test pilots, we found fatigue-related neuroelectric changes during cognitive processing that preceded appreciable degradations in performance. These results suggest the feasibility of on-line systems that warn of impaired performance due to prolonged mental work by persons engaged in critical or hazardous work. GRA

N88-19999# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
A NEURONAL MODEL OF CLASSICAL CONDITIONING Technical Report, Oct. 1979 - Sep. 1987
A. H. KLOPF Oct. 1987 159 p
(AD-A188378; AFWAL-TR-87-1139) Avail: NTIS HC A08/MF A01 CSCL 12I

The neuronal model of classical conditioning is proposed to yield a model more in accordance with animal learning phenomena. Instead of correlating pre- and postsynaptic levels of activity, changes in pre- and postsynaptic levels of activity should be correlated to determine the changes in synaptic efficacy that represent learning. Instead of correlating approximately simultaneous pre and postsynaptic signals earlier changes in presynaptic signals should be correlated with later changes in postsynaptic signals. A change in the efficacy of a synapse should be proportional to the current efficacy of the synapse, accounting for the initial positive acceleration in the s-shaped acquisition curves observed in animal learning. The resulting model, termed a drive reinforcement model of single neuron function, suggest that nervous system activity can be understood in terms of two classes of neuronal signals: Drives that are defined to be signal levels and reinforcers that are defined to be changes in signal levels. Defining drives and reinforcers in this way, in conjunction with the neuronal model is an extension of the neurobiological theory of learning. It is shown that the proposed neuronal model predicts the basic categories of classical conditioning phenomena. GRA

N88-20000# Dayton Univ., Ohio. Research Inst.
AIRCREW TRAINING DEVICES: UTILITY AND UTILIZATION OF ADVANCED INSTRUCTIONAL FEATURES, PHASE 4 Final Summary Report, Oct. 1984 - Mar. 1987
DONALD J. POLZELLA, DAVID C. HUBBARD, JAMES E. BROWN, and H. C. MCLEAN Nov. 1987 89 p
(Contract F33615-84-C-0066)
(AD-A188418; AFHRL-TR-87-21) Avail: NTIS HC A05/MF A01 CSCL 05I

An aircrew training device is not merely a flight simulator. It is also equipped with sophisticated hardware and software capabilities, known as advanced instructional features, that permit a simulator instructor to control, monitor, and create simulator training missions. This report summarizes a three-phase project designed to determine the utility and utilization of AIFs based on a survey of simulator instructors from the Air Force Major Commands. Phase 1 surveyed 134 instructor pilots and weapon director instructors assigned to principal Tactical Air Command (TAC) ATD training sites. Phase 2 surveyed 273 instructor pilots, flight engineers, and radar/navigators from Air Training Command (ATC), Military Airlift Command (MAC), and Strategic Air Command (SAC). Phase 3 extended the survey to 155 electronic warfare and aerial gunnery instructors from ATC, SAC, and TAC training facilities. The results indicated that the level of AIF use was affected somewhat by hardware and software unreliability, implementation time, functional limitations, and design deficiencies. However, the perceived training value of a feature was the most important determinant of its use. In addition, it was recommended that the training of simulator instructors be improved. Training should include not only how to use AIFs but how to use them effectively. Guidelines need to be specified for the effective use of AIFs. It is not sufficient to know how to use a feature; when to use it must also be known. GRA

N88-20001# Naval Submarine Medical Research Lab., Groton, Conn.
HUMAN EFFICIENCY FOR VISUAL DETECTION OF TARGETS ON CRT DISPLAYS USING A TWO-LEVEL MULTIPLE CHANNEL TIME HISTORY FORMAT Interim Report
JOSEPH DIVITA and THOMAS HANNA 2 Oct. 1987 27 p
(AD-A188419; NSMRL-1101) Avail: NTIS HC A03/MF A01 CSCL 06P

Human observers were tested for their ability to detect targets on visual displays. The displays simulated the multiple channel time history format of sonar displays, using two levels of intensity encoding. A target was presented on 50 percent of the trails and appeared as a vertical line at a fixed position. Observers indicated their judgment as to whether a target was present by using a four-category rating scale. Receiver-operating characteristics (ROCs) were generated from the rating data and compared to ROCs for an optimal detector. Data were collected for two signal-to-noise ratios and for 32, 64, and 128 lines of data. Results indicated that observers were 3 to 5 dB less sensitive than an optimal detector. Performance improved as the number of lines increased, but not to the extent predicted by optimal integration of information across lines of the display. Human inefficiency with this display is possibly due to the inability to focus on a single column of data or to the use of a suboptimal decision rule for judging the presence of the target. GRA

N88-20002# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
A COMPARISON OF THE ARMY'S PROJECT A: COGNITIVE AND PSYCHOMOTOR TESTS TO ANALOGOUS AIR FORCE AND NAVY TESTS Research Note, Oct. 1986 - Oct. 1987
MARK Y. CZARNOLEWSKI Dec. 1987 52 p
(AD-A188636; ARI-RN-87-73) Avail: NTIS HC A04/MF A01
CSCL 05H

This report describes predictor batteries measuring cognitive abilities and psychomotor skills that are being developed by the research efforts represented by the Army's Project A, the Air Force's Learning Ability Measurement Program (Lamp) and Basic Attributes Test (BAT) Program, and the Navy's spatial abilities effort. Much of the enclosed information regarding the Air Force and Navy measures is based on R. E. Christal's reports on cognitive tests developed by TTCP Services. Comparisons made between Project A measures with those of the other services concentrate on: (1) conceptual comparisons (i.e., the construct representativeness and methodological paradigm on which the tests are based); and (2) operational comparisons, i.e., matching each Project A test to similarly constructed tests developed by the other two services. GRA

N88-20003# Air Force Human Resources Lab., Brooks AFB, Tex.
FIELD DEPENDENCE-INDEPENDENCE AND ITS RELATIONSHIP TO FLIGHT TRAINING PERFORMANCE Interim Technical Paper, Sep. 1983 - Dec. 1986
THOMAS R. CARRETTA Dec. 1987 16 p
(AD-A188888; AFHRL-TP-87-36) Avail: NTIS HC A03/MF A01
CSCL 15A

Previous research has suggested that level of field dependence-independence could be used as a measure of social skills and vocational interests. According to this research, field-dependent individuals tend to prefer areas of work that require social skills, whereas field-independent individuals favor positions in the sciences or practical-analytical-oriented occupations. This study examined the usefulness of field dependence-independence measure for predicting performance during flight training. One thousand nine hundred seventy-seven (1,977) United States Air Force pilot candidates were administered the Embedded Figures Test as part of a computer-administered test battery prior to entry into Undergraduate Pilot Training (UPT). Several items on the Embedded Figures Test demonstrated poor reliability. Further, the level of field dependence-independence was not found to be related to performance during flight training. It was recommended that the test be eliminated for consideration as a selection and classification tool. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A88-29132
FERTIRRIGATION SYSTEMS IN PLANT CULTURE
TAIKICHI TAKANO (Meijo University, Nagoya, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 233-239. refs

The use of rockwool culture to grow plants, a system of practical application in plant growth under microgravity, was experimentally tested. The nutrient requirements of the vegetables grown were determined by systematically varying the nutrient anions and cations. The results showed that the amount of water and nutrient required for plant growth were reduced by one-fifth and one-third, respectively, compared to growth in soil culture. C.D.

A88-29135
AZOLLA AND OTHER SMALL VASCULAR FLOATING PLANTS AS A FUNCTIONING AGENT OF NITROGEN FIXATION IN CELSS
MICHIHIKO YATAZAWA (Aichi Gakuin University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 253-256. refs

Studies of N-fixing agents to be included in CELSS reveal that Azolla fixes at a rate of 600-800 mg N/m-squared day. When the culture is made stratifically, the N-fixing capacity per unit culture volume is 100 times that of legume-rhizobium symbiosis. The N-fixing capacities of other small vascular floating plants were less than that of Azolla while their photosynthetic capacities were similar. K.K.

A88-29136
THE FEASIBILITY OF CHLORELLA AS THE EXCHANGER OF CO2 FOR O2 AND THE FOOD RESOURCES IN THE SPACE STATION
TATSUICHI IWAMURA (Nagoya University, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 257-264. refs

The feasibility of Chlorella as the exchanger of CO2 for O2 and the nutritional food resources in the Space Station is estimated by calculating the oxygen production from the growing algal cells in a continuous culture system where the cell population density and other environmental conditions are kept constant. An algal culture placed on a hemispheric surface of about 2-3 m in radius is needed to generate the oxygen and nutritional biomass necessary for human activity on the Space Station. Problems associated with the construction of the algal culture system and the utilization of the algal biomass as food and feed are discussed. K.K.

A88-29137* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UNCONVENTIONAL FOOD REGENERATION IN SPACE - OPPORTUNITIES FOR MICROBIAL FOOD PRODUCTION
GENE R. PETERSEN, WAYNE W. SCHUBERT, P. K. SESHAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and ERIC H. DUNLOP (Washington University, Saint Louis, MO) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 265-276. refs

The possible role of microbial species in regenerating food is considered, and three areas where microbial systems can be used in controlled ecological life support systems are discussed. Microbial species can serve as the biological portion of hybrid chemical/biological schemes for primary food products, as a means more fully to utilize waste materials from agronomical food production, and as a source of nutritional supplements to conventional plant foods. Work accomplished in each of these areas is described. The role of microgravity fermenters in this technology is addressed. C.D.

A88-29140* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEED, UTILIZATION, AND CONFIGURATION OF A LARGE, MULTI-G CENTRIFUGE ON THE SPACE STATION
SJOERD L. BONTING (NASA, Ames Research Center, Moffett Field, CA) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 297-305. refs

A large, multi-g centrifuge is required on the Space Station (1) to provide valid 1-g controls for the study of zero-g effects on animals and plants and to study readaptation to 1 g; (2) to store animals at 1 g prior to short-term zero-g experimentation; (3) to permit g-level threshold studies of gravity effects. These requirements can be met by a 13-ft-diam., center-mounted centrifuge, on which up to 48 modular habitats with animals (squirrel monkey, rat, mouse) and plants are attached. The advantages of locating this centrifuge with the vivarium, a common environmental

control and life support system, a general-purpose work station and storage of food, water, and supplies in an attached short module, are elaborated. Servicing and operation of the centrifuge, as well as minimizing its impact on other Space Station functions are also considered. Author

A88-29141
SOLAR PLANT GROWTH FACILITY (SPGF) - AN APPROACH TOWARD FUTURE BIOLOGICAL LIFE SUPPORT SYSTEMS
G. SERENTSCHY and G. TRAXLER (Oesterreichische Raumfahrt- und Systemtechnik GmbH, Vienna, Austria) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 306-312.

Studies on the development of an artificially closed ecological system using higher plants as a major constituent and supporting physicochemical subsystems are being conducted. The investigations are directed toward a potential experiment in a low earth orbit using direct sunlight for photosynthesis and biomass production. An operational ground model representing a closed system for the biological specimen has been constructed and is being used for parameter studies; these investigations comprise the analysis of the technical performance of the system, e.g., with respect to the various control loops. Studies to be performed with different types of higher plants are expected to have a substantial importance with respect to the development of future biological life support systems for use in long term manned missions as well as in permanent space structures or stations. Author

A88-29142
A SYSTEMATIC APPROACH FOR CELSS RESEARCH IN JAPAN
KEIJI NITTA (National Aerospace Laboratory, Chofu, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 313-320.

Controlled ecological life support system (CELSS) research activities have included trade-off studies of such technological matters as gas recycling, water purification and recycling, waste management, and food production. In the area of gas recycling, technical problems associated with gas separation and concentration methods were investigated as well as a gas conversion method using algae cultivation. In the case of water recycling, technological problems pertaining to membrane filtration and vapor distillation are studied. In the area of waste management/food production, problems associated with physico-chemical waste reduction and microbial waste decomposition are considered. K.K.

A88-29143* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
INTEGRATION, DESIGN, AND CONSTRUCTION OF A CELSS BREADBOARD FACILITY FOR BIOREGENERATIVE LIFE SUPPORT SYSTEM RESEARCH
R. PRINCE, W. KNOTT, and PAUL BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 321-332. refs

Design criteria for the Biomass Production Chamber (BPC), preliminary operating procedures, and requirements for the future development of the Controlled Ecological Life Support System (CELSS) are discussed. CELSS, which uses a bioregenerative system, includes the following three major units: (1) a biomass production component to grow plants under controlled conditions; (2) food processing components to derive maximum edible content from all plant parts; and (3) waste management components to recover and recycle all solids, liquids, and gases necessary to support life. The current status of the CELSS breadboard facility is reviewed; a block diagram of a simplified version of CELSS and schematic diagrams of the BPS are included. V.L.

A88-29144
A CONCEPT STUDY OF A REGENERABLE GAS RECYCLING SYSTEM
K. OTSUJI, T. SAWADA (Mitsubishi Heavy Industries, Ltd., Nagoya Aircraft Works, Japan), S. SATOH, and M. MINEMOTO (Takasago Technical Institute, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 333-340.

A carbon dioxide adsorption process using solid amine is evaluated as a candidate for early application in CELSS. A comparison made between the steam regeneration and heat/vacuum regeneration processes of the solid amine in terms of adsorption efficiency, regeneration energy, and simplicity reveal the superiority of the steam regeneration process for the present application. It is shown that the Sabatier reaction can be used for oxygen recovery. K.K.

A88-29145
A PRELIMINARY EXPERIMENTAL STUDY ON THE GAS RECYCLING SYSTEM FOR CELSS
SHUJI KANDA, HIROYUKI MATSUMURA, TAKATOSHI SHOJI (Kawasaki Heavy Industries, Ltd., Kobe, Japan), KEIJI NITTA, KOJI OHTSUBO (National Aerospace Laboratory, Chofu, Japan) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 341-348.

A controlled ecological life support system (CELSS) concept study revealed the need for a CO2 and O2 separating and concentrating system to regenerate the gas resources and to maintain the stable operation of CELSS. Fundamental characteristic tests were carried out on solid amine and salcomine to obtain the basic design data for the CO2 and O2 separation and concentration system. The concept design of the gas recycling system aims to support life science missions in the initial operational capability of Space Station activity. In this case, CO2 is extracted from the animal vivarium outlet gas and O2 is extracted from the outlet of the phylotron ad algae cultivation system. K.K.

A88-29146
A MASS SPECTROMETRIC STUDY ON GAS CIRCULATION IN CELSS
I. NISHI, M. TATEISHI, A. NAGANO, Y. SUZUKI, and H. SHIBUYA (Tokyo, Science University, Noda, Japan) IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 349-356.

The fine control of the gas circulation between animals and plants is of crucial importance in the maintaining of the artificial CELSS. The gas circulation is concerned with the O2, CO2, water and N2 exchange among animals, plants, and microbacteria, followed by the metabolic, photosynthetic processes and the biochemical processes. A mass spectrometer computer system developed for this study is described. The monitoring of O2 and CO2 gas exchange was investigated in the metabolic and photosynthetic processes of the Chinese hamster and the spirulina (Algea), respectively. The gas exchange between the two was also investigated. Author

A88-29147
THE DEVELOPMENT OF AN IMPROVED RESEARCH ANIMAL HOLDING FACILITY - TRACE CONTAMINANTS/ODORS EXPERIMENTS WITH A FUNCTIONAL MODEL
HIDEO SUDOH, HIROYUKI MATSUMURA, KUNIAKI MURAO (Kawasaki Heavy Industries, Ltd., Tokyo, Japan), SATORU WATANABE, MITSURO KIDA (Nagoya University, Japan) et al. IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986 . Tokyo, MYU Research, 1987, p. 357-364.

Results from experiments conducted to investigate the trace contaminants/odors of rodents using a prototype functional model of an improved research animal holding facility (RAHF) are presented, and a breadboard model (BBM) of the RAHF is described. Results of the 10-day experiment showed that the

behavioral activities and food/water intake of hamsters are severely lowered for NH3 concentrations exceeding 300-400 ppm, and that with waste management, the concentration of odors was reduced to about 1/10 of that without waste management. The prototype BBM uses a fully-closed environmental control system and a biocontamination control system, and it can accommodate experiments of three-months duration or more. R.R.

A88-29564
HEAT STRESS EVALUATION OF ANTI-EXPOSURE FLIGHT GARMENTS
JONATHAN W. KAUFMAN (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, March 1988, p. 213-219. refs

The usefulness of antiexposure suit ensembles containing polytetrafluoroethylene (PTFE) coverall is examined. Six males, ranging in age from 23-39 years, wore a standard flight ensemble and four combinations of the PTFE coverall while performing a psychomotor task and a physical work task under varying heat stress conditions. The total sweat rate, heart storage rate, final heart rate, and mean weighted skin temperature of the men were measured. It is observed that the mean test duration for the standard ensemble is 177 + or - 9 min and for the four PTFE coverall configurations about 105 + or - 32 min. I.F.

A88-30586
THERMAL COATING REQUIRED FOR HARD SPACE SUITS
JAMES H. BRAHNEY Aerospace Engineering (ISSN 0736-2536), vol. 8, March 1988, p. 18-22.

The Integrated Thermal and Micrometeoroid Garment (ITMG) worn by Space Shuttle astronauts during EVA will in the future take the form of a hard suit; attention is presently given to the incorporation of a high reflectance coating on the suit structure surface to minimize environmental effects. The coating must have both high IR reflectance and high corrosion and wear resistance; it must also be immune to LEO atomic oxygen mass loss effects. Physical vapor deposition is judged to be the most advantageous metal or alloy coating process for the ITMG. O.C.

A88-30748
HIGH ALTITUDE-LOW PROFILE POSITIVE PRESSURE BREATHING (HA/LP-PPB) OXYGEN MASK ASSEMBLY
ORLAND WILCOX and NEVAN ENGLE (Gentex Corp., Pomona, CA) SAFE Journal, vol.18, Spring 1988, p. 18-24.

The paper describes an oronasal mask assembly which was designed and developed using ASCC AIR STD 61/21 as the performance specification. Among the major design considerations were a two-valve system for minimum respiratory resistance, a sequenced edge roll for the faceseal, and a modified smooth bore oxygen delivery hose for reduced flow resistance. The present mask assembly was developed as a direct replacement for the MBU-5/P and MBU-12/P oxygen mask assemblies. K.K.

A88-30750
POSITIVE PRESSURE BREATHING AS A G-PROTECTION DEVICE - SAFETY CONCERNS
TOM JENNINGS (Illinois, University, Eye and Ear Infirmary, Chicago) and CLAUDE ZANETTI (Edgewater Hospital, Chicago, Il) SAFE Journal, vol.18, Spring 1988, p. 52-57. refs

Positive Pressure Breathing (PPB) is a technique in which air is forced into a pilot via a face mask and raises his intrathoracic pressure. It has been shown to lengthen subjects' ability to endure +Gz acceleration epochs and now has been proposed to be used operationally to increase G-tolerance. However, positive pressure breathing can cause ear pain, ear and sinus blocks, pneumothorax and air embolism. All these side effects are potentially fatal to the pilot. The pressure proposed for operational use, at altitudes that occur in partially pressurized cockpits of operational aircraft, causes greater lung distension than pressure gradients known to cause pulmonary overpressurization in animals and man. Finally, other new means of increasing G-tolerance safely are examined. Author

A88-32677
WORKLOAD MANAGEMENT IN MILITARY COCKPITS - PRESENT INSIGHTS
R. M. TAYLOR (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Recent advances in cockpit aids for military operations; Proceedings of the Symposium, London, England, Mar. 31, 1987 . London, Royal Aeronautical Society, 1987, p. 10-32. refs

In recent cockpit systems, a degree of responsibility for information processing and control has been relegated to automated components over which the pilot exercises a monitoring role, thereby reducing flexibility, adaptability, and pilot situation awareness. Adaptive systems are required for pilot workload control which are able to maintain situation awareness and support pilot decision making through the application of appropriate display/control and automation technologies. Attention is presently given to pilot cognition theories, perceptual organization and selective attention processes, and the features of pilot memory and understanding. O.C.

A88-32678
WORKLOAD AND SITUATION AWARENESS IN FUTURE AIRCRAFT
TERRY J. EMERSON, JOHN M. REISING, and HAROLD G. BRITTEN-AUSTIN (USAF, Wright-Patterson AFB, OH) IN: Recent advances in cockpit aids for military operations; Proceedings of the Symposium, London, England, Mar. 31, 1987 . London, Royal Aeronautical Society, 1987, p. 33-44. refs

The need to predict and verify military pilot workloads during future aircraft cockpits' design phase, as well as in real time, during mission execution, is discussed. Pilot workload and performance estimation must take into account specific avionic suite, mission scenario, and environmental conditions; such fitness parameters as stress, fatigue, and confusion must also be considered. The 'electronic crewmember' constituted by automated cockpit systems will play an active role in deciding what corrective action must be taken when problems arise. The modeling of multiple mental resources and the development of a workload signature or template that is tailored to the capabilities and limitations of the pilot are considered. O.C.

N88-19095# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
WHEN DECISION AIDS FAIL Final Report, 15 Jun. 1985 - 15 Jun. 1986
ERHARD O. EIMER Mar. 1987 33 p
(AD-A187531; AAMRL-TR-87-035) Avail: NTIS HC A03/MF A01 CSCL 23B

This research was concerned with ways in which a C3-system adapts to the breakdown of a decision aiding device (DAD). Subjects were tested in a team judgement task in which they had to predict the outcome of an uncertain, dynamic event on discrete trails, with or without the use of a DAD of varying validity. After training, DAD validity was reduced to zero. Subjects performed more poorly with a DAD of low validity than without a DAD. Subjects consistently performed more poorly than they could have by using a maximizing strategy. After DAD breakdown, subjects performed more poorly than control subjects who never used a DAD. Prior DAD validity had no effect on performance with an invalid DAD. Performance with an invalid DAD was found to be predicted by efficiency, the ability to use valid and ignore invalid information. GRA

N88-19096# Naval Submarine Medical Research Lab., Groton, Conn.
BRIGHTNESS CONTRAST AND CHARACTER HEIGHT OF FIVE FLAT PANEL COMPUTER DISPLAYS Memorandum Report
KEVIN LAXAR, DAVID F. NERI, and SAUL M. LURIA 2 Sep. 1987 11 p
(AD-A187743; NSMRL-MR-87-5) Avail: NTIS HC A03/MF A01 CSCL 12F

To determine the relative legibility of the flat panel displays of five IBM-PC compatible lap-top microcomputers, their brightness

contrasts and character heights, which generally contribute to legibility, were measured under normal lighting and in the dark. The Datavue 25, the Toshiba T1100 Plus, and the Zenith Z-181 used a liquid crystal display in various foreground/background color combinations. The Data General (DG) One had an electroluminescent display, and the Grid-Gridcase 3 used a plasma display, both of which are self-luminous. The brightness contrast of all the displays was acceptable under normal lighted conditions. The DG One had the highest contrast in a lighted room (92 percent), at viewing angles both normal to the vertical screen surface and at 45 in the horizontal plane. The DG One and the Gridcase 3 had the highest contrast in the dark (over 98 percent). The Toshiba's screen was not backlighted and could not be used in a dark room. All the screens displayed 25 lines of 80 characters. The height of upper case characters ranged from 0.137 to 0.208 inches, and all were acceptable for normal viewing distances. normal viewing distances. Keywords: Laptop computers; Microcomputers; Display systems; Liquid crystal display systems; Photometry; Screens (Display); Image processing. GRA

N88-19097# Aeronautical Research Labs., Melbourne (Australia).
A WORKED EXAMPLE OF AN APPLICATION OF THE SAINT SIMULATION PROGRAM
S. SESTITO Sep. 1987 33 p
(AD-A188198; ARL-SYS-TM-93; DODA-AR-004-554) Avail: NTIS HC A03/MF A01 CSCL 12E

The Systems Analysis of Integrated Networks of Tasks (SAINT) is a network modeling and simulation technique developed to assist the design and analysis of complex human-machine systems. Thus document discusses some of the SAINT concepts, the development of a SAINT network, the method of inputting the network into the SAINT environment, and presents a brief look at the output from SAINT. GRA

N88-19098# Pacific Northwest Labs., Richland, Wash.
AN ECONOMIC ANALYSIS OF A MULTI-COMMODITY FRUIT AND VEGETABLE IRRADIATOR
M. D. BROWN, D. E. EAKIN, J. K. YOUNG, and G. L. TINGEY Jul. 1987 26 p Presented at the American Institute of Chemical Engineers Summer National Meeting, Minneapolis, Minn., 6 Aug. 1987
(Contract DE-AC06-76RL-01830)
(DE88-003425; PNL-SA-15112; CONF-870822-8) Avail: NTIS HC A03/MF A01

Although irradiation of foods has been studied since the late 1940's and irradiation of grains and potatoes has been approved for years, only recently has the Food and Drug Administration approved irradiation of pork, fresh fruits and vegetables at doses up to 100 krad for commercial sale. A key element in commercializing irradiation technology by the food processing industry is economic viability. This paper presents an economic analysis for a multi-commodity fruit and vegetable irradiator processing apples, cherries, pears, asparagus, onions, and potatoes. Dose, throughput, and the schedule were examined. Design information and capital and operating costs for various sizes of irradiators are presented. The economics look promising, with typical costs in larger facilities in the range of a few cents per pound of product. DOE

N88-19502# Fokker B.V., Amsterdam (Netherlands).
THE ESA/FOKKER SERVICE END-EFFECTOR SUBSYSTEM. A ROBOTIC/MAN-COMPATIBLE SERVICING APPROACH
A. C. M. VANSWIETEN and R. H. BENTALL (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 145-157 Nov. 1987
Avail: NTIS HC A21/MF A01

The requirements, design, and operational performance of an end effector are presented. Design objectives, trade-offs, breadboard models, tests, and developments are covered. Design characteristics are: robotic/man compatible grapple fixture; grappling performance compatible with Hermes Robot Arm and Service Manipulator system; versatile application of tools; power and data bus connection for coupling with intelligent tools; torque and force sensing capabilities for compliant operations; and status checking and decision making inside the end-effector-subsystem. A range of possible tools which would comprise the basic servicing capabilities is described. ESA

N88-19505# Technische Hochschule, Darmstadt (West Germany).
ON A KNOWLEDGE BASED ASSISTED SYSTEM FOR HIGHLY AUTONOMOUS CONTROL OF EXPERIMENT-MANIPULATORS IN THE MAN-TENDED FREE FLYER
G. KEGEL, A. ABDULWAHAB, and R. BRUDER *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 175-183 Nov. 1987 Sponsored by BMFT
Avail: NTIS HC A21/MF A01

A knowledge based control and sensor-feedback hierarchy concept which performs global task-oriented manipulation sequences filled with specific knowledge and initialized by the general ground station command is presented. It is intended for the control systems for in-orbit experiment and maintenance manipulators, where highly autonomous performance of multisensor controlled task sequences is used as an alternative to direct teleoperation. The theoretical knowledge base concept, similar to the Winston-Horn frame structure, is elaborated into implementable data structures. The knowledge represented in rules and physical data used by algorithms for planning a subcommand sequence consisting of single steps of various sensor feedback configurations is discussed. An implemented robot-control interface library and the sensor-equipped end effector for verification of expected performances is described. ESA

N88-19506# Technische Hochschule, Darmstadt (West Germany). Dept. of Control Engineering.
A KNOWLEDGE-BASED APPROACH FOR SENSORY-CONTROLLED ASSEMBLY OPERATIONS
W. SIMON, E. ERSUE, and ST. WIENAND *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 185-190 Nov. 1987 Sponsored by Deutsche Forschungsgeimschaft
Avail: NTIS HC A21/MF A01

The approach for a knowledge-based robot operation system using different types of sensory information is presented. The system is intended for orbital assembly, maintenance, and repair tasks in a semiautomatic or automatic manner, using a general knowledge base. The components of this knowledge base are examined and a knowledge representation scheme based on a combination of rules and frames is proposed. A prototype of the approach implemented on a robotic hardware test bed is discussed for the part-mating problem. ESA

N88-19507# Karlsruhe Univ. (West Germany).
MOBILE ROBOT ACTIVITY MODEL FOR AUTONOMOUS FREE FLYING PLATFORMS
U. REMBOLD, R. DILLMANN, A. KELLNER, and J. EITELJOERGE (Erno Raumfahrttechnik G.m.b.H., Bremen, West Germany) *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 191-202 Nov. 1987 Sponsored by Deutsche Forschungsgeimeinschaft
Avail: NTIS HC A21/MF A01

The use of artificial intelligence (AI) techniques for the control problem of free flying autonomous platforms is discussed. For rendezvous, docking and manipulation operation between target system and chaser appropriate integrated control systems consisting of planning components, execution control components and supervision components are required. An experimental terrestrial mobile autonomous robot system capable of travelling, docking, and manipulation with two manipulator arms is presented. This system is under development to evaluate the efficiency of AI-tools and their integration into complex systems to perform complex tasks or missions autonomously in an unstructured environment. ESA

N88-19508# Fokker B.V., Amsterdam (Netherlands).
THE HERMES ROBOT ARM, ITS DESIGN AND VERIFICATION
R. J. HAMANN and J. A. HOOGSTRATEN *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 205-215 Nov. 1987
Avail: NTIS HC A21/MF A01

A rationale for the overall verification approach for the Hermes robot arm (HERA) was derived from applicable test categories, test item levels, test types, and candidate facilities/models. General and specific test facilities are described. The approach is illustrated with examples of planned test set-ups. It is shown that many of the usual techniques for the testing of space mechanisms can be applied for the verification of a space manipulator. Major constraints, however, arise from the limitations imposed by a one-g test environment. The verification approach for HERA is further complicated by the integrated electrical architecture of the Hermes/HERA system. The model approach proposed is characterized by the emphasis on qualification at subsystem level. At the HERA system level extensive use is made of software simulation to validate the design. ESA

N88-19509# Technische Hochschule, Darmstadt (West Germany).
REMOTE MANIPULATION IN ORBITAL CONSTRUCTION, SERVICING AND REPAIR MISSIONS: IS ONE ARM ENOUGH? A COMPARATIVE EVALUATION OF THE PERFORMANCE FEATURES OF ROBOTS WITH ONE OR MORE ARMS
H. BRUHM *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 217-225 Nov. 1987
Avail: NTIS HC A21/MF A01

Qualitative and quantitative performance features which are expected to make the difference between single and multiarm systems for orbital robots are reviewed. Methods for comparative evaluation of single and multiarm systems with respect to their maximum force/torque capability, payload positioning accuracy, repeatability, and stiffness are presented. The capabilities of multiarm systems are highlighted by the analysis of two tasks. The use of single-arm systems is not recommended. ESA

N88-19510# Central Research Labs., Red Wing, Minn.
REMOTE REPAIR DEMONSTRATION OF SOLAR MAXIMUM MAIN ELECTRONICS BOX
RICHARD H. ADAMS, ALAN E. GROSS, and CARLETON E. JENNRICH *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 227-232 Nov. 1987
Avail: NTIS HC A21/MF A01

The remote repair of the Solar Maximum satellite Main Electronics Box (MEB) using a master/slave servomanipulator is described. The MEB was not designed to be repaired on-orbit and represented the most difficult repair task performed by NASA astronauts. The viewing system, tooling, support equipment, and manipulator system used to perform the replacement sequence is presented. The technology demonstrations are described, along with guidelines for performing remote servicing. The remote servicing system demonstrates how tasks can be effectively performed on space vehicles in an unstructured or unfamiliar remote environment. ESA

N88-19518# MATRA Espace, Toulouse (France).
PROMISING CONCEPTS FOR GROUND-TO-ORBIT EXPERIMENT TELEOPERATION
PH. LEBOUAR and C. LOEILLET *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 301-308 Nov. 1987
Avail: NTIS HC A21/MF A01

System and user requirements for ground based control of spaceborne experiments are reviewed, and a telescience concept is described. The communication network is based on two separate high data rate links between data relay satellites (DRS) and users in low Earth orbit. It allows a two way link between ground users and DRS without ground retransmission. The onboard data management system is essentially the same as for standard payload control, but with additional functions such as accepting time tagged commands and command validation without user control on the ground. The impact of the telescience concept on the Columbus User Operations Center and Payload Operations Control Center is assessed. A concept validation phase is outlined. ESA

N88-19519# Fraunhofer-Inst. fuer Produktionsanlagen und Konstruktionstechnik, Berlin (West Germany).
GROUND BASED SUPERVISORY AND PROGRAMMING SYSTEM FOR AUTOMATIC EXPERIMENT EXECUTION IN ORBIT
G. DUELEN, U. KIRCHHOFF, and R. BERNHARDT *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 309-316 Nov. 1987
Avail: NTIS HC A21/MF A01

For the automatic execution of orbital experiments under closed lab conditions a concept for a ground based supervision and manual interaction mode for the change of the experiment execution is presented. This approach is based on off-line programming technologies developed in terrestrial manufacturing technology. Experiment execution is realized automatically based on programmed action sequence without manual interaction. Activities in the cell are shown in a 3-D representation on a graphic screen on ground. If the execution sequence has to be changed, e.g., due to experiment results, a new execution program for the next time period can be generated on ground, tested by the use of a simulation system, sent to the experiment controllers, and a new action sequence realized in the orbital system. A first realization concept as a part of the Robot Technology Experiment on the Spacelab D2-Mission is presented. ESA

N88-19520# University Coll., London (England).
COVARIANT CONTROL OF BILATERAL SERVOS FOR IN-ORBIT MANIPULATION
J. E. E. SHARPE and K. V. SIVA (United Kingdom Atomic Energy Authority, Harwell, England) *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 317-323 Nov. 1987 Sponsored by Fairey Engineering Ltd.
Avail: NTIS HC A21/MF A01

A class of covariant bilateral force reflecting systems for teleoperation that enables the operator to use sensory feel to control the slave with a total transmission delay of 200 msec is introduced. The prototype 3 kWe electrohydraulic master-slave system has a forward positional bandwidth of 20 Hz and is capable of positioning a mass of 4 kg flexibly supported at 0.75 m radius at a slew rate of 200 deg/sec. The reflected sensory force has a bandwidth greater than 250 Hz. Experimental evidence shows the master-slave system to appear transparent to the operator within the normal positional bandwidth. The operators therefore feel that they are directly swinging the load mass at the end of a flexible rod and are able to control the vibrations of the rod. This is not possible with simple positional control as the resonant system is outside the control loop. The operator uses the high frequency sensory information in an adaptive manner. However, with the transmission delay it is necessary to reduce the sensory force gain to obtain stability. ESA

N88-19521# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
TELEOPERATION FOR A SPACELAB TECHNOLOGY EXPERIMENT
E. SCHMIDT *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 325-331 Nov. 1987
Avail: NTIS HC A21/MF A01

A teleoperation system for the Robotics Technology Experiment proposed for the Spacelab D-2 mission is presented. The principal architecture of such a system consisting of a TV system, and an on-board and a ground teleoperation work station is described. The TV system supports teleoperation as visual feedback by providing a stereo image of the manipulator arm activities within the work cell. Advanced sensor balls are applied as a 6 degree-of-freedom controller for the human operator on board and on ground. A major element of the ground teleoperation station is

a 3D graphics system in order to display the actual joint configuration of the robot and to simulate the robot motion without the inherent transmission delay times. ESA

N88-19524# National Aerospace Lab., Amsterdam (Netherlands).
THE HERMES MANIPULATION SYSTEM (HERA) SIMULATION FACILITY DEVELOPMENT
J. J. M. PRINS, P. DIELMAN, and J. A. HOOGSTRATEN (Fokker B.V., Amsterdam, Netherlands) *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 353-364 Nov. 1987
Avail: NTIS HC A21/MF A01

A simulator for the Hermes robot arm (HERA), a space manipulator system to perform tasks ranging from capture and berthing to tool operation in various operational modes from fully automatic to purely manual, is described. The HERA simulation facility (HSF) consists of the HSF pilot (HSFP); the non real-time HSF (NRT HSF); and the real-time HSF (RT HSF). The HSFP is a limited real-time simulation facility, which includes a simple Hermes cockpit mockup, a simulation computer and a real-time computer image generation system. The NRT HSF is the main HERA simulation tool for detailed design, analysis, and verification. It features the highest model fidelity of all three facilities. The RT HSF prime function is to provide high fidelity real-time man-in-the-loop and hardware-in-the-loop simulation. ESA

N88-19527# MATRA Espace, Paris-Velizy (France).
UTILIZATION OF ROBOTICS AND TELEOPERATION FOR FUTURE IN-ORBIT OPERATIONS
TH. BLAIS, J. L. LACOMBE, and P. WETZEL *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 377-383 Nov. 1987
Avail: NTIS HC A21/MF A01

The main in-orbit elements and operations required by the future in-orbit infrastructure are reviewed. Man's role and location with respect to the operations areas is a major design element for space teleoperation and robotics systems. It is shown that robotics/teleoperation and man have to be considered as complementary, enabling large operational automony of the robotics system when man performs on-ground or remote supervision (e.g., from a space station). This is applicable for assembly (external robotics) and payload operations (internal robotics). Efficient and safe work share between the external manipulator arm and the man in pressurized area (on the same space system) may be an alternative to extravehicular activity (EVA) or preferably the nominal way to perform operations which cannot be fully completed by EVA only (large load transfer). The telemanipulator arm provides both the astronaut transfer capability (with loads and tools) and a firm support at work site (open cherry picker), increasing the effectiveness of EVA (less astronaut fatigue, shorter transfer time). A man in the pressurized area ensures supervision. ESA

N88-19530# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ROTEX: THE ROBOTIC TECHNOLOGY EXPERIMENT ON SPACELAB D-2 MISSION
J. BUESING *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 399-404 Nov. 1987
Avail: NTIS HC A21/MF A01

The Robotic Technology Experiment (ROTEX) mechanical and electrical hardware architecture, especially the software configuration, covering the flight and ground software functions is outlined. The selected decentral control concept, the sensor equipment of the manipulator, and the implemented external feedback control are described. The different operating modes executed under automatic, on-board telemanipulation, or ground telemanipulation control, are presented, as well as the experiment tasks, orbit replacement unit exchange and truss structure mounting, performed by the robot in orbit, as performance verification in a micro-g environment. ESA

N88-19535# British Aerospace Public Ltd. Co., Bristol (England). Space and Communications Div.
EVA, THE TECHNOLOGICAL CHALLENGE
T. J. CARTWRIGHT and P. A. BLYTHE *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 451-457 Nov. 1987
Avail: NTIS HC A21/MF A01

The technological challenge which must be overcome if man is to work outside the mother spacecraft is considered. Within the context of a space suit system hardware architecture the key requirements are discussed and a baseline subsystem design proposed for operations from the Hermes spaceplane. The technological issues and in particular the levels of technological maturity associated with this baseline are assessed in order to appraise the readiness of European industry to respond to extravehicular activity needs. With due consideration to the magnitude of the development required a plan is proposed for a European space suit system. Close consultation with U.S. and/or Soviet specialists is a possibility and technology transfer is addressed. ESA

N88-19536*# TRW Space Technology Labs., Redondo Beach, Calif.
TECHNOLOGY REQUIREMENTS FOR TELEROBOTIC SATELLITE SERVICING IN SPACE
HANS F. MEISSINGER *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 459-467 Nov. 1987
(Contract NAS8-35031)
Avail: NTIS HC A21/MF A01 CSCL 05H

Telerobotic servicer technology requirements were identified for typical on-orbit servicing operations, including: automation requirements and automated system utilization in typical servicing missions; key automation technologies used for servicing; evolution concepts; technology development timetable; and servicing technology drivers. Teleoperation, robotics, and artificial intelligence are needed in the servicing missions investigated. Analysis shows that teleoperation will be used more widely than fully robotic systems, at least during the early space station years because of the diversity and unpredictability of many servicing tasks which call for the human operator's skills, resourcefulness, and decision-making ability. There will be heavy dependence on a sophisticated, flexible, readily accessible, high-speed and high-capacity data management system which can provide the expert system support required in diagnosing, troubleshooting, decision making, task scheduling, and mission planning. ESA

N88-19537# British Aerospace Public Ltd. Co., Stevenage (England). Space and Communications Div.
A TELEOPERATED MANIPULATOR SYSTEM CONCEPT FOR UNMANNED PLATFORMS
J. MURDOCH and J. S. SHEPPARD *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 469-474 Nov. 1987
Avail: NTIS HC A21/MF A01

A Platform Manipulator System (PMS) concept is proposed to provide, as a primary function, a means of exchanging payload and utility orbit replacement units (ORU) between an unmanned platform and a docked logistics vehicle without the need for man in orbit. The concept is principally directed towards Columbus Polar Platform in order to avoid the requirement to de-orbit for a servicing operation, but is also applicable to the external servicing of the resource module of the Man-Tended Free Flyer. Features of the proposed system include teleoperation from ground, a dual berthing/ORU exchange function, a limited rotational transportation capability of the manipulator base, and a bi-arm end effector concept. ESA

N88-19538# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
MAN-TENDED OPTIONS FOR EUROPEAN SPACE ROBOTICS
R. H. BENTALL and D. KASSING *In its* Proceedings of the 1st European In-Orbit Operations Technology Symposium p 475-483 Nov. 1987
Avail: NTIS HC A21/MF A01

Options and applications for robotics in European man-tended and autonomous operations in space are discussed, and future options for European robotics are identified. Man-tended robotics operations for internal and external servicing (including the Hermes robot arm) are reviewed. A technology demonstration program is proposed. ESA

N88-19539# CAE Electronics Ltd., St. Laurent (Quebec).
MULTI-AXIS CONTROL OF TELEMANIPULATORS
G. M. MCKINNON, M. L. KING, and D. RUNNINGS *In* ESA. Proceedings of the 1st European In-Orbit Operations Technology Symposium p 487-491 Nov. 1987
Avail: NTIS HC A21/MF A01

The development of multiaxis hand controllers for use in telemanipulator systems in space is described. Experience in the control of the shuttle remote manipulator system is reviewed, together with subsequent tests involving a number of simulators and configurations, including use as a side arm flight control for helicopters. Factors affecting operator acceptability are reviewed. It is shown that six degrees of freedom controllers can be used naturally and effectively for tasks requiring dexterity and performance. ESA

N88-19559# British Aerospace Public Ltd. Co., Lancashire (England). Military Aircraft Div.
COMPUTER AIDED TACTICS FOR AIR COMBAT
N. MITCHELL *In* AGARD. Advances in Air-Launched Weapon Guidance and Control 11 p Dec. 1987
Avail: NTIS HC A06/MF A01

In order to achieve maximum operational effectiveness with an acceptable crew workload, the new generation of NATO fighter aircraft will contain a significant degree of automation and computer support for the crew. One key area of support is computer aided tactics, which help the crewman to assess the complex air battle situation, select appropriate targets, and plan the best method of attack. A microcomputer tactical aid called MITAC is described. By computing a range of possible aircraft and missile flight paths and processing the results through a sequence of tactical flight rules, MITAC can offer the crewman useful advice on recommended attacks and their consequences. It provides good insight into the sort of facility that could be available in the next generation of fighter cockpits. Author

N88-19884*# Taylor and Associates, Inc., Wrightwood, Calif.
SPACE STATION ARCHITECTURAL ELEMENTS MODEL STUDY. SPACE STATION HUMAN FACTORS RESEARCH REVIEW
THOMAS C. TAYLOR, EYOUB KHAN, JOHN SPENCER, CARLOS ROCHA, and ETHAN WILSON CLIFFTON (Cliffton, Ethan Wilson, San Francisco, Calif) *In* NASA. Ames Research Center, Space Station Human Factors Research Review. Volume 3: Space Station Habitability and Function: Architectural Research p 117-135 Oct. 1987
Avail: NTIS HC A10/MF A01 CSCL 05H

Presentation visuals and an extended abstract represent a study to explore and analyze the interaction of major utilities distribution, generic workstation, and spatial composition of the SPACEHAB space station module. Issues addressed include packing densities vs. circulation, efficiency of packing vs. standardization, flexibility vs. diversity, and composition of interior volume as space for living vs. residual negative volume. The result of the study is expected to be a series of observations and preliminary evaluation criteria which focus on the productive living environment for a module in orbit. J.P.B.

N88-19885*# Kalil (Michael) Design Studio, New York, N.Y.
SPACE STATION ARCHITECTURAL ELEMENTS MODEL STUDY
MICHAEL KALIL *In* NASA. Ames Research Center, Space Station Human Factors Research Review. Volume 3: Space Station Habitability and Function: Architectural Research p 137-143 Oct. 1987
(Contract NASA ORDER A-21776)
(REPT-31799) Avail: NTIS HC A10/MF A01 CSCL 05H

The space station must unite the properties and behavior of individual and place, using proportions from both to make whole the understanding of ourselves at this moment in evolution. Harmonious proportions in any environment are similar to the acceptance and enjoyment of the harmony of many well-tuned musical instruments. A well-tuned or well-ordered environment tends to have invisible proportions. They produce order but do not intrude on the perception and cognitive mapping of the environment. Systems of proportion are not ends in themselves but are a means to select a series of spaces which relate one to another in dimensionally specific terms. These internal relationships create a whole when the forms are harmonious. This harmonic relationship is of intrinsic value for individuals to be physically and psychologically in balance with their universe. Author

N88-19886*# Southern California Inst. of Architecture, Santa Monica. Inst. for Future Studies.
SPACE STATION GROUP ACTIVITIES HABITABILITY MODULE STUDY: A SYNOPSIS
DAVID NIXON and TERRY GLASSMAN *In* NASA. Ames Research Center, Space Station Human Factors Research Review. Volume 3: Space Station Habitability and Function: Architectural Research p 145-153 Oct. 1987
Avail: NTIS HC A10/MF A01 CSCL 05H

Space station habitability was studied by investigating crew activity routines, proximities, ergonomic envelopes, and group volumes. Ten alternative schematic interior designs were proposed. Preliminary conclusions include: (1) in-service interior modifications may be necessary and should be planned for; (2) design complexity will be increased if the module cluster is reduced from five to three; (3) the increased crew circulation attendant upon enhancement of space station activity may produce human traffic bottlenecks and should be planned for; (4) a single- or two-person quiet area may be desirable to provide crew members with needed solitude during waking hours; and (5) the decision to choose a two-shift or three-shift daily cycle will have a significant impact on the design configuration and operational efficiency of the human habitat. J.P.B.

N88-19888*# California Univ., Berkeley. Dept. of Architecture.
SOCIAL FACTORS IN SPACE STATION INTERIORS
GALEN CRANZ, ALICE EICHOLD, KLAUS HOTTES, KEVIN JONES, and LINDA WEINSTEIN *In* NASA. Ames Research Center, Space Station Human Factors Research Review. Volume 3: Space Station Habitability and Function: Architectural Research p 165-190 Oct. 1987
Avail: NTIS HC A10/MF A01 CSCL 05H

Using the example of the chair, which is often written into space station planning but which serves no non-cultural function in zero gravity, difficulties in overcoming cultural assumptions are discussed. An experimental approach is called for which would allow designers to separate cultural assumptions from logistic, social and psychological necessities. Simulations, systematic doubt and monitored brainstorming are recommended as part of basic research so that the designer will approach the problems of space module design with a complete program. J.P.B.

N88-19917# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ASPECTS OF BIOREGENERATIVE LIFE SUPPORT SYSTEMS
P. SCHILLER and N. BOUGHAROUAT *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 125-128 Dec. 1987
Avail: NTIS HC A15/MF A01

A concept for a life support package for biological experiments in space was developed. This approach allows the study of the problems of bioregenerative life support at laboratory oriented size and level. Nevertheless the basic technology is very similar to a man oriented system and allows scaling up. Technologies required and studied for such a small scale system like water cleaning and recovery, stable cultivation conditions, system control, contamination recovery, extraction of edible substances, and the oxygen/carbon dioxide cycle are common to all the systems. The system consists of culture vessel with illumination gas exchanger; cell harvester/medium separator; maltose separator; waste absorber; control and monitoring system; sterilizing system; and spare culture storage. ESA

N88-19934# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.
RADIATION PROBLEMS IN MANNED SPACE FLIGHT WITH A VIEW TO THE SPACE STATION
G. REITZ, H. BUECKER, and R. FACIUS *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 209-214 Dec. 1987
Avail: NTIS HC A15/MF A01

Gaps in knowledge and abilities which must be closed for an effective and economic realization of a space radiation protection concept are discussed. This includes the accurate determination of the components of the complex field of cosmic ionizing radiation, the proper evaluation of the biological importance of its densely ionizing component and of the depth dose distribution of the less penetrating component, the establishment of adequate radiation protection standards and of a system of dosimetric surveillance, as well as studies into the possibilities to harden selectively the Space Station or parts of it against components of cosmic radiation. ESA

N88-19970# Joint Publications Research Service, Arlington, Va.
HUMAN FACTOR IN ENGINEERING WORK Abstract Only
EMILIYA SERGEYEVICH CHUGUNOVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences p 22 27 Apr. 1987 Transl. into ENGLISH from Nauka i Tekhnika (Riga, USSR), no. 10, Oct. 1986 p 8-10
Avail: NTIS HC A05/MF A01

Methods developed to predict the probable success of a person in engineering work are discussed. The method emphasizes the development of generalized models of an engineer. Such models accurately predict a person's capacity to become a successful engineer. These models differ significantly for men and women. Some of the differences in qualifications of males and females as future engineers are discussed and a sample personality sketch for a successful male and female engineer is presented. Author

N88-20004# Joint Food and Agriculture Organization - International Atomic Energy Agency, Vienna (Austria). Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.
FOOD IRRADIATION NEWSLETTER, VOL. 11, NO. 1
Apr. 1987 51 p
(DE88-700808; INIS-MF-11059-VOL-11-NO-1) Avail: NTIS (US Sales Only) HC A04/MF A01

This issue reports a number of activities which took place during the second half of 1986 and early 1987: In Point of Fact - Food Irradiation was published in February 1987; Twenty-five participants joined the FAO/IAEA Study Tour on Radiation Disinfestation of Grain which visited the Netherlands, Hungary and the USSR from 18 August to 5 September 1986; An IFFIT training course was held in 1986; Report of the results of feeding trials of irradiated food in human volunteers in the People's Republic of China; An up-dated list of clearances of irradiated foods in different countries. DOE

N88-20005*# Alabama Univ., Huntsville. Dept. of Psychology.
OMV MAN/SYSTEM SIMULATION INTEGRATION: A PRELIMINARY ANALYSIS AND RECOMMENDATION Final Report
JON G. ROGERS 11 Apr. 1988 50 p
(Contract NAG8-546)
(NASA-CR-182602; NAS 1.26:182602) Avail: NTIS HC A03/MF A01 CSCL 05H

The Orbital Maneuvering Vehicle (OMV) presents a series of challenges to the human operator. Some are unique to the OMV system itself, and are largely due to remote control versus control from the cockpit. Other challenges are not necessarily unique to the OMV, but are characteristic of many man-machine space flight systems. All of these challenges affect the operator's ability to perform his portion of the mission, and could lead to human error which might jeopardize the vehicle, mission, or both. It is imperative to make every effort to design the control and displays to facilitate the operator's task. The experimental program should address the perceptual, mediational, and motor dimensions of operator performance. With this in mind, a literature review with relevant design considerations was initiated, and a comprehensive outline of control/display parameters were developed. Out of this, a series of questions not answered in the literature was derived which can be converted into experimental protocols for the simulation program. A major task of the aircraft pilot as well as the OMV operator is prediction. Certain display principles have proved to enhance the pilot's ability to predict. A brief examination of some of these principles in relationship to OMV may be useful. B.G.

N88-20006*# Texas A&M Univ., College Station.
REGENERATIVE LIFE SUPPORT SYSTEM RESEARCH Progress Report, Sep. 1987 - Mar. 1988
Mar. 1988 326 p
(Contract NAG9-253)
(NASA-CR-182606; NAS 1.26:182606; SRC-4-5873-2) Avail: NTIS HC A15/MF A01 CSCL 06K

Sections on modeling, experimental activities during the grant period, and topics under consideration for the future are contained. The sessions contain discussions of: four concurrent modeling approaches that were being integrated near the end of the period (knowledge-based modeling support infrastructure and data base management, object-oriented steady state simulations for three concepts, steady state mass-balance engineering tradeoff studies, and object-oriented time-step, quasidynamic simulations of generic concepts); interdisciplinary research activities, beginning with a discussion of RECON lab development and use, and followed with discussions of waste processing research, algae studies and subsystem modeling, low pressure growth testing of plants, subsystem modeling of plants, control of plant growth using lighting and CO2 supply as variables, search for and development of lunar soil simulants, preliminary design parameters for a lunar base life support system, and research considerations for food processing in space; and appendix materials, including a discussion of the CELSS Conference, detailed analytical equations for mass-balance modeling, plant modeling equations, and parametric data on existing life support systems for use in modeling. Author

N88-20007# Army Research Inst. of Environmental Medicine, Natick, Mass.
PERSPECTIVES IN MICROCLIMATE COOLING INVOLVING PROTECTIVE CLOTHING IN HOT ENVIRONMENTS
KAREN L. SPECKMAN, ANNE E. ALLAN, MICHAEL N. SAWKA, ANDREW J. YOUNG, and STEPHEN R. MUZA Sep. 1987 73 p
(AD-A188370) Avail: NTIS HC A04/MF A01 CSCL 05H

The effectiveness of microclimate cooling systems in alleviating the thermal burden imposed upon soldiers by the wearing of chemical protective clothing under varying environmental conditions

has been examined in a series of studies conducted by the U.S. Army Research Institute of Environmental Medicine on the copper manikin, in the climatic chambers and in the field. Liquid-cooled undergarments (LCU) and air-cooled vests (ACV) were tested under environmental conditions from 29 C, 85 percent rh to 52 C, 25 percent rh. These parameters were chosen to stimulate conditions which may be encountered in either armored vehicles, or in desert or tropic climates. We have reviewed seven studies using LCU (including two ice-cooled vests) and six studies using ACV. LXU tests investigated the effect on cooling when the proportion of total skin surface covered by the LCU was varied. ACV tests examined the effects on cooling during different combinations of air temperature, humidity and air flow rates. Additionally, these combinations were tested at low and moderate metabolic rates. The findings from these LCU and ACV studies demonstrate that: (1) cooling can be increased with a greater body surface coverage by a LCU, and (2) evaporative cooling with an ACV is enhanced at low metabolic rates with optimal combinations of air flow rates and dry bulb/dew point temperatures, resulting in the extension of tolerance time. The application of these findings to industrial work situations is apparent. GRA

N88-20008# Naval Submarine Medical Research Lab., Groton, Conn.

FIBROUS GLASS AEROSOLS: A LITERATURE REVIEW

BRUCE R. LAVERTY 2 Oct. 1987 21 p

(AD-A188420; NSMRL-SR-87-2) Avail: NTIS HC A03/MF A01

CSCL 05H

The submarine atmospheric is a topic of interest, considering that once submerged, the craft relies on its own electrostatic precipitators (ESP's), scrubbers, and filters to create, ideally, an environment with minimal aerosolized toxic materials and other by-products. Historically, atmosphere sampling aboard nuclear submarines has shown contaminants. Other contaminants include: ozone, (major source: by-product of the ESP's); Freon, (major source: ship's refrigeration system and air conditioning plants); hydrogen, (major source: ship's batteries); carbon dioxide, (major source: human respiration); and carbon monoxide, (major source: cigarette smoking). Contaminants tested for but not found were elemental mercury, and asbestos. Considering that asbestos is no longer recommended for use, secondary to its carcinogenci and co-carcinogenic qualities, fibrous glass has become a common substitute. One use of fibrous glass aboard the Ohio class submarine is acoustic and thermal insulation around perforated ducting, which runs through many exposed, high traffic spaces, i.e., crew's berthing spaces. Although the raw fibrous glass is protected from the environment it is possible, through natural wear and tear of the housing material, that at some time the insulating material may become exposed and mechanically aerosolized. Obvious questions then are: (1) do submarine aerosols contain fiber glass, and (2) are there health hazards related to the inhalation of these fibers. This paper reviews our current knowledge as to the health hazards of exposure. GRA

N88-20009# Human Engineering Labs., Aberdeen Proving Ground, Md.

USER PERCEPTIONS OF SIDE-ARM FLIGHT CONTROL IN ROTARY-WING AIRCRAFT Final Report

JOHN K. SCHMIDT, PAUL E. ELLIOTT, and WILLIAM B. DEBELLIS Oct. 1987 26 p

(AD-A188519; HEL-TN-7-87) Avail: NTIS HC A03/MF A01

CSCL 01D

It is anticipated that conventional primary flight controls will be replaced by side-arm devices in future rotary-wing aircraft. Side-arm controls are projected to have certain ergonomic advantages that will greatly enhance a helicopter pilot's mission capability. Several studies have been conducted to test their feasibility, their handling qualities, and the optimal configuration, but little work has been done to anticipate what human factors implications side-arm controls will have once integrated into the cockpit. Sixteen scout and attack helicopter pilots were interviewed regarding side-arm primary flight controls. Interviewee responses reflected some new as well as already identified problem areas. The authors suggest that these issues be addressed before actual implementation is made. GRA

N88-20010# Illinois Univ., Urbana. Dept. of Psychology.

VISUAL DISPLAY REPRESENTATION OF MULTIDIMENSIONAL SYSTEMS: THE EFFECT OF INFORMATION CORRELATION AND DISPLAY INTEGRALITY Interim Report, Mar. 1985 - Mar. 1986

ELIZABETH J. CASEY and CHRISTOPHER D. WICKENS Dec. 1987 40 p

(Contract MDA903-83-K-0255; DA PROJ. 201-61102-B-74-F)

(AD-A188655; ARI-RN-87-80) Avail: NTIS HC A03/MF A01

CSCL 23B

This research note provides data on the use of object and schematic face displays to present dynamic multivariate system information. Twelve subjects detected and diagnosed failures in a system whose variables were intercorrelated. Three visual analog displays (a bar graph display, a pentagon, and a schematic face display) represented the system. These displays differed in the degree of integrality of their component features. Detection performance yielded a speed/accuracy tradeoff with little evidence of superiority for any of the displays. Diagnostic performance showed a superiority for the more separable display, however. This superiority was attributed to the fact that diagnosis required subjects to focus attention directly on a single attribute, a focussing that benefited from a display which separated the attributes from one another. The results of the study are discussed in a broader context of other studies which looked at the proximity of information. The data also demonstrated the promise of the schematic face display as a means of displaying dynamic system information.

GRA

N88-20186# McDonnell-Douglas Helicopter Co., Mesa, Ariz. Engineering and Training Simulation.

REDUCING ROTARY WING AIRCRAFT DEVELOPMENT TIME/COST THROUGH THE USE OF SIMULATION

S. RAMACHANDRAN, W. E. RICHESON, and D. C. BORGMAN *In* AGARD. Flight Vehicle Development Time and Cost Reduction 8 p Sep. 1987

Avail: NTIS HC A14/MF A01

Advances in simulation technology have made man-in-the-loop simulation highly capable, desirable and affordable for rotorcraft design and development. Since the use of simulation as a design tool is relatively new to the helicopter industry, the U.S. Army/McDonnell Douglas Helicopter Company AH-64A (Apache) is used as an example to evaluate the potential cost and time savings realizable through the use of simulation. It is shown that a modern full mission engineering simulator when used effectively could provide cost savings of several millions of dollars, and could reduce helicopter development and flight test by at least a year or two. The means to exploit the full potential of simulation during rotorcraft design, development, and test are also discussed.

Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A88-30740
APPLICATION OF TWO-STEP LASER MASS SPECTROMETRY TO COSMOGEOCHEMISTRY - DIRECT ANALYSIS OF METEORITES
JONG HOON HAHN, RENATO ZENOBI, RICHARD N. ZARE (Stanford University, CA), and JEFFREY L. BADA (California, University, La Jolla) Science (ISSN 0036-8075), vol. 239, March 25, 1988, p. 1523-1525. Research supported by the University of California. refs
(Contract NSF CHE-85-05926)

Two-step laser desorption/laser multiphoton ionization mass spectrometry was used to analyze polycyclic aromatic hydrocarbons in C1, C2, ad C3 carbonaceous chondrites and in some ordinary chondrites. Parent ion peaks of polycyclic aromatic hydrocarbons dominate the mass spectra at an ionization wavelength of 266 nm. The concentration of phenanthrene in the Murchison meteorite was found to be 5.0 ppm. K.K.

A88-31476
1986 ISSOL MEETING, 5TH, BERKELEY, CA, JULY 21-25, 1986, PROCEEDINGS. PART 2
JAMES P. FERRIS, ED. (Rensselaer Polytechnic Institute, Troy, NY) Meeting sponsored by the International Society for the Study of the Origin of Life. Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, 158 p. For individual items see A88-31477 to A88-31487.

This volume includes papers on the problem of the origin of life in the context of developments in biology; the system perspective of the earth and its life; new prospects for deducing the evolutionary history of metabolic pathways in prokaryotes, with aromatic biosynthesis as a case-in-point; Archaebacterial class I and class II aldolases from extreme halophiles; the degeneracy rule of genetic code; and a critical analysis of prebiotic ribose synthesis. Additional papers are on the cybernetic origins of replication, the evolution of E. coli tRNA(Trp), a theoretical investigation of the role of clay edges in prebiotic peptide formation, montmorillonite as a multifunctional mineral catalyst for the prebiological formation of phosphate esters, a statistical examination of self-ordering of amino acids in proteins, and the origin of the life event. I.S.

A88-31481
PREBIOTIC RIBOSE SYNTHESIS - A CRITICAL ANALYSIS
ROBERT SHAPIRO (New York University, NY) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 71-85. refs

This paper examines the literature which supports claims that D-ribose was readily available on the prebiotic earth. The single reaction cited in favor of prebiotic ribose synthesis is the polymerization of formaldehyde (the formose reaction) in the presence of limestone; ribose has been identified as a minor product (1 percent or less) of this reaction, but only in the presence of concentrated formaldehyde. Moreover, the complex sugar mixture produced in the formose reaction is rapidly destroyed under the reaction conditions. Finally, nitrogenous substances, if present in the prebiotic biosphere, would interfere with the formose reaction by reacting with formaldehyde, the sugar intermediates, and the sugar products in undesirable ways. It is concluded that the evidence currently available does not support the claim that ribose was synthesized on the prebiotic earth, except for brief periods of time, in low concentration, and under conditions unsuitable for nucleoside synthesis. I.S.

A88-31484* Molecular Research Inst., Palo Alto, Calif.
THEORETICAL INVESTIGATION OF THE ROLE OF CLAY EDGES IN PREBIOTIC PEPTIDE BOND FORMATION. II - STRUCTURES AND THERMODYNAMICS OF THE ACTIVATED COMPLEX SPECIES
JACK R. COLLINS, GILDA H. LOEW, BRIAN T. LUKE (Molecular Research Institute, Palo Alto, CA), and DAVID H. WHITE (Santa Clara, University, CA) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 107-119. refs
(Contract NCC2-86)

Molecular orbital calculations are used to study amino acid activation by anhydride formation in neutral phosphates and in tetrahedral silicate and aluminate sites on clay edges. The results agree with previous ab initio studies of Luke et al. (1984) on the reactant species. Relative heats of formation of the anhydrides indicate the extent of anhydride formation to be the greatest for Al and the least for phosphate, which is the same order as the stability of hydrolysis. I.S.

A88-31485
MONTMORILLONITE - A MULTIFUNCTIONAL MINERAL CATALYST FOR THE PREBIOLOGICAL FORMATION OF PHOSPHATE ESTERS
JAMES P. FERRIS, CHUN-HSIEN HUANG, and WILLIAM J. HAGAN, JR. (Rensselaer Polytechnic Institute, Troy, NY) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 121-133. refs
(Contract NSF CHE-85-06377)

The possibility that montmorillonite clays may serve to bind and concentrate 3-prime-nucleotides and thus promote formation of cyclic nucleotides was explored. In the experiments, incubating (for 16-20 h) a suspension of one of a series of homoionic montmorillonites mixed with an aqueous solution of 3-prime-AMP and a cyclization-promoting agent (either diaminomaleonitrile, DAMN, or diiminosuccinonitrile, DISN. Concentrations of 3-prime-AMP, DAMN, DISN, the quantity of clay, and the presence or absence of 0.2 PIPES buffer were varied in a systematic fashion. The best yields of 2-prime-3-prime-AMP were obtained using Na(+)- or Ca(2+)-montmorillonite, resulting in yields comparable with that obtained using the native clay. When a soluble metal ion was used in place of the metal-ion-montmorillonite complex, no cyclic AMP was detected, establishing the catalytic role of the clay surface in the formation of cyclic AMP. I.S.

A88-31486
A STATISTICAL EXAMINATION OF SELF-ORDERING OF AMINO ACIDS IN PROTEINS
RANDALL A. KOK, JOHN A. TAYLOR (Millikin University, Decatur, IL), and WALTER L. BRADLEY (Texas A & M University, College Station) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 135-142. refs

Steinman and Cole (1967) have claimed that amino acids will naturally assume a nonrandom sequence when polymerized into polypeptides, basing their claim on a comparison of the frequency with which various dipeptide bonds were found to form in dilute amino acid solution with the dipeptide frequencies acutually observed in several proteins. This paper examines this claim statistically by reanalyzing (for actual sequences) the ten proteins studied by Steinman and Cole plus other proteins for which all amino acid sequences are known. Actual dipeptide frequencies were determined using a computer program which was written to count the various dipeptides, once a given protein sequece was entered. Random frequencies of the various dipeptides were calculated, and experimental dipeptide frequencies were obtained from Steinman and Cole data. The chi-square tests showed no statistical correlation at all between experimental dipeptide frequencies and actual frequencies. I.S.

A88-31487
ON THE ORIGIN OF LIFE EVENT
F. G. MOSQUEIRA (Universidad Nacional Autonoma de Mexico, Alvaro Obregon, Mexico) (International Society for the Study of the Origin of Life, Meeting, 5th, Berkeley, CA, July 21-25, 1986) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 18, no. 1-2, 1988, p. 143-156. refs

On the assumption of a uniform sample space probability hypothesis the maximum number of polypeptides (or other kind of polymers) that could be synthesized in the prebiotic earth is estimated. Besides, on the basis of five premises that are postulated as indispensable requirements for the origin of a living system, and under the constraints of a protein-nucleic acid chemistry, it is concluded categorically that the origin of life event could not be the result of unbiased polymerization phenomena. On the contrary, biased and specific patterns of polymerization had to be an essential component in this fundamental event. Finally, several theories on the origin of life and complementary concepts, like hypercyclic organization and self-organization phenomena in dissipative structures, are discussed in the light of the conclusions arrived at in this work. Author

N88-19929# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Aerospace Medicine.
EUROPEAN ACTIVITIES IN EXOBIOLOGICAL RESEARCH IN SPACE
G. HORNECK *In* ESA. Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 185-192 Dec. 1987
Avail: NTIS HC A15/MF A01

The history of exobiology research is reviewed, and research domains and techniques are described. The relation of cosmic organic compounds to life; interplanetary or interstellar transfer of life; life as a planetary phenomenon; and the physical and chemical boundary conditions for life are considered. European exobiology missions, including exposure of biological systems to components of free space, EURECA experiments, and exploration of the planetary system are discussed. Space environment simulation experiments are mentioned. ESA

N88-19954# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
WHY LIFE SCIENCE IN SPACE? THE NEXT STEP TO GO BEYOND
W. OCKELS *In its* Proceedings of the 3rd European Symposium on Life Sciences Research in Space p 315-316 Dec. 1987
Avail: NTIS HC A15/MF A01

The utility for life sciences of spaceborne research is discussed. ESA

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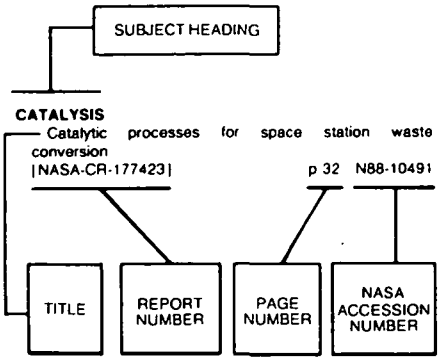

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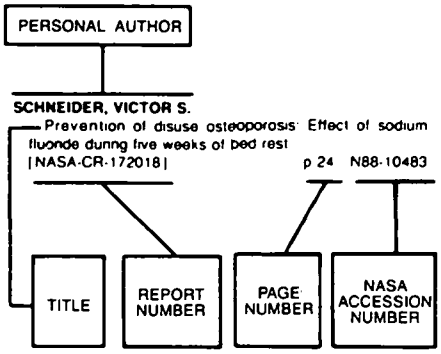

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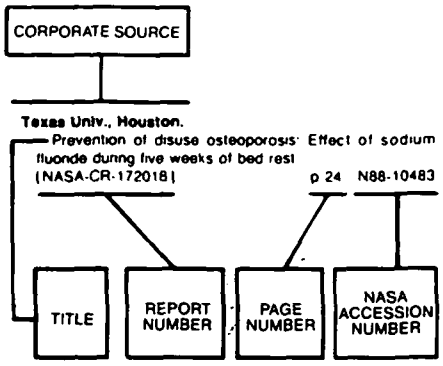

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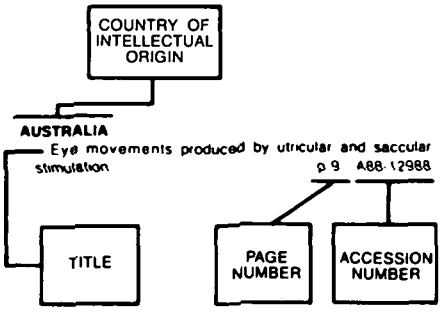

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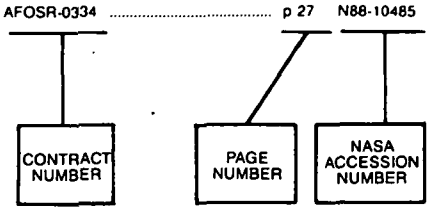

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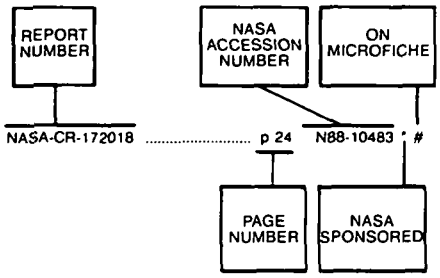

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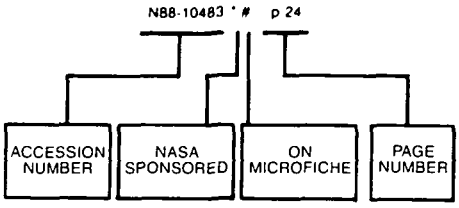

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