NASA

Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

NASA SP-7011(309)
April 1988

(NASA-SP-7011(309)) AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 309) (NASA) 57 p

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Aerospace Medicine and Biology

NASA SP-7011(309)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 309)

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 March 1988 in

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

Scientific and Technical Information Division 1988
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 136 reports, articles and other documents announced during March 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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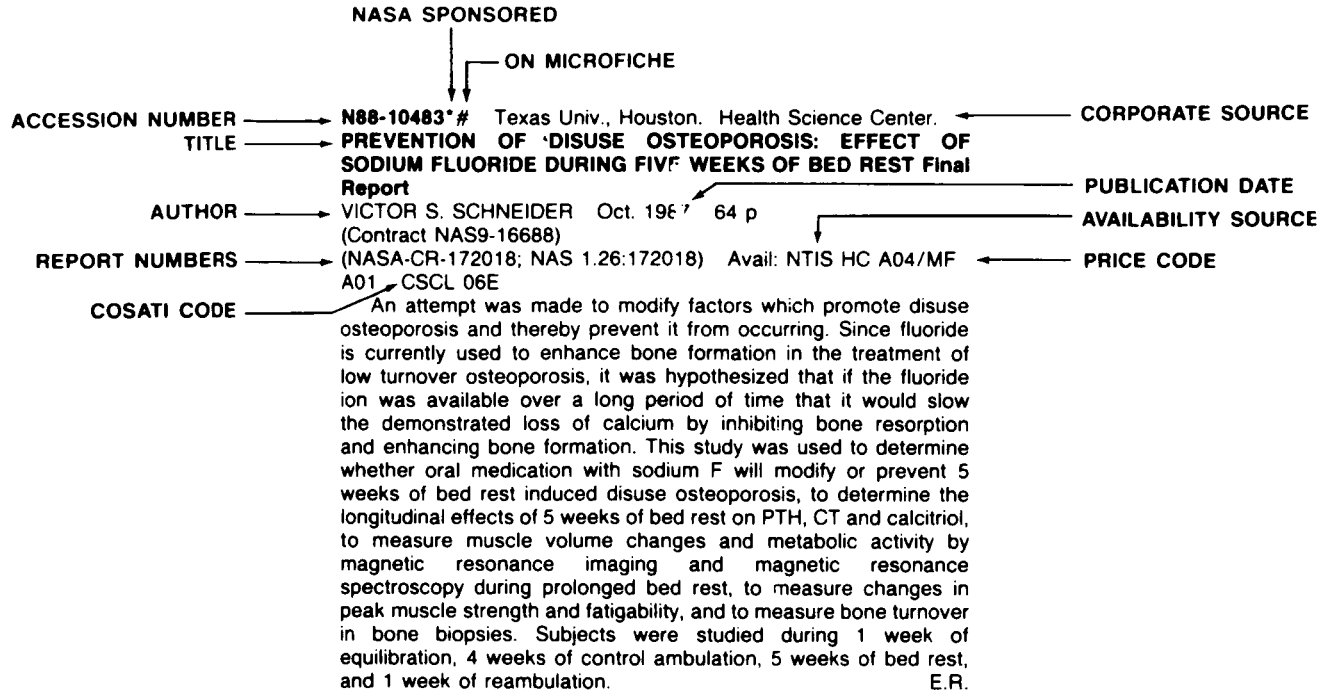
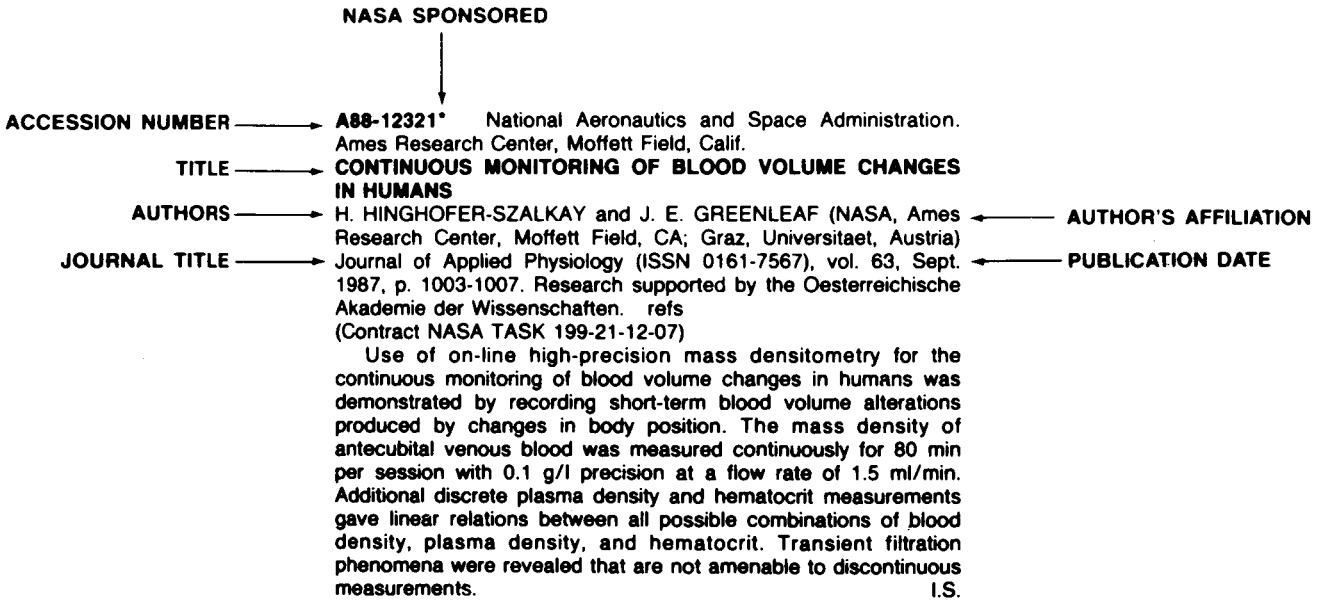


TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 309)

APRIL 1988

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LIFE SCIENCES (GENERAL)

A88-17224
CIRCANNUAL RHYTHMS: ENDOGENOUS ANNUAL CLOCKS IN THE ORGANIZATION OF SEASONAL PROCESSES
EBERHARD GWINNER (Max-Planck-Institut fuer Verhaltensphysiologie, Andechs, Federal Republic of Germany) Berlin and New York, Springer-Verlag (Zoophysiology. Volume 18), 1986, 164 p. refs

A detailed discussion of circannual rhythms is presented. Evidence for circannual rhythms in various organisms is reviewed, and the properties of free-running circannual rhythms are examined, including the degree of persistence and range of permissive conditions, the range of circannual period length and transients, the dependence of period on external conditions, and the synchronization of circannual rhythms. The mechanisms of circannual organization are discussed, including interactions with the circadian system, the interrelationship among different circannual functions, and components of specific circannual functions. The adaptive significance of circannual rhythms is addressed. C.D.

A88-17952
EFFECT OF ULTRAVIOLET IRRADIATION ON THE ACTIVITY OF CYTOCHROMES OF THE P-450-DEPENDENT SYSTEM OF MICROSOMAL OXIDATION IN THE RAT LIVER [VLIIANIE UL'TRAFIOLETOVOGO OBLUCHENIIA NA AKTIVNOST' TSITOKHROM R-450-ZAVISIMOI SISTEMY MIKROSOMAL'NOGO OKISLENIIA V PECHENI KRYS]
A. KHAKIMOV, L. I. DEEV, M. IA. AKHALAIA, A. G. PLATONOV, A. K. KASYMOV (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR; Andizhanskii Gosudarstvennyi Pedagogicheskii Institut, Andizhan, Uzbek SSR) et al. Akademiia Nauk Uzbekskoi SSR, Doklady (ISSN 0134-4307), no. 7, 1987, p. 53-55. In Russian. refs

A88-17958
PRIMARY PROCESSES OF ELECTRON TRANSFER AND THE STRUCTURAL ORGANIZATION OF THE REACTION CENTERS OF PHOTOSYNTHESIS [PERVICHNYE PROTSESSY PERENOSA ELEKTRONA I STRUKTURNAIA ORGANIZATSIIA REAKTSIONNYKH TSENTROV FOTOSINTEZA]
V. A. SHUVALOV and V. A. KLIMOV (AN SSSR, Institut Pochvovedeniia i Fotosinteza, Pushchino, USSR) Biofizika (ISSN 0006-3029), vol. 32, Sept.-Oct. 1987, p. 814-829. In Russian. refs

The relationship between the structure of the reaction centers (RCs) of photosynthetic systems (i.e., the composition of the RC subunits, the molecular structure of proteins, and the spatial organization of chromophores) and primary electron transfer in the RCs of various photosynthesizing organisms is discussed. Consideration is given to the types of RCs that constitute the reaction centers of two different photosystems, I and II, and to the differences in the photosystems and of their RCs in purple bacteria, green bacteria, and green plants. The differences in the RC structure of these organisms are correlated with the differences in the processes of electron transfer in these RCs. I.S.

A88-17960
CHANGES IN THE BLOOD OXYGEN-TRANSPORT CHARACTERISTICS IN ANIMALS EXPOSED TO A HIGH-DENSITY NORMOXIC GASEOUS MEDIUM [IZMENENIIA KISLORODTRANSPORTNYKH SVOISTV KROVI U ZHIVOTNYKH POSLE PREBYVANIIA V NORMOKSICHESKOI GAZOVOI SREDE POVYSHENNOI PLOTNOSTI]
A. M. VOLZHSKAIA and G. V. TROSHIKHIN (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, July 1987, p. 908-912. In Russian. refs

The effect of breathing high-density normoxic gas mixture on the oxygen-transport characteristics of blood was investigated in rats exposed for 5 or 10 days to a high-density (34 g/l) normoxic nitrogen-oxygen atmosphere. Measured immediately after the exposure and 24 hours later, the hematocrit value, the number of erythrocytes, the contents of hemoglobin and 2,3-diphosphoglycerate in erythrocytes, and the plasma erythropoiesis activity in exposed rats were found to be elevated in comparison with unexposed controls. The results demonstrate that rats exposed to a high-density normoxic atmosphere develop compensatory changes in the blood oxygen transport system which are similar to those induced by hypoxia. I.S.

A88-17961
EFFECT OF OXYGEN SUPPLY ON THE ENERGETICS OF SKELETAL AND CARDIAC MUSCLES OF THE RAT UNDER CONDITIONS OF MUSCLE PERFUSION [VLIIANIE KISLORODNOGO SNABZHENIIA NA ENERGETIKU SKELETNOI I SERDECHNOI MYSHTS KRYSY V USLOVIIAKH IKH PERFUZII]
IU. S. ALIUKHIN (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, July 1987, p. 920-925. In Russian. refs

The effect of oxygen supply on the energy expenditure of a resting organ was investigated using isolated perfused preparations of rat soleus muscle and heart and comparing the effects of the surplus oxygen (40 percent oxygen content for the soleus and 95 percent for the heart) on the parameters of energy expenditure in the two muscle systems. For the soleus muscle, the relationship between the energy expenditure parameter (based on the lactate production) and the oxygen supply was linear for oxygen delivery up to 60-100 nmol/g per sec, but at higher oxygen levels, the correlation disappeared. In the resting heart, this relationship held up to 460 nmol/g per sec oxygen supply rate. The efficiency of the soleus contraction increased upon the decrease in the oxygen supply below 40-80 nmol/g per sec. I.S.

A88-17962
INVESTIGATION OF HYPOTHALAMIC MECHANISMS REGULATING THE ACTIVITY OF RESPIRATORY NEURONS OF THE MEDULLA DURING HYPOXIA [ISSLEDOVANIE GIPOTALAMICHESKIKH MEKHANIZMOV REGULIATSII AKTIVNOSTI DYKHATEL'NYKH NEIRONOV PRODOLGOVATOGO MOZGA V USLOVIIAKH GIPOKSII]
M. A. KARAPETIAN, N. S. AKOPIAN, and O. G. BAKLAVADZHIAN (Erevanskii Gosudarstvennyi Universitet, Yerevan, Armenian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, July 1987, p. 926-932. In Russian. refs

The effect of acute hypoxia on the response of electrically stimulated neurons from different hypothalamic nuclei and on the respiration in general was investigated using rats with implanted electrodes. Rats were exposed to simulated altitudes of 4000-5000 or 8500-9000 m, and the neuronal impulse activity was measured before, during, and after hypobaric exposures. It was found that, while the stimulation of the hypothalamus activates the medullary respiratory and reticular neurons under normal conditions, at the altitude of 4500-5000 m, the influence of the tetanic stimulation of hypothalamus was less, though it prevailed over its inhibiting effect. At the altitude of 8000-9000 m (against the background of hypoxic depression of unit activity), the stimulation of hypothalamus exhibited mainly a stimulating effect. I.S.

A88-18051
AN ATP-DEPENDENT CA(2+)-TRANSFER SYSTEM OF THE RAT BRAIN AT THE EARLY STAGE OF ACUTE RADIATION EFFECT [ATF-ZAVISIMAIA CA/2+/-TRANSPORTIRUIUSHCHAIA SISTEMA MOZGA KRYS NA RANNEM ETAPE OSTROGO LUCHEVOGO VOZDEISTVIIA]
O. P. MATYSHEVSKAIA, A. N. VASIL'EV, and N. E. KUCHERENKO (Kievskii Gosudarstvennyi Universitet, Kiev, Ukrainian SSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Sept.-Oct. 1987, p. 609-613. In Russian. refs

A88-18052
THE RELEASE OF MYOGLOBIN INTO THE BLOOD OF IRRADIATED SWINE PARALLEL TO A DECREASE IN THE ACTIVITY IN THE BLOOD OF CERTAIN ENZYMES, MARKERS OF MUSCLE INJURY [VYBROS MIOGLOBINA V KROV' OBLUCHENNYKH SVINEI PRI SNIZHENII AKTIVNOSTI V KROVI RIADA FERMENTOV-MARKEROV POVREZHDENIIA MYSHECHNOI TKANI]
L. N. UL'IANENKO, G. M. ROTT, I. V. ROZHINSKAIA, A. G. IPATOVA, A. I. BURTSEV (AMN SSSR, Nauchno-Issledovatel'skii Institut Meditsinskoi Radiologii, Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziastvennoi Radiologii, Obninsk, USSR) et al. Radiobiologiia (ISSN 0033-8192), vol. 27, Sept.-Oct. 1987, p. 625-629. In Russian. refs

A88-18053
THE EFFECT OF THERAPEUTIC APPLICATION OF PURINE DERIVATIVES ON THE LIFE SPAN OF IRRADIATED ANIMALS [VLIIANIE TERAPEVTICHESKOGO PRIMENENIIA PURINOVYKH PROIZVODNYKH NA PRODOLZHITEL'NOST' ZHIZNI OBLUCHENNYKH ZHIVOTNYKH]
E. A. PROKUDINA, A. E. BOROVITSKAIA, N. O. KADYROVA, and L. P. RZHONSNITSKAIA (Tsentral'nyi Nauchno-Issledovatel'skii Rentgenoradiologicheskii Institut Leningrad, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Sept.-Oct. 1987, p. 653-656. In Russian. refs

The effect of purine derivatives and of the timing of the treatment on the survival rate of irradiated animals was studied in rats irradiated by X-rays before being treated with either meradine or etimizole. One group received meradine 24 h after irradiation and then 5.5 months later; the second group received meradine 1 month after irradiation; and the third group received successive infusions of etimizole 1, 3.5, and 7 months following irradiation. The survival of rats in the first group did not differ from that of the control group (i.e., the unirradiated rats injected with meradine), while rats that received treatment by either drug one month following irradiation exhibited higher survival rates than the untreated animals. Successive treatments with etimizole 3.5, 5.5, or 7 months later did not affect the survival rate. It is suggested that purine derivatives increase the regeneration and compensation of radiation-induced lesions at the time of clinical recovery, reducing an irreversible component of radiation damage. I.S.

A88-18054
NEUROEFFECTS OF LONG-TERM MICROWAVE IRRADIATION - SYSTEMIC, NEURONAL, AND ELECTRON-MICROSCOPE STUDIES [NEIROEFFEKTY DLITEL'NOGO DEISTVIIA MIKROVOLN - SISTEMNOE, NEIRONAL'NOE I ELEKTRONNO-MIKROSKOPICHESKOE ISSLEDOVANIIA]
N. B. SUVOROV, M. V. MEDVEDEVA, and N. N. VASILEVSKII (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Sept.-Oct. 1987, p. 674-679. In Russian. refs

The functional and physical effects of long-term microwave irradiation on the activity and morphology of the brain were studied in cats fitted with implanted electrodes and kept in an electromagnetic field (2375 mHz, 500 microW/sq cm) for 200 h. The EEG biorhythms measured in irradiated and unexposed cats were correlated with the results of electron-microscope examinations. The results revealed the presence in irradiated cats of functional disorders in the neuronal activity of several brain formations, which were associated with a physical injury to axodendritic synapses that provide a morphological bond between the respective brain formations. I.S.

A88-18055
THE RELATIONSHIP BETWEEN THE RADIOPROTECTIVE EFFECT OF HELIUM-NEON LASER RADIATION IN IRRADIATED BACTERIAL CELLS AND THE TIME INTERVAL BETWEEN TWO TYPES OF IRRADIATION [ZAVISIMOST' RADIOZASHCHITNOGO DEISTVIIA GELII-NEONOVOGO LASERNOGO IZLUCHENIIA NA KLETKI BAKTERII OT INTERVALA VREMENI MEZHDU DVUMIA VIDAMI OBLUCHENIIA]
K. SH. VOSKANIAN, N. V. SIMONIAN, TS. M. AVAKIAN, and G. M. AVAKIAN (AN ASSR, Fizicheskii Institut; Erevanskii Gosudarstvennyi Universitet, Yerevan, Armenian SSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Sept.-Oct. 1987, p. 708-711. In Russian.

A88-18650
BIPHASIC VENTILATORY RESPONSE OF ADULT CATS TO SUSTAINED HYPOXIA HAS CENTRAL ORIGIN
MARTIN VIZEK, CHERYL K. PICKETT, and JOHN V. WEIL (Colorado, University, Denver) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Oct. 1987, p. 1658-1664. refs
(Contract NIH-HL-14985)

The mechanism responsible for the decrease of ventilation ('the roll-off' effect) during sustained hypoxia was investigated using 5 awake and 14 anesthetized cats. The roll-off effect was found in both groups of cats. Isocapnic hypoxia was found to initially increase ventilation as well as phrenic and carotid sinus nerve activity. During the roll-off, ventilation and phrenic nerve activity decreased similarly, while the carotid sinus nerve activity remained unchanged. Thus, the ventilatory roll off was reflected in phrenic but not in carotid sinus nerve activity, indicating that the mechanism responsible for the secondary decrease in ventilation lies within the central nervous system. I.S.

A88-18731* California Univ., Riverside.
FACILITATION OF THE GROWTH OF PROTEIN CRYSTALS BY HETEROGENEOUS/EPITAXIAL NUCLEATION
ALEXANDER MCPHERSON (California, University, Riverside) and PAUL J. SHLICHTA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) (U.S. Army, DARPA, NASA, et al., American Conference on Crystal Growth, 7th, Monterey, CA, July 12-17, 1987) Journal of Crystal Growth (ISSN 0022-0248), vol. 85, no. 1-2, Nov. 1987, p. 206-214. refs

A preliminary exploration has been made of the effect of inorganic crystals on the nucleation of protein crystals. Four

representative proteins were crystallized by the vapor diffusion technique in the presence of fifty species of inorganic crystals. A substantial decrease in critical supersaturation was caused by thirty nucleants for canavalin and by seven to fifteen nucleants for the other proteins. Several cases of anomalous morphology were observed, as well as one instance of epitaxy, i.e., lysozyme on apophyllite. It has thus been shown that inorganic crystals can be used as heterogeneous nuclei or epitaxial substrates for facilitating reliable and controlled nucleation in automated protein crystal growth experiments. Author

A88-19039
WAS THE ARCHAEAN BIOSPHERE UPSIDE DOWN?
JAMES C. G. WALKER (Michigan, University, Ann Arbor) Nature (ISSN 0028-0836), vol. 329, Oct. 22, 1987, p. 710-712. NSF-supported research. refs

It is argued that, on the anoxic Archaean earth, the oxidized partner in photosynthesis was probably iron. As oxidized iron is markedly less soluble and mobile than the reduced partner, organic carbon, differential transport in the Archaean biosphere would have had an effect just the opposite of that in the modern biosphere. The oxidized partner would have settled downward more rapidly than the reduced partner, resulting in the accumulation of excess oxidant in sediments and stagnant pools. An equivalent excess of the more volatile reduced compounds would have been left behind in ocean and atmosphere in the form of dissolved organic carbon and gaseous hydrocarbons. On average, therefore, the Archaean biosphere may have been oxidizing at the bottom and reducing on top. C.D.

A88-19327
NEURONAL MECHANISMS OF LEARNING [NEIRONNYE MEKHANIZMY OBUCHENIIA]
VIKTOR MAKSIMOVICH STOROZHUK Kiev, Izdatel'stvo Naukova Dumka, 1986, 264 p. In Russian. refs

This book discusses the synaptic, neuronal, and interneuronal processes which control the elementary and associative learning mechanisms in invertebrates and in warm-blooded animals. Classical and instrumental conditioned reflexes are examined, with special consideration given to the dynamics of neuronal impulse reactions during the formation, realization, extinction, and differentiation of conditioned reflexes. Cellular analogues of the elementary and associative forms of learning are analyzed. Special attention is given to the neuronal organization of purposeful movements. I.S.

A88-19347
PHYSIOLOGICAL MECHANISMS OF STRESS AND ADAPTATION UNDER THE EFFECT OF ACUTE STRESS AGENTS [FIZIOLOGICHESKIE MEKHANIZMY STRESSA I ADAPTATSII PRI OSTROM DEISTVII STRESS-FAKTOROV]
FEDOR IVANOVICH FURDUI Kishinev, Izdatel'stvo Shtiintsa, 1986, 256 p. In Russian. refs

This book presents an overview of data on the development of stress reactions and the mechanisms of adaptation to stress. New information is given on the effect of the diurnal rhythms on the development of stress and adaptation reactions and on the significance of different endocrine glands in the resistance to stress and the ability of an organism to adapt. The sequence of the engagement of different brain formations and endocrine glands in the response reactions to acute stress is examined. The roles of the cholinergic, sympathoadrenal, and hypothalamic-hypophyseal-neurosecretory systems in the formation of both stress and adaptation reactions are discussed together with the mechanisms acting in the development of the integral response reaction. Special attention is given to the revision of Selye's concept of stress. I.S.

A88-19449
ADAPTATION OF AN ORGANISM TO STRESS SITUATIONS AND THE PREVENTION OF CARDIAC-RHYTHM DISTURBANCES [ADAPTATSIIA ORGANIZMA K STRESSORNYM SITUATSIIAM I PREDUPREZHDENIE NARUSHENII RITMA SERDTSA]
F. Z. MEERSON (AMN SSSR, Nauchno-Issledovatel'skii Institut Obshchei Patologii i Patologicheskoi Fiziologii, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 18, Oct.-Dec. 1987, p. 56-79. In Russian. refs

The systemic, cellular, and molecular mechanisms responsible for stress-induced cardiac-rhythm disturbances, such as atrial fibrillation, arrhythmia, and cardiac arrest, are discussed together with the internal defense mechanisms that are activated by the stress and act to prevent or reduce the expression of stress-induced disturbances. Special consideration is given to the protective role of adaptation and to the effect of antioxidants. It was found that periodically repeated electric-shock treatments lower the level of postischemic ectopic activation and thus partially prevent the development of fibrillation; an administration of antioxidants, such as ionol, reinforces the effect of such treatment. I.S.

A88-19450
THE PHYSIOLOGICAL MECHANISMS OF BIOLOGICAL RHYTHMS [O FIZIOLOGICHESKIKH MEKHANIZMAKH BIOLOGICHESKIKH RITMOV]
N. A. AGADZHANIAN, A. A. BASHKIROV, and I. G. VLASOVA (Universitet Druzhby Narodov, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 18, Oct.-Dec. 1987, p. 80-104. In Russian. refs

This paper presents a classification scheme for a continuous spectrum of physiological rhythms that includes all known temporal rhythm ranges. Consideration is given to the circadian and the seasonal biorhythms and to the factors that regulate the circadian and seasonal physiological changes and the associated behavior regimes, such as sleep-wakefulness rhythm, motor and the emotional activity changes, and food intake. Special attention is given to the rhythms of the central nervous system and to the role of biorhythms in forming adaptive reactions to extreme environmental conditions, such as hypoxia, hypothermia, and hyperthermia. Data are presented which support the concept of endogenously controlled (and exogenously corrected) biological clocks. I.S.

A88-19618
EFFICIENCY OF SULFUR-CONTAINING RADIATION PROTECTORS UNDER DIFFERENT CONDITIONS OF IRRADIATION [EFFEKTIVNOST' SEROSODERZHASHCHIKH RADIOPROTEKTOROV PRI RAZLICHNYKH USLOVIIAKH LUCHEVOGO VOZDEISTVIIA]
V. G. VLADIMIROV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1987, p. 24-26. In Russian.

Data are presented documenting the radiation-protective efficiency of cystamine. When administered to patients 40-60 min before radiation treatment (with doses between 5.2 and 78 Gy), cystamine was shown to reduce (by almost 50 percent) the number of lymphocytes with chromosomal aberrations. Since cystamine has been shown to be nontoxic in doses of 0.8-1.2 given three times every 6 hours, it can be given repeatedly. I.S.

A88-19878
INTERINDIVIDUAL VARIATION IN HYPOXIC VENTILATORY RESPONSE - POTENTIAL ROLE OF CAROTID BODY
MARTIN VIZEK, CHERYL K. PICKETT, and JOHN V. WEIL (Colorado, University, Denver) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 1884-1889. refs
(Contract NIH-HL-124985)

The potential contribution of the peripheral chemoreceptor function to the individual variation in hypoxic ventilatory response (HVR) was evaluated. Both ventilatory and peripheral chemoreceptor responses to hypoxia were measured in 51 anesthetized cats with exposed carotid sinus nerve (CSN). For measurement of ventilatory responses, the tracheal cannula was

connected to a low-resistance valve, and the tidal volume was measured with a pneumotachograph; carotic body neural output was recorded with Pt bipolar electrodes. An arterial blood sample was drawn for measurements of pH and of O2 and CO2 pressures. Large interindividual differences were found in HVR, spanning a sevenfold range. The HVR response correlated positively with the CSN response to hypoxia, indicating that interindividual variation in HVR is associated with comparable variation in hypoxic sensitivity of carotid bodies and that differences in peripherial chemoreceptor sensitivity may contribute to interindividual variability of HVR. I.S.

A88-19880
SUBUNIT COMPOSITION OF RODENT ISOMYOSINS AND THEIR DISTRIBUTION IN HINDLIMB SKELETAL MUSCLES
R. W. TSIKA, R. E. HERRICK, and K. M. BALDWIN (California, University, Irvine) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 2101-2110. refs
(Contract NIH-AM-30346)

A88-19881* California Univ., Irvine.
EFFECT OF ANABOLIC STEROIDS ON SKELETAL MUSCLE MASS DURING HINDLIMB SUSPENSION
R. W. TSIKA, R. E. HERRICK, and K. M. BALDWIN (California, University, Irvine) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 2122-2127. refs
(Contract NIH-AM-30346; NAS2-10522)

The effect of treatment with an anabolic steroid (nandrolone decanoate) on the muscle mass of plantaris and soleus of a rats in hindlimb suspension, and on the isomyosin expression in these muscles, was investigated in young female rats divided into four groups: normal control (NC), normal steroid (NS), normal suspension (N-sus), and suspension steroid (sus-S). Steroid treatment of suspended animals (sus-S vs N-sus) was found to partially spare body weight and muscle weight, as well as myofibril content of plantaris (but not soleus), but did not modify the isomyosin pattern induced by suspension. In normal rats (NS vs NC), steroid treatment did enhance body weight and plantaris muscle weight; the treatment did not alter isomyosin expression in either muscle type. I.S.

A88-19882* California Univ., Irvine.
EFFECT OF ANABOLIC STEROIDS ON OVERLOADED AND OVERLOADED SUSPENDED SKELETAL MUSCLE
R. W. TSIKA, R. E. HERRICK, and K. M. BALDWIN (California, University, Irvine) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 2128-2133. refs
(Contract NIH-AM-30346; NAS2-10522)

The effect of treatment with an anabolic steroid (nandrolone decanoate) on the muscle mass, the subcellular protein content, and the myosin patterns of normal overloaded and suspended overloaded plantaris muscle in female rat was investigated, dividing rats into six groups: normal control (NC), overload (OV), OV steroid (OV-S), normal suspended (N-sus), OV suspended (OV-sus), and OV suspended steroid (OV-sus-S). Relative to control values, overload produced a sparing effect on the muscle weight of the OV-sus group as well as increases of muscle weight of the OV group; increased protein content; and an increased expression of slow myosin in both OV and OV-sus groups. Steroid treatment of OV animals did not after the response of any parameter analyzed for the OV group, but in the OV-sus group steroid treatment induced increases in muscle weight and in protein content of the OV-sus-S group. The treatment did not alter the pattern of isomyosin expression observed in the OV or the OV-sus groups. These result suggest that the steroid acts synergistically with functional overload only under conditions in which the effect of overload is minimized by suspension. I.S.

A88-20254* Rockefeller Univ., New York.
EXPIRATORY MUSCLE CONTROL DURING VOMITING - ROLE OF BRAIN STEM EXPIRATORY NEURONS
A. D. MILLER and L. K. TAN (Rockefeller University, New York) IN: Respiratory muscles and their neuromotor control. New York, Alan R. Liss, Inc., 1987, p. 455-458. refs
(Contract NAG2-164; NSG-2380; NIH-NS-20585; NIH-RR-07065; NSF BNS-83-17651)

The neural mechanisms controlling the muscles involved during vomiting were examined using decerebrated cats. In one experiment, the activity of the ventral respiratory group (VRG) expiratory (E) neurons was recorded during induced 'fictive vomiting' (i.e., a series of bursts of coactivation of abdominal and phrenic nerves that would be expected to produce expulsion in unparalyzed animals) and vomiting. In a second, abdominal muscle electromyographic and nerve activity were compared before and after sectioning the axons of descending VRG E neurons as they cross the midline between C1 and the obex (the procedure that is known to abolish expiratory modulation of internal intercostal muscle activity). The results of the study indicate that the abdominal muscles are controlled differently during respiration and vomiting. I.S.

A88-20255* California Univ., Irvine.
SYMPATHETIC PREGANGLIONIC EFFERENT AND AFFERENT NEURONS MEDIATED BY THE GREATER SPLANCHNIC NERVE IN RABBIT
YASUHIRO TORIGOE, ROXANA D. CERNUCAN, JO ANN S. NISHIMOTO, and ROBERT H. I. BLANKS (California, University, Irvine) Experimental Neurology (ISSN 0014-4886), vol. 87, 1985, p. 334-348. refs
(Contract NAG2-288; NIH-EY-000160)

As a part of the study of the vestibular-autonomic pathways involved in motion sickness, the location and the morphology of preganglionic sympathetic neurons (PSNs) projecting via the greater splanchnic nerve were examined. Retrograde labeling of neurons was obtained by application of horseradish peroxidase to the cut end of the greater splanchnic nerve. Labeled PSNs were found, ipsilaterally, within the T1 to T11 spinal cord segments, with the highest density of neurons in T6. Most PSNs were located within the intermediolateral column, but a significant portion also occurred within the lateral funiculus, the intercalated region, and the central autonomic area; the proportion of labeling between the four regions depended on the spinal cord segment. I.S.

A88-20264* Rockefeller Univ., New York.
LOCALIZATION OF MOTONEURONS INNERVATING INDIVIDUAL ABDOMINAL MUSCLES OF THE CAT
ALAN D. MILLER (Rockefeller University, New York) Journal of Comparative Neurology (ISSN 0021-9967), vol. 256, 1987, p. 600-606. refs
(Contract NSF BNS-83-17651; NAG2-164; NSG-2380; NIH-NS-20585; NIH-RR-07065)

The paper presents the results of a systematic investigation of the innervation of the cat's individual abdominal muscles. The segmental distribution of the different motor pools was determined by using electrical microstimulation of the ventral horn to produce visible localized muscle twitches and by retrograde transport of horseradish peroxidase injected into individual muscles. The segmental distribution of each motor pool was as follows: rectus abdominis, T4-L3; external oblique, T6-L3; transverse abdominis, T9-L3; and internal oblique, T13-L3. I.S.

A88-20267* Cincinnati Univ., Ohio.
DEVELOPMENT AND CHARACTERIZATION OF HISTOPLASMA CAPSULATUM-REACTIVE MURINE T-CELL LINES AND CLONES
GEORGE S. DEEPE, JR., JAMES G. SMITH, DAVID DENMAN, WARD E. BULLOCK (Cincinnati, University, OH), and GERALD SONNENFELD (Louisville, University, KY) Infection and Immunity (ISSN 0019-9567), vol. 54, Dec. 1986, p. 714-722. refs
(Contract NIH-AI-23017; NIH-AI-17339; NCC2-213)

Several Histoplasma capsulatum-reactive murine cloned T-cell lines (TCLs) were isolated from spleens of C57BL/6 mice immunized with viable H. capsulatum yeast cells, using the methodology of Kimoto and Fathman (1980). These T-cells were characterized phenotypically as Thy-1.2(+) Lyt-1(+) L3T4(+) Lyt-2(-), that is, as the helper/inducer phenotype. The cloned T cells proliferate in response to histoplasmin and, in some cases, to heterologous fungal anigens. Upon injection of mice with the antigen, the T-cells mediate local delayed-type hypersensitivity responses and, after stimulation, release regulatory lymphokines. I.S.

A88-20268* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENETIC TRANSFORMATION IN THE METHANOGEN METHANOCOCCUS VOLTAE PS
G. BERTANI and L. BARESI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Bacteriology (ISSN 0021-9193), vol. 169, June 1987, p. 2730-2738. DOE-supported research. refs

Mutations causing requirements for histidine, purine, and vitamin B12 were obtained in strain PS of Methanococcus voltae (archaebacteria) upon irradiation with UV or gamma rays. The first two mutations were shown to revert at low frequencies and were used to demonstrate the occurrence of transformation with homologous, wild-type DNA. The transformation rates obtained for these presumably chromosomal markers were in the range of 2 to 100 transformants per microgram of DNA. Mutants resistant to 2-bromoethanesulfonate and to 5-methyl-DL-tryptophan were also isolated. Author

A88-20272* Florida Agricultural and Mechanical Univ., Tallahassee.
BRAIN CHOLINERGIC INVOLVEMENT DURING THE RAPID DEVELOPMENT OF TOLERANCE TO MORPHINE
Z. Z. WAHBA, E. T. ORIAKU, and S. F. A. SOLIMAN (Florida Agricultural and Mechanical University, Tallahassee) Pharmacology (ISSN 0031-7012), vol. 34, 1987, p. 66-73. NIH-supported research. refs
(Contract NSG-2183)

The effect of repeated administration of morphine on the activities of the cholinergic enzymes, choline acetyltransferase (ChAT) and acetylcholinesterase (AChE), in specific brain regions were studied in rats treated with 10 mg/kg morphine for one or two days. Repeated administration of morphine was associated with a decline in the degree of analgesia produced and with a significant increase of AChE activity of the medulla oblongata. A single injection of morphine resulted in a significant decline in ChAT activity in the hypothalamus, cerebellum, and medulla oblongata regions. After two consecutive injections, no decline in ChAT was observed in these regions, while in the cerebral cortex the second administration elicited a significant decline. The results suggest that the development of tolerance to morphine may be mediated through changes in ChAT activity and lend support to the involvement of the central cholinergic system in narcotic tolerance. I.S.

A88-20279* Texas Univ., Houston.
AFFINITY IMMUNOBLOTTING - HIGH RESOLUTION ISOELECTRIC FOCUSING ANALYSIS OF ANTIBODY CLONOTYPE DISTRIBUTION
KEITH A. KNISLEY and L. SCOTT RODKEY (Texas, University, Houston) Journal of Immunological Methods (ISSN 0022-1759), vol. 95, 1986, p. 79-87. refs
(Contract NIH-AI-20590; NAS9-17403)

A sensitive and specific method is proposed for the analysis of specific antibody clonotype changes occurring during an immune response and for comparing multiple sera for antibody clonotype similarities. Polyclonal serum antibodies separated by isoelectric focusing (IEF) were analyzed by an affinity immunoblotting method using antigen-coated nitrocellulose membranes. Antibodies present on the surface of the acrylamide gels following IEF bind the antigen on the nitrocellulose when the coated nitrocellulose is laid over the gels. The technique has been used to analyze Ig clonotypes specific for five protein antigens and two carbohydrate antigens. Optimal antigen concentrations for coating the nitrocellulose membranes were found to range from 10-100 microgram/ml. R.R.

A88-20282* 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. Tokyo, MYU Research, 1987, p. 247-252. refs

The life sciences research facilities for the Space Station are being designed to accommodate both animal and plant specimens for long durations studies. This will enable research on how living systems adapt to microgravity, how gravity has shaped and affected life on earth, and further the understanding of basic biological phenomena. This would include multigeneration experiments on the effects of microgravity on the reproduction, development, growth, physiology, behavior, and aging of organisms. To achieve these research goals, a modular habitat system and on-board variable gravity centrifuges, capable of holding various animal, plant, cells and tissues, is proposed for the science laboratory. Author

A88-20288* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE CORTEX TRANSFORM - RAPID COMPUTATION OF SIMULATED NEURAL IMAGES
ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) Computer Vision, Graphics, and Image Processing (ISSN 0734-189X), vol. 39, Sept. 1987, p. 311-327. refs

With a goal of providing means for accelerating the image processing, machine vision, and testing of human vision models, an image transform was designed, which makes it possible to map an image into a set of images that vary in resolution and orientation. Each pixel in the output may be regarded as the simulated response of a neuron in human visual cortex. The transform is amenable to a number of shortcuts that greatly reduce the amount of computation. I.S.

A88-20311* Louisville Univ., Ky.
EFFECT OF ANTIORTHOSTATIC SUSPENSION ON INTERFERON-ALPHA/BETA PRODUCTION BY THE MOUSE (41939)
ANDREA ROSE, JOSEPH M. STEFFEN, X. J. MUSACCHIA, GERALD SONNENFELD (Louisville, University, KY), and ADRIAN D. MANDEL (NASA, Ames Research Center, Moffett Field, CA) Society for Experimental Biology and Medicine, Proceedings (ISSN 0037-9727), vol. 177, 1984, p. 253-256. refs
(Contract NCC2-213; NSG-2325)

Mice were suspended in a model that simulates the weightlessness that occurs during prolonged space flight. After one and two weeks of suspension in an antiorthostatic (head-down tilt) position, the mice were challenged with polyriboinosinic-polyribocytidylic acid to induce interferon-alpha/beta. Interferon production was severely reduced in mice that had been sus-

pended. When mice were allowed to recover in cages for a week following removal from suspension they recovered their full interferon-production capacity. Mice suspended in an orthostatic (horizontal) position did not have their interferon production capabilities affected, which indicates that stress per se was not a major component in the effects of antiorthostatic suspension on inteferon induction. Author

A88-20312* Florida Agricultural and Mechanical Univ., Tallahassee.
THE EFFECT OF ALTERED 5-HYDROXYTRYPTAMINE LEVELS ON BETA-ENDORPHIN
KARAM F. A. SOLIMAN, DEBORAH C. MASH, and CHARLES A. WALKER (Florida Agricultural and Mechanical University, Tallahassee) Society for Experimental Biology and Medicine, Proceedings (ISSN 0037-9727), vol. 182, 1986, p. 187-193. refs
(Contract NSG-2183; NIH-RR-0811; NIH-R03-AG-03755)

The purpose of the present study was to examine the effect of altering the concentration of 5-hydroxytryptamine (5-HT) on beta-endorphin (beta-Ep) content in the hypothalamus, thalamus, and periaqueductal gray (PAG)-rostral pons regions of the rat brain. The selective 5-HT reuptake inhibitor, fluoxetine (10 mg/kg), significantly lowered beta-Ep content in the hypothalamus and the PAG. Parachlorophenylalanine, which inhibits 5-HT synthesis, significantly elevated beta-Ep in all brain parts studied. Intracisternal injections of the neurotoxin 5-prime, 7-prime-dihydroxytryptamine with desmethylimipramine pretreatment significantly increased beta-Ep content in the hypothalamus and the PAG. In adrenalectomized rats, fluoxetine significantly decreased beta-Ep levels in the hypothalamus and increased the levels in the PAG. The results indicate that 5-HT may modulate the levels of brain beta-Ep. Author

A88-20313* Louisville Univ., Ky.
POTENTIAL MECHANISMS OF CYTOSOLIC CALCIUM MODULATION IN INTERFERON-GAMMA TREATED U937 CELLS
JON B. KLEIN, KENNETH R. MCLEISH, GERALD SONNENFELD, and WILLIAM L. DEAN (Louisville, University, Kentucky) Biochemical and Biophysical Research Communications (ISSN 0006-291X), vol. 145, June 30, 1987, p. 1295-1301. Research supported by the Jewish Hospital of Louisville. refs
(Contract NIH-HL-36303; NCC2-213)

The ability of interferon-gamma (IFN-gamma) to alter cytoplasmic Ca(2+) content in the monocytelike cell line U937 was investigated, using a slow Ca-channel blocker, diltiazem. In addition, the Ca-ATPase and the Ca-uptake activities were measured in isolated U937 membranes, together with the effect of inositol trisphosphate (IP3) upon the Ca(2+) release from Ca-loaded membranes. The addition of 50 U/ml INF-gamma to U937 cultures was found to increase internal Ca(2+) by about 100 percent within 3 min. The increase was significantly reduced by incubation in Ca-free buffer or by the addition of diltiazem. A crude membrane preparation from U937 cells was found to contain significant amounts of Ca-ATPase activity and to sequester Ca(2+) to a level of 8 nmol/mg in 30 sec; the addition of IP3 induced release of a portion of the sequestered Ca(2+) which was then resequestered. The results suggest that IFN-gamma causes an increase of cytoplasmic Ca(2+), in part, by the IP3-induced release from the internal storage sites and, in part, from the entry of extracellular Ca through slow channels. I.S.

A88-20314* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PURIFICATION AND SUBUNIT STRUCTURE OF A MEMBRANE-BOUND ATPASE FROM THE ARCHAEBACTERIUM HALOBACTERIUM SACCHAROVORUM
LAWRENCE I. HOCHSTEIN, HORDUR KRISTJANSSON, and WIJAYA ALTEKAR (NASA, Ames Research Center, Moffett Field, CA) Biochemical and Biophysical Research Communications (ISSN 0006-291X), vol. 147, Aug. 31, 1987, p. 295-300. refs

The procedure for the isolation and 70-fold purification of membrane-bound cold-sensitive ATPase from Halobacterium saccharovorum is described. Upon exposure to cold, the enzyme dissociates into two major subunits, I (87 kDa) and II (60 kDa), and two minor subunits, III (29 kDa) and IV (20 kDa). The stoichiometry of the enzyme is proposed to be I2.II2.III.IV; the molecular mass of such a complex would be 343 kDa, which is in good agreement with the value of 350 kDa obtained by gel filtration. The structure of the ATPase from H. saccharovorum makes it unlike any previously described ATPase. I.S.

N88-13845# Environmental Protection Agency, Research Triangle Park, N.C. Inhalation Toxicology Div.
SHORT-TERM IN VITRO SCREENING STUDIES RELATED TO THE INHALATION TOXICOLOGY OF POTENTIALLY TOXIC AEROSOLS Final Report, Jun. 1984 - Apr. 1986
ELAINE C. GROSE and JUDITH A. GRAHAM Aug. 1987 27 p
(AD-A184815) Avail: NTIS HC A03/MF A01 CSCL 06K

The toxicity of JCE001 particles was tested using the rabbit alveolvar macrophage (RAM) test, hamster tracheal cultures and in vivo pulmonary bactericidal activity in mice. In the RAM test, incubation of alveolar macrophages (AM) with the JCE001 particles decreased AM viability, cellular adenosine 5' -triphosphate (ATP) and total protein levels. The lowest effective dose as determined by Williams' test was 50 micrograms/mL of JCE001 particles for all parameters examined. The presence of soluble cytotoxic components was established. The nature and rate of release of soluble toxic components from the JCE001 particles were important contributing factors in the mechanism by which these particles produced their toxic effects. A single 1-hr in vitro exposure of hamster tracheal ring organ cultures to the JCE001 particles was conducted to determine the dose response on ciliated respiratory epithelium. JCE001 particles caused a significant decrease in cilia beating frequency and an increase in cytopathological alterations. Morphological alterations in the tracheal epithelium were observed with light microscopy and scanning electron microscopy. The effect of the JCE001 particles on the ability of AM to kill inhaled pneumoniae was also measured. Bactericidal activity of all groups treated with the JCE001 particles was markedly reduced compared to that of controls. GRA

N88-13846# Army Research Inst. of Environmental Medicine, Natick, Mass.
A PLETHYSMOGRAPH FOR MEASURING PULMONARY VENTILATION IN SMALL ANIMALS
VINCENT FORTE, JR., STEPHEN MUZA, REED HOYT, and ALLEN CYMERMAN 3 Jun. 1987 31 p
(AD-A184978; USARIEM-T-18-87) Avail: NTIS HC A03/MF A01 CSCL 06D

A plethysmograph was developed to permit non-invasive measurement of pulmonary ventilation in small animals. In this system, precise measurements of temperature, humidity, and barometric pressure are used to calculate tidal volume, while a BASIC computer program directs the collection and display of data on tidal volume, frequency, body temperature, chamber temperature, and relative humidity. The long acoustical time constant of the plethysmograph permits accurate measurement of tidal volume in a wide variety of small unrestrained animals such as mice, rats, and hamsters. GRA

N88-13847# John B. Pierce Foundation of Connecticut, New Haven.
MICROWAVE CHALLENGES TO THE THERMOREGULATORY SYSTEM
ELEANOR R. ADAIR Aug. 1987 98 p
(Contract F33615-85-C-4500)
(AD-A185391; USAFSAM-TR-87-7) Avail: NTIS HC A05/MF A01 CSCL 06G

Three experiments were conducted to measure the upper tolerance limit for maintaining thermal balance in squirrel monkeys during exposure to 2450-MHz radiofrequency radiation (RFR). During microwave exposure at high intensity, thermoregulatory behavior, metabolic, vasomotor, and sudomotor responses were mobilized in normal fashion, but the capacity to lose heat through sweating found to be the limiting factor in microwave tolerance.

The major conclusion drawn from these studies is that the thermoregulatory system deals with energy absorbed from microwave fields in exactly the same way as energy produced in the body by normal metabolic processes or absorbed during exposure to conventional radiant or convective heat sources.
GRA

N88-14601# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
14 Sep. 1987 105 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-87-011) Avail: NTIS HC A06/MF A01

Articles from the open literature in the areas of aerospace medicine, agriculture, biochemistry, biotechnology, the environment, epidemiology, genetics, human factors, immunology, industrial medicine, laser bioeffects, marine mammals, medical science, microbiology, military medicine, molecular biology, nonionizing radiation effects, pharmacology, toxicology, physiology, public health, radiation biology, and virology are included.

N88-14602# Joint Publications Research Service, Arlington, Va.
ELECTRON CYTOCHEMICAL DETECTION OF CA(2)+-ATPASE IN PROTONEMA OF MOSS FUNARIA HYGROMETRICA (H E D W.) UNDER HYPOGRAVITATION Abstract Only
YE. M. NEDUKHA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 14 Sep. 1987 Transl. into ENGLISH from Tsitologiya i Genetika (Kiev, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 3-6
Avail: NTIS HC A06/MF A01

A study was made of the localization of Ca(2)+-ATPase in the cells of the portonema of funaria hygrometrica grown in a clinostat to assist in predicting the possibility of existence and adaptation of plants to weightlessness. Electron cytochemical studies of subapical protonema cells of funaria hygrometrica revealed localization of irregularly shaped electron-dense granules with morphology corresponding to the product of a cytochemical reaction. There was no ATPase activity in the plasmalemma of cells growing in the clinostat, apparently a result of disrupted functioning of the plasmalemma. Ca(2)+-ATPase did manifest activity with the cytoplasmic membranes in the clinostat. Author

N88-14603# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANATOMIC ANALYSIS OF SEEDLING ORGANS OF PISUM SATIVUM (FABACEAE) CULTIVATED UNDER SPACE FLIGHT CONDITIONS Abstract Only
Z. A. NOVRUZOVA, A. A. ALIYEV, U. K. ALEKPEROV, A. L. MASHINSKIY, N. M. CHAPARI, and G. K. RAGIMOVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1-2 14 Sep. 1987 Transl. into ENGLISH from Botanicheskiy Zhurnal (Leningrad, USSR), v. 72, no. 5, May 1987 p 657-659
Avail: NTIS HC A06/MF A01

A morphologic-anatomic study was performed of 29-day seedlings of Pisum sativum L cultivated on board the Salyut-7 spacecraft as a part of the Oazis 1-AM program and on control seedlings grown on earth under similar conditions of temperature, humidity and illumination. Analysis of the basic anatomic elements, leaf, stem and root, showed quantitative and slight qualitative differences among experimental specimens, probably a response of the plants to their growth conditions. The experimental conditions did not modify the development of the structural elements of the organs. Differences were found only in the degree of sclerification of cells in the conducting bundles of the stem. Author

N88-14608# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
5 Nov. 1987 74 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-87-013) Avail: NTIS HC A04/MF A01

Topics in life sciences addressed include: agricultural science; biophysics; biotechnology; epidemiology; genetics; immunology; medicine; laser bioeffects; pharmacology; toxicology; radiation effects; physiology; public health; and psychiatry.

N88-14612# Joint Publications Research Service, Arlington, Va.
SLEEP INDUCED IN CAT BY ELECTRIC STIMULATION OF ACOUSTIC AND MOTOR AREAS IN BRAIN CORTEX Abstract Only
D. E. GELITASHVILI-PAPIDZE and N. G. ERISTAVI *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 49 5 Nov. 1987 Transl. into ENGLISH from Soobshcheniya Akademii Nauk Gruzinskoy SSR (Tbilisi, USSR), v. 125, no. 2, Feb. 1987 p 385-388
Avail: NTIS HC A04/MF A01

Experiments carried out on normal animals showed that repeated stimulation of acoustic and motor areas of the brain cortex led to induction of sleep. Experiments on adult cats under nembutal anesthesia supported this finding. Initial stimulation of these areas resulted in typical orientational reactions to sound, somewhat related to the intensity of the electric stimulus. Repeated stimulations induced the sleepy state and eventually sound sleep. Increase in stimuli led to even deeper sleep. An assumption was made that the same mechanism is involved in development of sleep due to repeated peripheral and direct stimulations. Author

N88-14868*# Galveston Coll., Tex. Div. of Mathematics and Science.
A SOLID PHASE ENZYME-LINKED IMMUNOSORBENT ASSAY FOR THE ANTIGENIC DETECTION OF LEGIONELLA PNEUMOPHILA (SEROGROUP 1): A COMPLIMENT FOR THE SPACE STATION DIAGNOSTIC CAPABILITY
KELLY E. HEJTMANCIK *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 20 p Nov. 1987
Avail: NTIS HC A15/MF A01 CSCL 06B

It is necessary that an adequate microbiology capability be provided as part of the Health Maintenance Facility (HMF) to support expected microbial disease events and environmental monitoring during long periods of space flight. The application of morphological and biochemical studies to confirm the presence of certain bacterial and fungal disease agents are currently available and under consideration. This confirmation would be facilitated through employment of serological methods to aid in the identification of bacterial, fungal, and viral agents. A number of serological approaches are currently being considered, including the use of Enzyme Linked Immunosorbent Assay (ELISA) technology, which could be utilized during microgravity conditions. A solid phase, membrane supported ELISA for the detection of Legionella pneumophila, an expected disease agent, was developed to show a potential model system that would meet the HMF requirements and specifications for the future space station. These studies demonstrate the capability of membrane supported ELISA systems for identification of expected microbial disease agents as part of the HMF. Author

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AEROSPACE MEDICINE

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

A88-17940
BLOOD VISCOSITY, HYPERVISCOSITY, AND HYPERVISCOSAEMIA
LEOPOLD DINTENFASS (Sydney, University, Australia) Lancaster, England, MTP Press, Ltd., 1985, 494 p. refs

This book describes the basic architecture of clinical hemorheology, which concerns especially ischemic and occlusive diseases, including the new areas of anxiety and psychosomatic

disorders. It covers the development of blood viscosity factors, their interaction with biochemical and physiological parameters, and develops the concept of 'hyperviscosemia' as a definite clinical syndrome. The review of applications covers representative areas of medicine. C.D.

A88-18032
TEMPORAL CHARACTERISTICS OF OBJECT-IMAGE RECOGNITION WITH FILTERING OF HIGH SPATIAL FREQUENCIES [VREMENNYE KHARAKTERISTIKI OPOZNANIIA PREDMETNYKH IZOBRAZHENII PRI FIL'TRATSII VYSOKIKH PROSTRANSTVENNYKH CHASTOT]
A. A. NEVSKAIA, V. N. PAUK, V. B. MAKULOV, T. S. BULASHEVICH, and V. D. GLEZER (AN SSSR, Institut Fiziologii; Gosudarstvennyi Opticheskii Institut, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Sept.-Oct. 1987, p. 757-766. In Russian. refs

The temporal characteristics of object recognition from images processed with different cut-off filtering limits of high spatial frequencies were determined using computer-processed half-tonal photographs of individual objects which were presented to different observers. The results indicate that recognition of the form is determined by the harmonic composition of the image. When the time of presentation is not limited, the recognition is possible with seven lower harmonics. The addition of high frequencies (but not above 28 harmonics), increases the speed of recognition. I.S.

A88-18033
BIORHYTHMS OF BINOCULAR VISION [BIORITMY BINOKULIARNOGO ZRENIIA]
T. P. TETERINA, V. V. VOLKOV, and L. P. KOCHETKOVA (Semipalatinskii Gosudarstvennyi Meditsinskii Institut, Semipalatinsk, Kazakh SSR; Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Sept.-Oct. 1987, p. 779-782. In Russian. refs

The biorhythms of monocular perception in the process of binocular fixation were investigated together with the effects of the subjects' age and physical load on the rhythms. It was found that, during binocular fixation of an immobile object in free space, there takes place a rhythmic synchronous alternation of the monocular perceptions by each of the two eyes. Average rhythm frequency in subjects with normal binocular vision was found to be 10.9 + or - 0.3/min, with a period duration of about 4.78/sec and a monocular-phase duration of between a fraction of a second and 1-3 seconds. Monocular rhythm frequency varied during the 24-h period, being lowest in the morning and highest around 6 PM. The rhythm frequency was found to be also affected by the age of an individual, being higher in young adults than in children aged 10-14 years, and by exercise, which increased the rhythm frequency. I.S.

A88-18034
DYNAMICS OF SENSORIMOTOR AND MENTAL ACTIVITIES DURING ADAPTATION TO HYPOXIC HYPOXIA AND SUBMAXIMAL PHYSICAL LOADS [DINAMIKA SENSOMOTORNOI I UMSTVENNOI DEIATEL'NOSTI V PROTSESSE ADAPTATSII K GIPOKSICHESKOI GIPOKSII I SUBMAKSIMAL'NYM FIZICHESKIM NAGRUZKAM]
A. IU. SHIKIN and I. L. SOLOMIN (Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Sept.-Oct. 1987, p. 850-852. In Russian. refs

The effects of submaximal physical loads and hypoxia on the sensorimotor and psychomotor activities of an operator were evaluated in healthy male subjects performing a series of nine daily strenous-exercise periods on a bicycle ergometer; beginning with the second exercise period, the subjects were also exposed to hypoxic atmospheres. The sensorimotor activity (SMA) was evaluated by estimating the ability of a subject to control the movements of a dynamic object, using specially designed training equipment. The psychomotor activity was evaluated by the Ioseliani (1968) test. It was found that physical exercise increased the stability of SMA, whereas the exposure to a hypoxic atmosphere had the opposite effect. Neither exercise nor hypoxia had a significant effect on psychomotor activity associated with the processing of numerical information. Adaptation of this type of activity to submaximal loads and to hypoxia was found to take place on the 8th day of the experiment and did not depend on the level of physical work capacity. I.S.

A88-18035
INDIVIDUAL DIFFERENCES IN THE EFFECT OF HYPERTHERMIA ON THE QUALITY OF THE VISUAL-MOTOR CONTROL OF MUSCULAR EFFORT [INDIVIDUAL'NYE RAZLICHIIA VLIIANIIA GIPERTERMII NA KACHESTVO ZRITEL'NO-MOTORNOGO KONTROLIA MYSHECHNOGO USILIIA]
V. A. KUZ'MENKO (AMN SSSR, Nauchno-Issledovatel'skii Institut Normal'noi Fiziologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 13, Sept.-Oct. 1987, p. 856-859. In Russian. refs

The individual differences in the effect of hyperthermia on the ability to maintain constant static physical effort were investigated. Eight healthy men were subjected to repeated (with one week intervals) 8-12 min exposures to 80-85 C during which they were asked to perform a dynamometer test designed to evaluate the ability of the subject to maintain muscular effort at the maximal level. The errors in the regulation of muscular effort were correlated with individual variations of the blood circulation. The increases of the regulatory errors due to hypothermia varied in the range of 14-79 percent. No correlation was found between the groups with high and low degrees of visual-motor control of muscular effort and the reactions to hyperthermia of the cardiovascular-function parameters. However, subjects with higher visual-motor control had higher levels of tissue blood supply (against the background of lower heart rates and arterial pressure) and higher excitability of the neural mechanisms regulating pressure activity. I.S.

A88-19619
ENDOCRINE-METABOLIC CHANGES DURING ADAPTATION TO HIGH TEMPERATURE [ENDOKRINNO-METABOLICHESKIE IZMENENIIA V PROTSESSE ADAPTATSII K VYSOKOI TEMPERATURE]
I. D. KUDRIN, A. I. KARPISHCHENKO, and N. A. STOLIAROVA Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1987, p. 40-43. In Russian.

The effect of living and working at 29-35 C on the functional activity of the hypophyseal-adrenal (HA) system and the thyroid gland, as well as on some features of energy metabolism was studied in male subjects flown from temperate-climate locations into a region of hot dry climate. The blood levels of ACTH, cortisol, thyroxine, glucose, and lactate, and blood lipids were measured on the 1st, 8th, 15th, and 22nd day after arrival at the new location. The results indicated an almost immediate (1st day) increase of ACTH and cortisol levels, which continued at least to the 8th day, indicating a stressed HA system. Physical exercise led to increases of glucose and lactate levels. After 15-22 days, the parameters of the HA system and of energy metabolism started to decrease towards normal values. Complete adaptation to hot climate occurred only after 2.5 months. I.S.

A88-19876
POSTURAL CARDIOVASCULAR REFLEXES - COMPARISON OF RESPONSES OF FOREARM AND CALF RESISTANCE VESSELS
LOUIS K. ESSANDOH, DANIEL A. DUPREZ, and JOHN T. SHEPHERD (Mayo Clinic and Foundation, Rochester, MN) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 1801-1805. refs
(Contract NIH-HL-05883)

Changes in vascular resistance of the forearm and the calf in response to postural changes from supine to sitting or to head-down tilt were measured in healthy male subjects. Changing from supine to sitting caused a decrease in the forearm blood flow (from 4.13 to 2.16 ml/100 ml per min) but not in the calf flow; the heart rate increased by 8.0 beats/min, with no change in mean arterial blood

pressure. During a 30-deg head-down tilt, there was a dilatation of the forearm but not the calf vessels, whereas a Valsalva maneuver caused a similar constriction of both vascular beds. The results indicate that the major reflex adjustments to changes in posture take place in the forearm. I.S.

A88-19877
EFFECTS OF VOLUNTARY CONSTRAINING OF THORACIC DISPLACEMENT DURING HYPERCAPNIA
T. CHONAN, M. B. MULHOLLAND, N. S. CHERNIACK, and M. D. ALTOSE (Cleveland Metropolitan General Hospital; USVA, Medical Center; Case Western Reserve University, Cleveland, OH) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 1822-1828. refs

A88-19879
VENTILATION DURING SLEEP ONSET
IAN M. COLRAIN, JOHN TRINDER, GEOFF FRASER, and GEORGE V. WILSON (Tasmania, University, Hobart, Australia) Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Nov. 1987, p. 2067-2074. refs

The present study was concerned with the quantitative and temporal properties of ventilation during sleep onset. Sleep onsets were studied in five young male adults in a series of single-subject designs in which sleep onsets were replications. The results indicated that, during sleep onset, the loss of alpha-activity in the electroencephalogram was associated with a substantial, rapid, and highly predictable reduction in ventilation. The change in ventilation was typically due to a reduction in tidal volume and was, in part, secondary to a reduction in metabolic rate. It is speculated that the nonmetabolic component may reflect the loss of waking neural drive to respiration, though the present study did not eliminate a variety of other interpretations. *Author*

A88-19978
BIOLOGICAL EFFECTS AND HEALTH IMPLICATIONS OF RADIOFREQUENCY RADIATION
SOL M. MICHAELSON (Rochester, University, NY) and JAMES C. LIN (Illinois, University, Chicago) New York, Plenum Press, 1987, 687 p. refs

The effects of RF and microwave radiation on plant and animal tissues are examined, summarizing the results of recent theoretical and experimental investigations from the fields of physics, engineering, mathematics, biology, chemistry, medicine, and environmental health. Chapters are devoted to a historical overview; the physics of RF and microwave radiation; dosimetry and measurement; the dielectric properties of biological materials; propagation and absorption in tissue media; molecular, cellular, and invertebrate biology; reproduction, development, and growth; thermoregulation; neural effects; behavioral effects; neuroendocrine effects; cardiovascular effects; effects on hematopoiesis and hematology; effects on immune responses; biochemical effects; effects on skin; cataracts and other ocular effects; epidemiological studies on humans; and personnel protection, protection guides, and standards. Diagrams, graphs, photographs, and tables of numerical data are provided. T.K.

A88-20310*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUID PARTICLE MOTION AND LAGRANGIAN VELOCITIES FOR PULSATILE FLOW THROUGH A FEMORAL ARTERY BRANCH MODEL
Y. I. CHO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; Drexel University, Philadelphia, PA), D. W. CRAWFORD (Southern California, University, Los Angeles, CA), L. H. BACK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. R. BACK ASME, Transactions, Journal of Biomechanical Engineering, vol. 109, Feb. 1987, p. 94-101. refs
(Contract NIH-HL-23619-05)

A flow visualization study using selective dye injection and frame by frame analysis of a movie provided qualitative and quantitative data on the motion of marked fluid particles in a 60 degree artery branch model for simulation of physiological femoral artery flow. Physical flow features observed included jetting of the branch flow into the main lumen during the brief reverse flow period, flow separation along the main lumen wall during the near zero flow phase of diastole when the core flow was in the downstream direction, and inference of flow separation conditions along the wall opposite the branch later in systole at higher branch flow ratios. There were many similarities between dye particle motions in pulsatile flow and the comparative steady flow observations. Author

A88-20436
ENERGY DEPOSITION IN A HETEROGENEOUS MODEL OF MAN - FAR-FIELD EXPOSURES
STANISLAW S. STUCHLY, ANDRZEJ KRASZEWSKI, GEORGE W. HARTSGROVE (Ottawa, University, Canada), MARIA A. STUCHLY (Health and Welfare Canada, Ottawa), and RONALD J. SPIEGEL (EPA, Research Triangle Park, NC) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. BME-34, Dec. 1987, p. 951-957. Research supported by Health and Welfare Canada, EPA, and NSERC. refs

Distributions of the specific absorption rate (SAR) were measured in a full-scale heterogeneous model of man. The model contained a skeleton, brain, lungs, and muscle. All these tissues had di-electric properties close to those of the respective in vivo properties of actual tissues at the test frequencies. SAR's were measured for exposures in the far field at 160, 350, and 915 MHz for the E and H polarizations. A computer-controlled scanning system and an implantable, minimally perturbing electric field probe were used. The results are also compared with the SAR distributions previously measured in a homogeneous model. Author

N88-13848# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL DETERMINANTS OF LOAD BEARING CAPACITY Technical Report, Nov. - Dec. 1986
JOSEPH E. DZIADOS, ANDREW I. DAMOKOSH, ROBERT P. MELLO, JAMES A. VOGEL, and KENNETH L. FARMER, JR. Jun. 1987 34 p
(AD-A184977; USARIEM-T-19-87) Avail: NTIS HC A03/MF A01 CSCL 06J

This study identifies some of the physiological determinants of load bearing capacity. Although it is reasonanble to assume that maximal aerobic capacity (VO2) is an important determinant of load bearing ability, research implicating the importance of muscular strength and endurance of the lower extremities in load bearing activity has not been reported. To address this deficiency, 49 infantrymen were measured for: 1) aerobic capacity, 2) muscular strength of the quadriceps and hamstrings 3) muscular endurance of the quadriceps and hamstrings and 4) body composition. Following these measures, the infantrymen made a maximal effort 10-mile road march with battle dress equipment. These data suggest that hamstring muscle strength may be an important determinant of prolonged load bearing performance. Further research may elucidate the degree to which aerobic capacity, muscle strength, and other physiological variables independently and/or interactively influence load bearing capacity. GRA

N88-13849# Army Research Inst. of Environmental Medicine, Natick, Mass.
HUMAN THERMOREGULATORY MODEL FOR WHOLE BODY IMMERSION IN WATER AT 20 AND 28 C
PETER TIKUISIS, RICHARD R. GONZALEZ, and KENT B. PANDOLF Jun. 1987 55 p
(AD-A185052; USARIEM-T-23-87) Avail: NTIS HC A04/MF A01 CSCL 06J

The mathematical models of thermoregulation of Stolwijk and Hardy and Montgomery were used to develop a model suitable for the simulation of human physiological responses to cold-water immersion. Data were obtained from experiments where thirteen healthy male volunteers were totally immersed under resting and nude conditions for 1 h in water temperatures of 20 and 28 C.

Mean measured rectal temperature (Tre) fell by about 0.9 and 0.5 C in 20 and 28 C water for all subjects, yet mean measured metabolic rate (M) rose by about 275 and 90 W for the low body fat group (n=7) and 195 and 45 W for the moderate body fat group (n=6). To predict the observed Tre and M values, the present model a) included thermal inputs for shivering from the skin independent of their inclusion with the central temperature to account for the observed initial rapid rise in M, b) determined a thermally neutral body temperature profile such that the measured and predicted initial values of Tre and M were matched, c) confined the initial shivering to the trunk region to avoid an overly large predicted initial rate of rectal cooling, and d) calculated the steady-state convective heat loss by assuming a zero heat storage in the skin compartment to circumvent the acute sensitivity to the small skin-water temperature difference when using conventional methods. The last three modifications are unique to thermoregulatory modeling. A BASIC computer listing of the model and a sample simulation are provided. GRA

N88-13850# Army Research Inst. of Environmental Medicine, Natick, Mass.
A DEVICE AND METHODOLOGY FOR MEASURING REPETITIVE LIFTING VO2MAX (OXYGEN CONSUMPTION RATE) Technical Report, Aug. 1983 - Aug. 1986
MARILYN A. SHARP, JOSEPH M. MCGRATH, EVERETT HARMAN, JOSEPH J. KNAPIK, and WILLIAM A. SAWYER Aug. 1987 45 p
(AD-A185195; USARIEM-T-31/87) Avail: NTIS HC A03/MF A01 CSCL 14B

A repetitive lifting device capable of reliably operation under heavy loads for prolonged periods was designed to study manual material handling problems unique to the Army. The device consists of a pneumatically driven platform which can lift or lower loads up to 100 kg, from 0 to 200 cm above floor level. The device was utilized to develop a multi-stage repetitive lifting maximal oxygen uptake procedure and is suitable to be used for a wide variety of lifting and lowering tasks. GRA

N88-14605# Joint Publications Research Service, Arlington, Va.
DAILY DYNAMICS OF SOME PHYSIOLOGICAL INDICATORS OF MAN UNDER DESERT CONDITION Abstract Only
A. I. FREYNK, K. AMANNEPESOV, G. F. SULTANOV, YA. G. GARLYYEV, and A. A. AMIYANTS *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 69 14 Sep. 1987 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenskoy SSR. Seriya Biologicheskikh Nauk (Ashkhabad, USSR), no. 6, Nov. - Dec. 1986 p 50-57
Avail: NTIS HC A06/MF A01

The need to develop reliable recommendations for organization of rest and work regimes and to define safe limits of stress for maintaining health under desert conditions prompted a study of orthostatic stability in a group of healthy inhabitants, acclimated to desert conditions. Studies involved 11 healthy volunteers. The studies showed significant daily variations in indicators of heat exchange, gas exchange, and the cardiovascular system in the subjects. The period between 1200 and 1800 was a period of high stress on all regulatory systems due to heat stress. The healthy subjects were able, with slight rest, to implement regulatory mechanisms to compensate for the effect of high temperatures. The extreme effect of high temperature increased with increased physical exertion and was manifested by decrease of orthostatic stability in the hot hours. Subjects were not dehydrated. The extreme effect of temperature increased under additional physical exertion as shown by the decrease of orthostatic stability in the hot hours. Author

N88-14606# Joint Publications Research Service, Arlington, Va.
INFRADIAN BIORHYTHMS OF HUMAN VITAL SIGNS Abstract Only
N. N. SHABATURA, V. G. TKACHUK, V. A. FEDKO, and S. B. PALIYENKO *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 71 14 Sep. 1987 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 33, no. 2, Mar. - Apr. 1987 p 10-15
Avail: NTIS HC A06/MF A01

Biorhythmic patterns were evaluated for a number of conventional vital signs in the case of 20 men, 20 to 24 years old, including two with neuromuscular disorders. The data led to the identification of two fundamental infradian patterns of activity, consisting of a circaseptadian rhythm (6.5 + or - 0.3 days) and, in the case of body temperature, an additional circadiseptadian rhythm (13.0 + or - 0.5 days). The longitudinal measurements were carried out over a 60 to 620 day period, demonstrating that social factors, while affecting vital sign biorhythms, do not have a primary role in their generation. Generation of the infradian rhythms appears to depend exclusively on endogenous mechanisms. Author

N88-14607# Joint Publications Research Service, Arlington, Va.
PHYSICOCHEMICAL CORRELATES OF HUMAN ADAPTATION TO EXTREME ENVIRONMENTS Abstract Only
A. F. KONKOVA, I. A. MAGAY, O. M. SHEKHAYEVA, V. F. SOKOLOV, and M. N. ANUFRIYEVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 71 14 Sep. 1987 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR. Seriya Biologicheskaya (Moscow, USSR), no. 1, Jan. - Feb. 1987 p 104-118
Avail: NTIS HC A06/MF A01

A discussion is presented of the energetics involved in maintaining viable homeostasis while the human body is exposed to extreme environmental factors. The self-adjustment in metabolic processes is shown to be of such nature as to maintain critical parameters within a narrow range, with heat production serving as the criterion of adjustment. Even on initial stages of exposure or anticipated exposure to different environmental factors, energy production would increase two- to five-fold above the level of basal metabolism. The extent of changes during the transitional change in the process of adaptation to a new level of functional status reflects the overall stability of the system and its flexibility. The increase in the internal energy of the system represents the adaptability of the system. Studies on nine healthy athletes demonstrated that the system adjusts to maintain vital parameters, e.g., pH, temperature, acid-base balance, within a narrow range while functioning in the most optimal regime. Author

N88-14609# Joint Publications Research Service, Arlington, Va.
HUMAN PHYSICAL FIELDS
GRIGORIY LVOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 8-11 5 Nov. 1987 Transl. into ENGLISH of Novosti Nauki i Tekhniki (Moscow, USSR), no. 24, 20 Dec. 1986 p 1-6
Avail: NTIS HC A04/MF A01

The fields which occur around biological objects were researched. The initial findings of the experiments are discussed. B.G.

N88-14610# Joint Publications Research Service, Arlington, Va.
EFFECT OF NIGHT WATCHES AND INTERMITTENT SLEEP ON STATE OF CIRCADIAN RHYTHMS OF PHYSIOLOGICAL FUNCTIONS OF FISHERMEN Abstract Only
V. A. SKRUPSKIY *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 48 5 Nov. 1987 Transl. into ENGLISH from Gigiyena i Sanitariya (Moscow, USSR), no. 12, Dec. 1986 p 76-78
Avail: NTIS HC A04/MF A01

A study of 3 groups of 6 fishermen with different watch schedules measured the effect of interrupted sleep and wakefulness on daily rhythms and adaptability of fishermen on a cruise. Group 1 slept through the night without interruption, groups

2 and 3 had intermittent sleep (day and night) and night watch. Average age was 31 + or - 0.7 years and average length of sea duty was 5.2 + or - 0.8 years. The irregular sleep pattern contributed to disturbances of sleep and to change of time pattern of physiological functions. This may reduce the body's adaptability and may lead to disturbances of the circadian rhythm. Work schedules requiring disruptions of sleep should not exceed 90 days in order to avoid desynchronization and disadaptation.
Author

N88-14611# Joint Publications Research Service, Arlington, Va.
NEUROPHYSIOLOGICAL ANALYSIS OF HYPOTHALAMIC REGULATION MECHANISMS OF PRIMARY SLEEP AND HYPOBIOSIS Abstract Only
I. G. KARMANOVA, YE. A. ARISTAKESYAN, and N. V. SHILLING *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 49 5 Nov. 1987 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 294, no. 1, May 1987 p 245-248 Original language document was announced in IAA as A87-46075 Avail: NTIS HC A04/MF A01

Studies were carried out to investigate the influence of the hypothalamus on seasonal variations of the primary sleep/wakefulness cycle and to identify the nature of the effect of both sections of the hypothalamus on the formation of the electrical activity of the primordial hippocampus of amphibians. The EEG studies were performed in different seasons in frogs with electrodes implanted in the primordial hippocampus. Particular consideration is given to the influence of the destruction of the two sections of the hypothalamus on the sleep/wakefulness cycle. IAA

N88-14614# California Univ., San Diego, La Jolla. Lab. for Biological Dynamics and Theoretical Medicine.
DIMENSIONAL ANALYSIS OF NONLINEAR OSCILLATIONS IN BRAIN, HEART AND MUSCLE
G. MAYER-KRESS, F. E. YATES, L. BENTON, M. KEIDEL, W. TIRSCH, S. J. POEPPL, and K. GEIST (Los Alamos National Lab., N. Mex.) 1987 51 p Presented at the CNLS Workshop on Nonlinearity in Biology and Medicine, Los Alamos, N. Mex., 18 May 1987 Prepared in cooperation with Goettingen Univ., Federal Republic of Germany
(Contract W-7405-ENG-36)
(DE87-014749; LA-UR-87-2881; CONF-8705193-2) Avail: NTIS HC A04/MF A01

We present some numerical studies on the dimensional analysis of temporal oscillations measured in the human electroencephalogram (EEG), heart rates (HR), and muscle tremor. We show that it is sufficient to characterize the individual system by a single dimension value alone. We give some detailed numerical analysis of the scaling structure of the attractors reconstructed from the time signal. Our methods are based on the concept of local gauge functions that we derive from the raw signals as well as from the transformed signal obtained from singular value decomposition. We were able to confirm and improve earlier results on the change of dimensionality of EEG signals. For heart rates and muscle tremor we observe significant changes in the dimensionality depending on the state of the system. We indicate which factors enter dimension estimates and where specific problems lie in each of the examples. DOE

N88-14615# Lawrence Livermore National Lab., Calif.
CURRENT STATUS OF HIGH POWER MICROWAVE EFFECTS AND SIMULATION
H. S. CABAYAN Dec. 1986 9 p Presented at the 3rd National Conference on High Power Microwave Technology for Defense Applications, Albuquerque, N. Mex., 1 Dec. 1986
(Contract W-7405-ENG-48)
(DE87-004112; UCRL-95052; CONF-861240-18) Avail: NTIS HC A02/MF A01

This article is based in part on the findings of the HPM Effects Panel. The findings of the panel have been reported elsewhere, and are summarized here. Issues covered include potential upper bounds of the fluences from HPM weapons, the phenomenology of HPM system effects, critical issues in HPM system effects simulation and HPM simulation requirements. DOE

N88-14616* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 305)
Jan. 1988 80 p
(NASA-SP-7011(305); NAS 1.21:7011(305)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 230 reports, articles, and other documents introduced into the NASA scientific and technical information system in December, 1987. Author

N88-14617# Research Inst. of National Defence, Stockholm (Sweden).
QUICK MEASUREMENT OF INDIVIDUAL STRESS REACTION LEVEL: DEVELOPMENT OF THE EMOTIONAL STRESS REACTION QUESTIONNAIRE (ESRQ)
GERRY LARSSON Apr. 1987 34 p In SWEDISH; ENGLISH summary Revised
(FOA-C-50050-5.3; ISSN-0347-7665; ETN-88-90747) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

The Emotional Stress Reaction Questionnaire (ESRQ) focuses on the emotional aspects of the acute stress reaction. The questionnaire provides an estimation of the magnitude of the stress reaction of an individual in a given situation in less than 1 min. Predictions of psychological coping potential can also be made. A presentation of how the ESRQ is derived from coping theory is given. The process of instrument development is described and instructions for usage and interpretation of the questionnaire are given. Normative data as well as assessments of reliability and validity are presented. ESA

N88-14618 Technische Hogeschool Twente, Enschede (Netherlands). Afdeling Klinische Neurofysiologie.
MODEL BASED MONITORING OF HUMAN SLEEP STAGES Ph.D. Thesis
BASTIAAN (BOB) KEMP 1987 137 p
(ISBN-90-9001448-9; B8709267; ETN-88-91355) Avail: Issuing Activity

Probabilistic models of sleep and of the sleep-related activity of brain, eyes, and muscles are proposed. The probabilistic generators in the models are Wiener, Poisson point, and Gaussian processes, and a Markov chain. The analysis algorithms, which are optimal for these models, were developed using nonlinear stochastic filtering theory and statistical detection theory. ESA

N88-14619# Gezondheidsraad, Hague (Netherlands).
UV RADIATION: HUMAN EXPOSURE TO ULTRAVIOLET RADIATION
10 Jun. 1986 177 p In DUTCH
(PB87-137410) Avail: NTIS HC E07/MF E01 CSCL 06R

Presented are recommendations for the safe use of artificially generated ultraviolet (UV) radiation. Exposure to radiation from UV lasers is not considered here, although some of the recommendations are also valid for radiation from this type of equipment. The report revises and extends the 1978 recommendations of the Health Council of the Netherlands on micrometer radiation, insofar as UV radiation (wavelength range 100 to 400 nm) is concerned. The 1978 report mainly discussed the unintentional exposure to electromagnetic radiation. The present report also considers extensively the intentional use of UV radiation sources, such as sun lamps, sun couches, solaria, etc., by the general public. GRA

N88-14620# McMaster Univ., Hamilton (Ontario). Dept. of Medicine.
OXYGEN TRANSPORT DURING EXERCISE AT EXTREME SIMULATED ALTITUDE: OPERATION EVEREST 2
JOHN R. SUTTON, JOHN T. REEVES, PETER D. WAGNER, BERTRON M. GROVES, ALLEN CYMERMAN, MARK K. MALCONIAN, PAUL B. ROCK, PATRICIA M. YOUNG, STEPHEN D. WALTER, and CHARLES S. HOUSTON (Vermont Univ., Burlington.) 21 May 1987 59 p
(Contract DAMD17-85-C-5206; PHS-HL-14985; PHS-HL-17731)
(AD-A185720) Avail: NTIS HC A04/MF A01 CSCL 06J

A decrease in maximal oxygen uptake has been demonstrated with increasing altitude. However, direct measurements of individual links in the oxygen transport chain at extreme altitude have not been obtained previously. Subjects exercised on a cycle ergometer and heart rate was recorded by an electrocardiograph; ventilation, VO2 and VCO2 were measured by open circuit. Arterial and mixed venous blood samples were collected from indwelling radial or brachial and pulmonary artery catheters for analysis of blood gases, oxygen saturation and content, and lactate. As barometric pressure decreased, VO2 max decreased. This was associated with profound hypoxemia and hypocapnia. Considering the major factors responsible for transfer of oxygen from the atmosphere to the tissues, the most important adaptations occurred in ventilation where a fourfold increase in alveolar ventilation was observed. Diffusion from alveolus to end capillary blood was unchanged with altitude. Diffusion from the capillary to the tissue mitochondria increased with altitude. With increasing altitude, blood lactate was progressively reduced at maximal exercise while at any absolute and relative submaximal workload, blood lactate was higher. These findings suggest that while glycogenolysis may be accentuated at low workloads, it may not be maximally activated at exhaustion. GRA

N88-14621# Army Research Inst. of Environmental Medicine, Natick, Mass.
MAXIMAL CARDIORESPIRATORY RESPONSES TO ONE- AND TWO-LEGGED CYCLING DURING ACUTE AND LONG-TERM EXPOSURE TO 4300M
CHARLES S. FULCO, PAUL B. ROCK, LAURIE TRAD, VINCENT FORTE, JR., and BRUCE RUSCIO 14 Jul. 1987 21 p
(AD-A185730) Avail: NTIS HC A03/MF A01 CSCL 06J

During exposure to high altitude, maximal oxygen consumption (V02max) is diminished immediately in proportion to the reduction in oxygen content of the inspired air. As the exposure lasts beyond a couple of days, there is an increase in arterial oxygen saturation. However, V02max does not increase possibly due to a reduction in cardiac output. The purpose of this investigation was to study the contribution of the increase in oxygen content to the working muscles without the potentially confounded problem of a reduced cardiac output. Seven male subjects (aged 17 to 24 years) performed one- and two-legged V02max tests on a cycle ergometer at sea level (SL), after 1 hour at 4300m simulated altitude (SA) and after two weeks of residence at the summit of Pikes Peak, CO. (PP;4300m). Cardiac output limits maximal performance during two-legged but not one-legged cycling. Since only one-legged V02max increased as more oxygen was made available to the working muscles then the altitude-induced reduction in cardiac output can be implicated as being responsible for the reduction in V02max during two legged cycling. GRA

N88-14622# Army Research Inst. of Environmental Medicine, Natick, Mass.
EXERCISE IN THE HEAT: EFFECTS OF DINITROPHENOL ADMINISTRATION
R. FRANCESCONI, R. HUBBARD, C. MATTHEW, M. DURKOT, and M. BOSSELAERS 26 Jul. 1987 28 p
(AD-A185731) Avail: NTIS HC A03/MF A01 CSCL 06O

Although dinitrophenol (DNP) stimulates excessive heat production by uncoupling oxidative phosphorylation, its effects on performance and thermoregulation during exercise in the heat have not been assessed. DNP was administered in two equal dosages (20mg/kg, 30 min interval); the second injection was followed immediately by exercise (9.14m/min) in the heat (30 C) or at room temperature (21 C) until exhaustion or 99 min. At 21 C control (saline-treated) rats manifested a mean endurance of 94 min which was reduced to 32 min among DNP-treated animals. Respective increments in rectal temperature (T sub re) for both groups were 0.02 C/min and 0.08 C/min. At 30 C control rats ran for 65 min (Tre/min=0.05 C) while DNP-treated animals had a mean endurance of only 12 min (Tre/min-0.22 C). DNP-treated rats (30 C) certainly manifested no decrement in tail-skin heat loss (Tsk/min=0.17 C vs 0.10 C) or saliva secretion (0.78g/min,DNP vs 0.19g/min, control) for their brief treadmill duration. Heat stress and DNP prevented the normal reduction in hematocrit and plasma protein levels during exercise while DNP increased osmolality and potassium levels post excercise. GRA

N88-14623*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AIRBORNE PARTICULATE MATTER IN SPACECRAFT
Feb. 1988 15 p Presented at a Panel Discussion held in Houston, Tex., 23-24 Jul. 1987
(Contract NAS9-17200)
(NASA-CP-2499; S-570; NAS 1.55:2499) Avail: NTIS HC A03/MF A01 CSCL 06K

Acceptability limits and sampling and monitoring strategies for airborne particles in spacecraft were considered. Based on instances of eye and respiratory tract irritation reported by Shuttle flight crews, the following acceptability limits for airborne particles were recommended: for flights of 1 week or less duration (1 mg/cu m for particles less than 10 microns in aerodynamic diameter (AD) plus 1 mg/cu m for particles 10 to 100 microns in AD); and for flights greater than 1 week and up to 6 months in duration (0.2 mg/cu m for particles less than 10 microns in AD plus 0.2 mg/cu m for particles 10 to 100 microns in AD. These numerical limits were recommended to aid in spacecraft atmosphere design which should aim at particulate levels that are a low as reasonably achievable. Sampling of spacecraft atmospheres for particles should include size-fractionated samples of 0 to 10, 10 to 100, and greater than 100 micron particles for mass concentration measurement and elementary chemical analysis by nondestructive analysis techniques. Morphological and chemical analyses of single particles should also be made to aid in identifying airborne particulate sources. Air cleaning systems based on inertial collection principles and fine particle collection devices based on electrostatic precipitation and filtration should be considered for incorporation into spacecraft air circulation systems. It was also recommended that research be carried out in space in the areas of health effects and particle characterization. Author

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BEHAVIORAL SCIENCES

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

A88-18546
DYNAMICS OF AUTOMATIC AND CONTROLLED VISUAL ATTENTION
ERICH WEICHSELGARTNER and GEORGE SPERLING (New York University, NY) Science (ISSN 0036-8075), vol. 238, Nov. 6, 1987, p. 778-780. refs
(Contract AF-AFOSR-85-0364)

Attentional processes that can occur while the eyes are stationary are experimentally studied. The time course of attention was observed using two kinds of stimuli: a cue to begin attending or to shift attention, and a stimulus to be attended. Precise measurements of the time course of attention showed that it consists of two partially concurrent processes: a fast, effortless, automatic process that records the cue and its neighboring events,

and a slower, effortful, controlled process that records the stimulus to be attended and its neighboring events. C.D.

A88-19620
RESTORATION OF WORK CAPACITY IN FLIGHT PERSONNEL [K PROBLEME VOSSTANOVLENIIA PROFESSIONAL'NOI RABOTOSPOSOBNOSTI LETNOGO SOSTAVA]
V. A. BODROV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1987, p. 46-48. In Russian.

This paper discusses the problem of partial work capacity loss by flight personnel due to functional aberrations in the nervous and cardiovascular systems, occurring before the appearance of clinical symptoms of a disease. These functional disorders may manifest themselves in elevated irritability, fatigability, decreased tolerance to the conditions of flight, and the development of fear sensation during flight. Methods for testing the preclinical functional aberrations are suggested, and procedures directed towards the correction of such conditions are considered. These programs must include medical, psychosociological, and occupational rehabilitation programs. I.S.

A88-20277* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBSERVERS' SENSITIVITY TO DYNAMIC ANOMALIES IN COLLISIONS
MARY KISTER KAISER (NASA, Ames Research Center, Moffett Field, CA) and DENNIS PROFFITT, R. (Virginia, University, Charlottesville) Perception and Psychophysics (ISSN 0031-5117), vol. 42, no. 3, 1987, p. 275-280. refs
(Contract NCA2-87)

The present study examined observers' ability to discriminate canonical and dynamically anomalous collisions that were presented in either frictionless or frictional systems. Whereas previous research has provided qualitative demonstrations that dynamic information can be extracted from visual events, the current study provides a parametric assessment of observers' sensitivity to dynamic invariants. The findings indicate that observers are competent when viewing both familiar, terrestrial (frictional) systems and unfamiliar but computationally simpler, 0-G (frictionless) systems. Thus, the sensitivity to these dynamic invariants in visual events is robust in natural systems whose dynamic properties differ from those of the environment in which humans evolved and developed. Author

A88-20297* Texas Univ., Austin.
THE HONEYMOON EFFECT IN JOB PERFORMANCE - TEMPORAL INCREASES IN THE PREDICTIVE POWER OF ACHIEVEMENT MOTIVATION
ROBERT L. HELMREICH, LINDA L. SAWIN, and ALAN L. CARSRUD (Texas, University, Austin) Journal of Applied Psychology (ISSN 0021-9010), vol. 71, no. 2, 1986, p. 185-188. refs
(Contract NCC2-286; NAG2-137)

Correlations between a job performance criterion and personality measures reflecting achievement motivation and an interpersonal orientation were examined at three points in time after completion of job training for a sample of airline reservations agents. Although correlations between the personality predictors and performance were small and nonsignificant for the 3-month period after beginning the job, by the end of six and eight months a number of significant relationships had emerged. Implications for the utility of personality measures in selection and performance prediction are discussed. Author

N88-13851# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afdeling Verrichtingspsychologie.
TASKOMAT, A TASK BATTERY FOR INFORMATION PROCESSING
L. C. BOER, A. W. K. GAILLARD, and P. G. A. M. JORNA 1987 124 p In DUTCH; ENGLISH summary
(Contract A83/K/045)
(IZF-1987-2; TD-87-1776; ETN-88-90860) Avail: NTIS HC A06/MF A01

The construction of, and experience with Taskomat, a standardized task battery for the testing of human information processing are reviewed. Administration procedures and fields of application are discussed, including selection of personnel, measurement of psychological fitness, effects of mental loads, and stress. A manual for the operator, and instructions for the test subject are included. ESA

N88-14613# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF GENERAL VERTICAL VIBRATION ON RELATIONSHIPS BETWEEN MEDIATORS IN VARIOUS SEGMENTS OF BRAIN Abstract Only
A. S. DMITRIYEV, M. YU. TAYTS, T. V. DUDINA, and T. S. KANDYBO *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 50 5 Nov. 1987 Transl. into ENGLISH from Doklady Akademii Nauk BSSR (Minsk, USSR), v. 31, no. 6, Jun. 1987 p 567-570
Avail: NTIS HC A04/MF A01

The activity of the central neuromediator systems involved in the response reaction to the extreme influences was studied. Reception of corticosterone by various brain structures was studied, reflecting the reaction of the central nervous system to changes in the functional status of the hypothalamus-hypophysis-adrenocortical system. The work was performed on adult male Wistar rats following 2 hours general vertical vibration at 10 Hz, amplitude 1 mm, acceleration 2 m/sq s. The decrease in excitability of zones of the cortex, and weakening of activation reaction in response to afferent signals are associated with the activation of the noradrenaline and serotoninergic systems. In the parietal cortex, significant changes occur in the reception of corticosterone, reflecting the variation in the choline, monoamine, and GABAergic neuronal activity with level of glucocorticoids in the body and the functional status of the hypothalamus-hypophysis-adrenocortical system. Author

N88-14624# Technische Hogeschool, Eindhoven (Netherlands).
VISION OF DETAILS IN SPACE AND TIME Ph.D. Thesis
FRANCISCUS JOHANNES BLOMMAERT 1987 186 p Sponsored by the Netherlands Organisation for the Advancement of Pure Research
(B8711402; ETN-88-91368) Avail: NTIS HC A09/MF A01

Temporal impulses and step responses of the human eye obtained psychophysically by a drift correcting perturbation technique are presented. Prediction of thresholds and latency on the basis of experimentally determined impulse responses is treated. The foveal point spread function as a determinant for detail vision is considered. Point spread function variation and visibility of details is discussed. Local visual responses in space and time are shown. Estimation of optical and neural imaging factors in letter confusion is studied. The effects of letter size on recognition at low contrast levels is tested. ESA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A88-16997* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEROBOT FLIGHT EXPERIMENT - CONTROL ISSUES IN ZERO G
LYLE M. JENKINS (NASA, Johnson Space Center, Houston, TX) IN: Guidance and control 1987; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Jan. 31-Feb. 4, 1987 . San Diego, CA, Univelt, Inc., 1987, p. 373-379. refs
(AAS PAPER 87-041)

A telerobot concept consisting of dual-arm dexterous manipulators controlled by an operator has been proposed as a supplement (and possibly an alternative) to EVA by space crews. Issues of control of manipulator arms arising from the mechanical response and the operator's interaction with the hand controllers and displays are discussed. It is noted that the Space Shuttle cabin and the payload bay are the primary facilities for the resolution of remote manipulation and issues with telerobots. K.K.

A88-16999* Stanford Univ., Calif.
EXPERIMENTS IN ADVANCED CONTROL CONCEPTS FOR SPACE ROBOTICS - AN OVERVIEW OF THE STANFORD AEROSPACE ROBOTICS LABORATORY
M. G. HOLLARS, R. H. CANNON, JR., H. L. ALEXANDER, and D. F. MORSE (Stanford, University, CA) IN: Guidance and control 1987; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Jan. 31-Feb. 4, 1987 . San Diego, CA, Univelt, Inc., 1987, p. 417-434. NASA-supported research. refs
(Contract F49620-82-C-00092; F33615-85-C-5106; F33615-82-K-5108; MDA903-86-K-0037)
(AAS PAPER 87-044)

The Stanford University Aerospace Robotics Laboratory is actively developing and experimentally testing advanced robot control strategies for space robotic applications. Early experiments focused on control of very lightweight one-link manipulators and other flexible structures. The results are being extended to position and force control of mini-manipulators attached to flexible manipulators and multilink manipulators with flexible drive trains. Experimental results show that end-point sensing and careful dynamic modeling or adaptive control are key to the success of these control strategies. Free-flying space robot simulators that operate on an air cushion table have been built to test control strategies in which the dynamics of the base of the robot and the payload are important. Author

A88-17000* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACE TELEROBOTICS TECHNOLOGY DEMONSTRATION PROGRAM
S. Z. SZIRMAY, P. S. SCHENKER, G. RODRIGUEZ, and R. L. FRENCH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Guidance and control 1987; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Jan. 31-Feb. 4, 1987 . San Diego, CA, Univelt, Inc., 1987, p. 435-444. refs
(AAS PAPER 87-045)

The paper reports the ongoing development of a telerobot demonstrator. The demonstrator is implemented as a laboratory-based research testbed, and will show proof-of-concept for supervised automation of space assembly, servicing, and repair operations. The demonstrator system features a hierarchically layered intelligent control architecture which enables automated planning and run-time sequencing of complex tasks by a supervisory human operator. The demonstrator also provides a full bilateral force-reflecting hand control teleroperations capability. The operator may switch smoothly between the automated and teleroperated tasking modes in run-time, either on a preplanned or operator-designated basis. Author

A88-17061* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS; PROCEEDINGS OF WORKSHOP II OF THE 26TH COSPAR PLENARY MEETING, TOULOUSE, FRANCE, JUNE 30-JULY 11, 1986
R. D. MACELROY, ED. (NASA, Ames Research Center, Moffett Field, CA) and D. T. SMERNOFF, ED. (New Hampshire, University, Durham) Workshop sponsored by COSPAR and International Academy of Astronautics. Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, 155 p. For individual items see A88-17062 to A88-17083.

The present conference on the development status of Controlled Ecological Life Support Systems (CELSSs) discusses food production and gas exchange with the Spirulina blue-green alga, biomass recycling for greater energy efficiency in algal culture CELSSs, algal proteins for food processing in a CELSS, a CELSS with photosynthetic N2-fixing cyanobacteria, the NASA CELSS program, and vapor compression ditillation and membrane technology for water revitalization. Also discussed are a fundamental study of CELSS gas monitoring, the application of catalytic wet oxidation to CELSS, a large-scale perspective on ecosystems, Japanese CELSS research activities, the use of potatoes in bioregenerative life-support, wheat production in controlled environments, and a trickle water and feeding system in plant culture. O.C.

A88-17062
PROGRESS IN EUROPEAN CELSS ACTIVITIES
A. I. SKOOG (Dornier System GmbH, Friedrichshafen, Federal Republic of Germany) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 3-6.

The European CELSS activities started in the late 1970s with system analysis and feasibility studies of Biological Life Support Systems (BLSS). Since then the European efforts have continued in two major directions: as a series of individual development tasks like the Environmental Life Support System and the Solar Plant Growth Facility, and in parallel hereto as overall coordination and planning activities for life support system long-term needs definition and payload definition for COLUMBUS utilization. The early initiations for CELSS came from the industry side in Europe, but since then planning and hardware feasibility analyses have been initiated also from the customer/agency side. Despite this, it is still too early to state that a 'CELSS-program' as a 'concerted' effort has been agreed upon in Europe. However, the general CELSS objectives have been accepted as planning and possible development goals for the European effort for manned space activities, and as experimental planning topics in the life sciences community for the next decades. Author

A88-17063
FOOD PRODUCTION AND GAS EXCHANGE SYSTEM USING BLUE-GREEN ALGA (SPIRULINA) FOR CELSS
MITSUO OGUCHI, KOJI OTSUBO, KEIJI NITTA, and SHIGEKI HATAYAMA (National Aerospace Laboratory, Chofu, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 7-10. refs

In order to reduce the cultivation area required for the growth of higher plants in space, adoption of algae, which have a higher photosynthetic ability, seems very suitable for obtaining oxygen

and food as a useful source of high quality protein. The preliminary cultivation experiment for determining optimum cultivation conditions and for obtaining the critical design parameters of the cultivator itself has been conducted. Spirulina was cultivated in a six-liter medium containing a sodium hydrogen carbonate solution and a cultivation temperature controlled using a thermostat. Generated oxygen gas was separated using a polypropyrene porous hollow fiber membrane module. Through this experiment, oxygen gas (at a concentration of more than 46 percent) at a rate of 100-150 ml per minute could be obtained. Author

A88-17064
BIOMASS RECYCLE AS A MEANS TO IMPROVE THE ENERGY EFFICIENCY OF CELSS ALGAL CULTURE SYSTEMS
R. RADMER, J. COX, D. LIEBERMAN, P. BEHRENS, and K. ARNETT (Martek Corp., Columbia, MD) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 11-15. refs

Algal cultures can be very rapid and efficient means to generate biomass and regenerate the atmosphere for closed environmental life support systems. However, as in the case of most higher plants, a significant fraction of the biomass produced by most algae cannot be directly converted to a useful food product by standard food technology procedures. This waste biomass will serve as an energy drain on the overall system unless it can be efficiently recycled without a significant loss of its energy content. Experiments are reported in which cultures of the alga Scenedesmus obliquus were grown in the light and at the expense of an added carbon source, which either replaced or supplemented the actinic light. As part of these experiments, hydrolyzed waste biomass from these same algae was tested to determine whether the algae themselves could be made part of the biological recycling process. Results indicate that hydrolyzed algal (and plant) biomass can serve as carbon and energy sources for the growth of these algae, suggesting that the efficiency of the closed system could be significantly improved using this recycling process. Author

A88-17065* New Hampshire Univ., Durham.
OPERATION OF AN EXPERIMENTAL ALGAL GAS EXCHANGER FOR USE IN A CELSS
DAVID T. SMERNOFF (New Hampshire, University, Durham), ROBERT A. WHARTON, JR. (NASA, Ames Research Center, Moffett Field, CA), and MAURICE M. AVERNER (NASA, Washington, DC) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 17-27. refs

Concepts of a CELSS anticipate the use of photosynthetic organisms for air revitalization. The rates of production and uptake of carbon dioxide and oxygen between the crew and the photosynthetic organisms are mismatched. An algal system used for gas exchange only will have the difficulty of an accumulation or depletion of these gases beyond physiologically tolerable limits. The results of a study designed to test the feasibility of using environmental manipulations to maintain physiologically appropriate atmospheres for algae (Chlorella pyrenoidosa) and mice (Mus musculus strain DW/J) in a gas-closed system is reported. Specifically, the atmosphere behavior of this system with Chlorella grown on nitrate or urea and at different light intensities and optical densities is considered. Manipulation of both the photosynthetic rate and the assimilatory quotient of the alga has been found to reduce the mismatch of gas requirements and allow operation of the system in a gas-stable manner. Author

A88-17066*
NON-CONVENTIONAL APPROACHES TO FOOD PROCESSING IN CELSS. I - ALGAL PROTEINS: CHARACTERIZATION AND PROCESS OPTIMIZATION
Z. NAKHOST, M. KAREL (MIT, Cambridge, MA), and V. J. KRUKONIS (Phasex Corp., Lawrence, MA) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 29-38. NASA-supported research. refs

Protein isolate obtained from green algae (Scenedesmus obliquus) cultivated under controlled conditions was characterized. Molecular weight determination of fractionated algal proteins using SDS-polyacrylamide gel electrophoresis revealed a wide spectrum of molecular weights ranging from 15,000 to 220,000. Isoelectric points of dissociated proteins were in the range of 3.95 to 6.20. Amino acid composition of protein isolate compared favorably with FAO standards. High content of essential amino acids leucine, valine, phenylalanine and lysine makes algal protein isolate a high quality component of CELSS diets. To optimize the removal of algal lipids and pigments supercritical carbon dioxide extraction (with and without ethanol as a co-solvent) was used. Addition of ethanol to supercritical CO2 resulted in more efficient removal of algal lipids and produced protein isolate with a good yield and protein recovery. The protein isolate extracted by the above mixture had an improved water solubility. Author

A88-17067
APPLICATION OF PHOTOSYNTHETIC N2-FIXING CYANOBACTERIA TO THE CELSS PROGRAM
IAN V. FRY, JANA HRABETA, JOE D'SOUZA, and LESTER PACKER (California, University, Berkeley) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 39-46. refs

The feasibility of using photosynthetic microalgae (cyanobacteria) as a subsystem component for the CELSS program, with particular emphasis on the manipulation of the biomass (protein/carbohydrate), has been addressed. Using factors which retard growth rates, but not photosynthetic electron flux, the partitioning of photosynthetically derived reductant may be dictated toward CO2 fixation (carbohydrate formation) and away from N2 fixation (protein formation). Cold shock treatment of fairly dense cultures markedly increases the glycogen content from 1 percent to 35 percent (dry weight), and presents a useful technique to change the protein/carbohydrate ratio of these organisms to a more nutritionally acceptable form. Author

A88-17068
SUNLIGHT SUPPLY AND GAS EXCHANGE SYSTEMS IN MICROALGAL BIOREACTOR
K. MORI (Keio University, Hiyoshi, Japan), H. OHYA, K. MATSUMOTO (Yokohama National University, Japan), and H. FURUNE (La Foret Engineering and Information Service Co., Tokyo, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 47-52. refs

The bioreactor with sunlight supply system and gas exchange systems presented here has proved feasible in ground tests and shows much promise for space use as a CELSS device. The main conclusions concerning the specification of a total system needed for a life support system for a man in a Space Station are the following: (1) a sunlight supply system with compactness and low electrical consumption, (2) a bioreactor system with high density and growth rate of chlorella, and (3) a gas exchange system with sufficient O2 production and CO2 assimilation.
Author

A88-17069* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVIEW OF RECENT ACTIVITIES IN THE NASA CELSS PROGRAM
R. D. MACELROY (NASA, Ames Research Center, Moffett Field, CA), J. TREMOR, D. T. SMERNOFF (New Hampshire, University, Dover), W. KNOTT, and R. P. PRINCE (NASA, Kennedy Space Center, Cocoa Beach, FL) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 53-57. refs

A CELSS (Controlled Ecological Life Support System) is a device that utilizes photosynthetic organisms and light energy to regenerate waste materials into oxygen and food for a crew in space. The results of theoretical and practical studies conducted by investigators within the CELSS program suggest that a bioregenerative life support system can be a useful and effective method of regenerating consumable materials for crew sustenance. Experimental data suggests that the operation of a CELSS in space will be practical if plants can be made to behave predictably in the space environment. Much of the work currently conducted within the CELSS program centers on the biological components of the CELSS system. The work is particularly directed at ways of achieving high efficiency and long term stability of all components of the system. Included are explorations of the conversion of nonedible cellulose to edible materials, nitrogen fixation by biological and chemical methods, and methods of waste processing. It is the intent of the presentation to provide a description of the extent to which a bioregenerative life support system can meet the constraints of the space environment, and to assess the degree to which system efficiency and stability can be increased during the next decade. Author

A88-17070* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A MODULAR BLSS SIMULATION MODEL
JOHN D. RUMMEL (NASA, Ames Research Center, Moffett Field, CA) and TYLER VOLK (New York University, New York) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 59-67. refs

The coordination of material flows in earth's biosphere is largely made possible by the buffering effect of huge material reservoirs. Without similarly-sized buffers, a bioregenerative life support system (BLSS) for extraterrestrial use will be faced with coordination problems more acute than those in any ecosystem found on earth. A related problem in BLSS design is providing an interface between the various life-support processors, one that will allow for their coordination while still allowing for system expansion. A modular model is presented of a BLSS that interfaces system processors only with the material storage reservoirs, allowing those reservoirs to act as the principal buffers in the system and thus minimizing difficulties with processor coordination. The modular nature of the model allows independent development of the detailed submodels that exist within the model framework. Using this model, BLSS dynamics were investigated under normal conditions and under various failure modes. Partial and complete failures of various components, such as the waste processor or the plants themselves, drive transient responses in the model system, allowing examination of the effectiveness of the system reservoirs as buffers. The results from simulations of this sort will help to determine control strategies and BLSS design requirements. An evolved version of this model could be used as an interactive control aid in a future BLSS. Author

A88-17071
PRELIMINARY EXPERIMENTAL RESULTS OF GAS RECYCLING SUBSYSTEMS EXCEPT CARBON DIOXIDE CONCENTRATION
K. OTSUJI, T. SAWADA (Mitsubishi Heavy Industries, Ltd., Nagoya, Japan), S. SATOH (Mitsubishi Heavy Industries, Ltd., Takasago, Japan), S. KANDA, H. MATSUMURA (Kawasaki Heavy Industries, Ltd., Kobe, Japan) et al. (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 69-72. refs

Oxygen concentration and separation is an essential factor for air recycling in a CELSS. Furthermore, if the value of the plant assimilatory quotient is not coincident with that of the animal respiratory quotient, the recovery of O2 from the concentrated CO2 through chemical methods will become necessary to balance the gas contents in a CELSS. Therefore, oxygen concentration and separation equipment using Salcomine and O2 recovery equipment, such as Sabatier and Bosch reactors, were experimentally developed and tested. Author

A88-17072
VAPOR COMPRESSION DISTILLER AND MEMBRANE TECHNOLOGY FOR WATER REVITALIZATION
A. ASHIDA (Hitachi, Ltd., Space Systems Div., Tokyo, Japan), K. MITANI (Hitachi, Ltd., Space Systems Div., Yokohama, Japan), K. EBARA, H. KUROKAWA (Hitachi, Ltd., Japan), I. SAWADA (Sasakura Engineering Co., Ltd., Osaka, Japan) et al. (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 73-76.

A88-17073
FUNDAMENTAL STUDY ON GAS MONITORING IN CELSS
I. NISHI, T. TATEISHI, G. TOMIZAWA (Tokyo, Science University, Chiba, Japan), K. NITTA, and M. OGUCHI (National Aerospace Laboratory, Chofu, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 77-80.

A mass spectrometer and computer system was developed for conducting a fundamental study on gas monitoring in CELSS. Respiration and metabolism of the hamster and photosynthesis of the Spirulina were measured in a combination system consisting of a hamster chamber and a Spirulina cultivator. They are connected through a membrane gas exchanger. Some technical problems were examined. In the mass spectrometric gas monitoring, a simultaneous multi-sample measurement was developed by employing a rotating exchange valve. Long term precise measurement was obtained by employing an automatic calibration system. The membrane gas sampling probe proved to be useful for long term measurement. The cultivation rate of the Spirulina was effectively changed by controlling CO2 and light supply. The experimental results are helpful for improving the hamster-Spirulina system. Author

A88-17074
THE APPLICABILITY OF CATALYTIC WET-OXIDATION TO CELSS
Y. TAKAHASHI (Niigata University, Japan), K. NITTA, M. OGUCHI (National Aerospace Laboratory, Chofu, Japan), and H. OHYA (Yokohama National University, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 81-84.

The wet-oxidation catalysis of Au, Pd, Pt, Rh or Ru on a ceramic honeycomb carrier was traced in detail by 16 to 20 repetitive batch tests each. As a result, Pt or Pd on a honeycomb carrier was shown to catalyze complete nitrogen gasification as N2. Though the catalysts which realize both complete nitrogen

gasification and complete oxidation could not be found, the Ru + Rh catalyst was found to be most promising. Ru honeycomb catalyzed both nitrification and nitrogen gasification. Author

A88-17075
A LARGE-SCALE PERSPECTIVE ON ECOSYSTEMS
HIROSHI MIZUTANI (Mitsubishi-Kasei Institute of Life Sciences, Tokyo, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 85-88. refs

Interactions between ecological elements must be better understood in order to construct an ecological life support system in space. An index was devised to describe the complexity of material cyclings within a given ecosystem. It was then applied to the cyclings of bioelements in various systems of material cyclings including the whole earth and national economies. The results show interesting characteristics of natural and man-made systems. Author

A88-17076
DESIGN OF AN ELEMENTAL ANALYSIS SYSTEM FOR CELSS RESEARCH
STEVEN H. SCHWARTZKOPF (California, University, Davis) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 89-93.

The results of experiments conducted with higher plants in tightly sealed growth chambers provide definite evidence that the physical closure of a chamber has significant effects on many aspects of a plant's biology. One of these effects is seen in the change in rates of uptake, distribution, and re-release of nutrient elements by the plant (mass balance). Experimental data indicates that these rates are different from those recorded for plants grown in open field agriculture, or in open growth chambers. Since higher plants are a crucial component of a CELSS, it is important that the consequences of these rate differences be understood with regard to the growth and yield of the plants. This paper will focus on the description of a system for elemental analysis which can be used to monitor the mass balance of nutrient elements in CELSS experiments. Additionally, data on the uptake of nutrient elements by higher plants grown in a growth chamber will be presented. Author

A88-17077
AN OVERVIEW OF JAPANESE CELSS RESEARCH ACTIVITIES
KEIJI NITTA (National Aerospace Laboratory, Chofu, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 95-103. refs

Controlled Ecological Life Support System (CELSS) efforts in Japan have thus far extended to gas recycling systems, water recycling systems, approaches to waste management, plant and algae physiology and cultivation studies, and CELSS bioreactor design studies. In addition, research has been undertaken in animal and fish physiology and breeding in outer space and on the effects of weightlessness on plant and animal life. Gas recycling technologies will be applied to the Japanese Experiment Module associated with the NASA Space Station. O.C.

A88-17078
STUDY OF THE RELATIONSHIPS BETWEEN PHOTOSYNTHESIS, RESPIRATION, TRANSPIRATION AND MINERAL NUTRITION IN WHEAT [ETUDE DES RELATIONS ENTRE PHOTSYNTHESE RESPIRATION, TRANSPIRATION ET NUTRITION MINERALE CHEZ LE BLE]
M. ANDRE, H. DUCLOUX, C. RICHAUD, D. MASSIMINO, A. DAGUENET (CEA, Institut de Recherche Fondamentale, Saint-Paul-lez-Durance, France) et al. (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 105-114. refs

A88-17079
UTILIZATION OF POTATOES IN BIOREGENERATIVE LIFE SUPPORT SYSTEMS
T. W. TIBBITS and R. M. WHEELER (Wisconsin, University, Madison) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 115-122. refs

Data on the tuberization, harvest index, and morphology of 2 cvs of white potatoe (Solanum tuberosum L.) grown at 12, 16, 20, 24 and 28 C, 250, 400 and 550 micromol/s sq m photosynthetic photon flux, 350, 1000 and 1600 microl/l CO2 are presented. A productivity of 21.9 g/sq m day of edible tubers from a solid stand of potatoes grown for 15 weeks with continuous irradiation at 400 micromol/s sq m, 16 C and 1000 microl/l CO2 has been obtained. This equates to an area of 34.3 sq m being required to provide 2800 kcal of potatoes per day for a human diet. Studies with side lighting indicate that productivities in this range should be realized from potatoes. Glycoalkaloid levels in tubers of controlled-environment-grown plants are within the range of levels found in tubers of field grown plants. The use and limitation of recirculating solution cultures for potato growth is discussed. Author

A88-17080* Utah State Univ., Logan.
WHEAT PRODUCTION IN CONTROLLED ENVIRONMENTS
FRANK B. SALISBURY, BRUCE BUGBEE, and DAVID BUBENHEIM (Utah State University, Logan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 123-132. Research supported by the Utah Agricultural Experiment Station. (Contract NCC2-139)

The present optimization study for maximum yield and quality conditions in the lunar or Martian Controlled Environment Life Support System (CELSS)-based growth of wheat has determined that, for 23-57 g/sq m per day of edible biomass, minimum CELSS size must be of the order of 12-30 sq m/person. About 600 W/sq m of electricity would be consumed by the artificial lighting required; temperature, irradiance, photoperiod, CO2 levels, humidity, and wind velocity are all controlled. A rock wool plant support allows direct seeding, and densities of up to 10,000 plants/sq m. Densities of up to 2000 plants/sq m appear to increase seed yields. O.C.

A88-17081
THE EFFECT OF RADIATION ON THE LONG TERM PRODUCTIVITY OF A PLANT BASED CELSS
B. G. THOMPSON and B. H. LAKE (Alberta Research Council, Edmonton, Canada) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 133-140. refs

Mutations occur at a higher rate in space than under terrestrial conditions, primarily due to an increase in radiation levels. These mutations may effect the productivity of plants found in a controlled ecological life support system (CELSS). Computer simulations of

plants with different ploidies, modes of reproduction, lethality thresholds, viability thresholds and susceptibilities to radiation induced mutations were performed under space normal and solar flare conditions. These simulations identified plant characteristics that would enable plants to retain high productivities over time in a CELSS. Author

A88-17082* New York Univ., New York.
MASS BALANCES FOR A BIOLOGICAL LIFE SUPPORT SYSTEM SIMULATION MODEL
TYLER VOLK (New York University, New York) and JOHN D. RUMEL (NASA, Ames Research Center, Moffett Field, CA) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 141-148. refs
(Contract NCA2-101)

Design decisions to aid the development of future space-based biological life support systems (BLSS) can be made with simulation models. Here the biochemical stoichiometry is developed for: (1) protein, carbohydrate, fat, fiber, and lignin production in the edible and inedible parts of plants; (2) food consumption and production of organic solids in urine, feces, and wash water by the humans; and (3) operation of the waste processor. Flux values for all components are derived for a steady-state system with wheat as the sole food source. Author

A88-17083
TRICKLE WATER AND FEEDING SYSTEM IN PLANT CULTURE AND LIGHT-DARK CYCLE EFFECTS ON PLANT GROWTH
T. TAKANO, K. INADA (Meijo University, Nagoya, Japan), and J. TAKANASHI (National Institute of Agrobiological Resources, Ibaraki, Japan) (COSPAR and International Academy of Astronautics, Plenary Meeting, 26th, Workshop on Controlled Ecological Life Support Systems, 2nd, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 4, 1987, p. 149-152.

Rockwool, as in inert medium covered or bagged with polyethylene film, can be effectively used for plant culture in the Space Station. The most important machine is the pump adjusting the dripping rate in the feeding system. Hydroaeroponics may be adaptable to a space laboratory. The shortening of the light-dark cycles inhibits plant growth and induces an abnormal morphogenesis. A photoperiod of 12-hr-dark may be needed for plant growth. Author

A88-17468
HUMAN FACTORS ENGINEERING TEST AND EVALUATION TOOLS, FACILITIES, AND METHODOLOGIES
BARRY L. BERSON (Lockheed-California Co., Burbank) Lockheed Horizons (ISSN 0459-6773), Sept. 1987, p. 32-38.

An account is given of a systematic methodology for reducing the risks and costs associated with the identification of significant man/machine interface problems prior to military aircraft development. Attention is given to the case of the P-3C Orion ASW aircraft update, in which an operator-centered design concept and human factors test activities were used early in the design phase; this methodology is being once again applied to the Advanced Tactical Aircraft program. Mockup hardware and part-task simulators are intensively used by the methodology. O.C.

A88-17722
MODELING OF MULTISTEP DECISION-MAKING PROBLEMS WITH FUZZY INITIAL DATA [MODELIROVANIE MNOGOSHAGOVYKH ZADACH PRINIATIIA RESHENII PRI NECHETKIKH ISKHODNYKH DANNYKH]
SERGEI VASIL'EVICH ASTANIN Elektronnoe Modelirovanie (ISSN 0204-3572), vol. 9, July-Aug. 1987, p. 93-97. In Russian. refs

A method is presented for constructing a fuzzy model of a multistep decision-making problem. Based on a subjective interpretation of solution results, classes of human operator strategies are identified. The model proposed here can be readily implemented in computer software and used for monitoring operator decisions in solving specific problems. V.L.

A88-18562
MEASUREMENTS OF SHIELDING EFFECTIVENESS OF MICROWAVE-PROTECTIVE SUITS
ARTHUR W. GUY, CARROL SORENSEN (Washington, University, Seattle), CHUNG-KWANG CHOU, and JOHN A. MCDOUGALL (City of Hope National Medical Center, Duarte, CA) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. MTT-35, Nov. 1987, p. 984-994. Research supported by AT&T Bell Laboratories. refs

This paper describes tests of the effectiveness of the Wave Guarde, Milliken, Invascreen, and U.S. Navy protective suits designed to shield the human body from exposure to high-intensity microwave fields. The waveguide-transmission-loss test was used together with tests on a full-sized man model filled with phantom muscle. In terms of shielding effectiveness, it is found that the Navy suit is the best, the Wave Guarde second best, and the Milliken and Invascreen the least effective. C.D.

A88-18563
SHIELDING EFFECTIVENESS OF IMPROVED MICROWAVE-PROTECTIVE SUITS
CHUNG-KWANG CHOU, JOHN A. MCDOUGALL (City of Hope National Medical Center, Duarte, CA), and ARTHUR W. GUY (Washington, University, Seattle) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. MTT-35, Nov. 1987, p. 995-1001. Research supported by Milliken & Co. and AT&T Bell Laboratories. refs

A88-18738
SATELLITE-MOUNTED ROBOT MANIPULATORS - NEW KINEMATICS AND REACTION MOMENT COMPENSATION
RICHARD W. LONGMAN, ROBERT E. LINDBERG, and MICHAEL F. ZEDD (U.S. Navy, Naval Research Laboratory, Washington, DC) International Journal of Robotics Research (ISSN 0278-3649), vol. 6, Fall 1987, p. 87-103.

When a robot arm is mounted on a satellite, the commanded arm motions produce motion of the satellite and therefore of the robot base. As a result, the robot joint angles that would normally be commanded to produce a prescribed robot end-effector position and orientation will cause the end-effector to miss the target. A new kind of robot kinetics has been developed that adjusts the joint angle commands to account for base motion. Methods are also developed to compute the satellite attitude disturbances resulting from robot motion for use in a reaction wheel compensation system or in feedforward control. Author

A88-19866
ROBOTS - AUTONOMOUS SPACE WORKERS
D. R. SLOGGETT Space (ISSN 0267-954X), vol. 3, Nov.-Dec. 1987, p. 6-10.

Crew safety, increased capability, and productivity drive the potential applications for robots in space. Enhanced astronaut safety, due to the reduced need for EVA, coupled with the ability to deal safely with malfunctions that cause hazardous conditions in the vicinity of the failed equipment are the main goals of using robots in space. In order to operate in space, the robots must be hardened against high energy particles, small meteorites, and radiation. NASA-sponsored work has shown the need to support features such as gross and dexterous manipulation, handling flexible objects, execution of 'learned' sequences, and multiarm operations. The use of intelligent robots on the Space Station is discussed. K.K.

N88-13852*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM. DESIGN, DEVELOPMENT, AND USE OF A GROUND-BASED PLANT GROWTH MODULE
ROBERT D. MACELROY, DAVID T. SMERNOFF (New Hampshire Univ., Durham.), and JOHN D. RUMMEL Sep. 1987 83 p Meeting held at Moffett Field, Calif., Sep. 1984, in Cocoa Beach, Fla., Apr. 1985 and in Carmel, Calif., 23-25 Apr. 1986
(Contract NCC2-27)
(NASA-CP-2479; A-87255; NAS 1.55:2479) Avail: NTIS HC A05/MF A01 CSCL 06K

Problems of food production by higher plants are addressed. Experimentation requirements and necessary equipment for designing an experimental Controlled Ecological Life Support System (CELSS) Plant Growth Module are defined. A framework is provided for the design of laboratory sized plant growth chambers. The rationale for the development of an informal collaborative effort between investigators from universities and industry and those at Ames is evaluated. Specific research problems appropriate for collaborative efforts are identified.

N88-13853*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CELSS PROGRAM MEETING
JOHN W. TREMOR and ROBERT D. MACELROY *In its* Controlled Ecological Life Support System. Design, Development, and Use of a Ground-Based Plant Growth Module p 1-9 Sep. 1987
Meeting held in Carmel Valley Inn, Calif., 23-25 Apr. 1986
Avail: NTIS HC A05/MF A01 CSCL 06K

A meeting on the potential contributions of plant science to the goals of Controlled Ecological Life Support System (CELSS) research produced discussions that helped to focus on a variety of topics. In the area of volatiles and soluble organics, microbial activity, disease, and productivity, participants emphasized the need to know more about the consequences of closure for the growth of plants. Under nutrient delivery systems, the problems focus on the need to maintain a stable, optimum nutrient system. Lighting systems discussions emphasized unique methods of direct lighting and development of improved irradiation sources. Flight experiment opportunities were outlined by one speaker. Documentation of the Plant Growth Module was discussed. The last day's discussion focused on the organization of the research group to be involved in the development and use of a two to three cubic meter sealed chamber and ancillary equipment. J.P.B.

N88-13854*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS: DEVELOPMENT OF A PLANT GROWTH MODULE
MEL M. AVERNER, ROBERT D. MACELROY, and DAVID T. SMERNOFF (New Hampshire Univ., Durham.) *In its* Controlled Ecological Life Support System. Design, Development, and Use of a Ground-Based Plant Growth Module p 11-40 Sep. 1987
Avail: NTIS HC A05/MF A01 CSCL 06K

An effort was made to begin defining the scientific and technical requirements for the design and construction of a ground-based plant growth facility. In particular, science design criteria for the Plant Growth Module (PGM) of the Controlled Ecological Life Support System (CELSS) were determined in the following areas: (1) irradiation parameters and associated equipment affecting plant growth; (2) air flow; (3) planting, culture, and harvest techniques; (4) carbon dioxide; (5) temperature and relative humidity; (6) oxygen; (7) construction materials and access; (8) volatile compounds; (9) bacteria, sterilization, and filtration; (10) nutrient application systems; (11) nutrient monitoring; and (12) nutrient pH and conductivity. J.P.B.

N88-13855*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANT GROWTH MODULE (PGM) CONCEPTUAL DESIGN
STEVEN H. SCHWARTZKOPF (California Univ., Davis.) and DARYL RASMUSSEN *In its* Controlled Ecological Life Support System. Design, Development, and Use of a Ground-Based Plant Growth Module p 41-70 Sep. 1987
Avail: NTIS HC A05/MF A01 CSCL 06K

The Plant Growth Module for the Controlled Ecological Life Support System (CELSS), designed to answer basic science questions related to growing plants in closed systems, is described functionally with artist's conception drawings. Subsystems are also described, including enclosure and access; data acquisition and control; gas monitor and control; heating, ventilation, and air conditioning; air delivery; nutrient monitor and control; microbial monitoring and control; plant support and nutrient delivery; illumination; and internal operations. The hardware development plan is outlined. J.P.B.

N88-13856# Arizona State Univ., Tempe.
EXAMINING THE RELATIVE EFFICIENCY OF PART- VERSUS WHOLE-TASK PRACTICE FOR MULTIPLE-TASK SITUATIONS Final Report, 1 Sep. 1984 - 31 Jul. 1987
DIANE L. DAMOS Aug. 1987 18 p
(Contract DAAG29-84-K-0197)
(AD-A185056; ARO-22256.4-LS) Avail: NTIS HC A03/MF A01 CSCL 05F

The primary purpose was to compare part-task training to whole-task training for a variety of dual-task combinations. Four experiments were performed. The first experiment examined the speed and accuracy of manual responses vs vocal responses when subjects performed a Stroop task. The second experiment was directly concerned with comparing the relative efficiency of part- versus whole-task training for multiple-task situations. The third experiment was designed to fill one of the more important gaps concerning combinations consisting of two tracking tasks. The fourth experiment examined the effect of response mode (manual vs vocal) on single- and dual-task performance as a function of task pacing. The first experiment provided some useful data while experiments 2 and 3 were inconclusive. Data from experiment 4 indicated that the use of voice recognition systems offers a number of advantages, particularly under dual-task conditions. GRA

N88-13857# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Ergonomics Group.
SITTING POSTURE OF HELICOPTER PILOTS OF THE ROYAL NETHERLANDS AIR FORCE; PRELIMINARY RECOMMENDATIONS
D. S. C. OSINGA and H. SCHUFFEL Aug. 1986 32 p
(Contract A82/KLU/113)
(IZF-1986-16; TD-86-3428-II; ETN-88-91716) Avail: NTIS HC A03/MF A01

Ergonomic recommendations emphasizing helicopter pilot sitting posture are provided. The recommendations are based on an anthropometric survey and a study on causes of helicopter pilot back pain complaints. Sitting posture dimensions of male military personnel with guidelines for the location of displays and controls, and a checklist for evaluating future cockpit lay-out are included. ESA

N88-13858# Pacific Northwest Labs., Richland, Wash.
IRRADIATION PRESERVATION OF SEAFOOD: LITERATURE REVIEW
P. M. MOLTON Oct. 1987 60 p
(Contract DE-AC06-76RL-01830)
(DE88-001691; PNL-6311) Avail: NTIS HC A04/MF A01

The application of gamma-irradiation for extending the shelf life of seafood has been of interest for many years. This report reviews a number of studies on seafood irradiation conducted over the past several years. Topics covered include seafood irradiation techniques and dosages, species applicability and differences, the effects of packaging on seafood preservation, and

changes in organoleptic acceptability as a result of irradiation. Particular attention is given to radiation effects (likely and unlikely) of concern to the public. These include the potential for generation of toxic chemical products, botulinum toxin production, and other health concerns. No scientifically defensible evidence of any kind was found for any harmful effect of irradiation of seafoods at the doses being considered (less than 300 krad), and all indications are that irradiation is an acceptable and needed additional tool for seafood preservation. DOE

N88-14625*# Boeing Aerospace Co., Seattle, Wash.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) CONCEPTUAL DESIGN OPTION STUDY
MELVIN OLESON and RICHARD L. OLSON Jun. 1986 171 p
(Contract NAS2-11806)
(NASA-CR-177421; NAS 1.26:177421) Avail: NTIS HC A08/MF A01 CSCL 06K

Results are given of a study to explore options for the development of a Controlled Ecological Life Support System (CELSS) for a future Space Station. In addition, study results will benefit the design of other facilities such as the Life Sciences Research Facility, a ground-based CELSS demonstrator, and will be useful in planning longer range missions such as a lunar base or manned Mars mission. The objectives were to develop weight and cost estimates for one CELSS module selected from a set of preliminary plant growth unit (PGU) design options. Eleven Space Station CELSS module conceptual PGU designs were reviewed, components and subsystems identified and a sensitivity analysis performed. Areas where insufficient data is available were identified and divided into the categories of biological research, engineering research, and technology development. Topics which receive significant attention are lighting systems for the PGU, the use of automation within the CELSS system, and electric power requirements. Other areas examined include plant harvesting and processing, crop mix analysis, air circulation and atmosphere contaminant flow subsystems, thermal control considerations, utility routing including accessibility and maintenance, and nutrient subsystem design. Author

N88-14626*# Boeing Aerospace Co., Seattle, Wash.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) PHYSIOCHEMICAL WASTE MANAGEMENT SYSTEMS EVALUATION
M. OLESON, T. SLAVIN, F. LIENING, and R. L. OLSON Jun. 1986 146 p
(Contract NAS2-11806)
(NASA-CR-177422; NAS 1.26:177422; BAC-37) Avail: NTIS HC A07/MF A01 CSCL 06K

Parametric data for six waste management subsystems considered for use on the Space Station are compared, i.e.: (1) dry incineration; (2) wet oxidation; (3) supercritical water oxidation; (4) vapor compression distillation; (5) thermoelectric integrated membrane evaporation system; and (6) vapor phase catalytic ammonia removal. The parameters selected for comparison are on-orbit weight and volume, resupply and return to Earth logistics, power consumption, and heat rejection. Trades studies are performed on subsystem parameters derived from the most recent literature. The Boeing Engineering Trade Study (BETS), an environmental control and life support system (ECLSS) trade study computer program developed by Boeing Aerospace Company, is used to properly size the subsystems under study. The six waste treatment subsystems modeled in this program are sized to process the wastes for a 90-day Space Station mission with an 8-person crew, and an emergency supply period of 28 days. The resulting subsystem parameters are compared not only on an individual subsystem level but also as part of an integrated ECLSS. Author

N88-14627# Eurocontrol Experimental Centre, Bretigny (France).
USE OF COLOUR ON ELECTRONIC DATA DISPLAYS (SECOND STUDY)
H. DAVID and J. ROELOFSEN Sep. 1986 79 p
(PB87-126744; EEC-199) Avail: NTIS HC E05/MF E05 CSCL 05H

A technique for the simulation of EDD codings was described in EEC Report number 171. In addition to the displays described in that report, thirty-two controllers (French and Portuguese) evaluated four alternative codings. Speed and subjective preference order was: color print on gray, red background for alerting; color print on grey, red characters for alerting; dark print on pastel color; enhanced monochrome (bright for alerting). GRA

N88-14628# Technology, Inc., San Antonio, Tex. Life Sciences Div.
RESEARCH AND DEVELOPMENT OF ANTI-G LIFE SUPPORT SYSTEMS. PART 1: DEVELOPMENT AND EVALUATION OF UNIFORM-PRESSURE ANTI-G SUITS Final Report, 1 Apr. 1981 - 31 Jul. 1985
ROBERT W. KRUTZ, JR., ROY W. THOMPSON, ARNOLD G. KRUEGER, and EMILY M. GAUSE Apr. 1987 53 p
(Contract F33615-81-C-0600)
(AD-A185658; USAFSAM-TR-86-36-PT-1) Avail: NTIS HC A04/MF A01 CSCL 05H

A skin pressure measuring device was designed and fabricated to measure pressure actually applied to the lower body during anti-G suit inflation. This device was used with a variety of developmetal uniform pressure anti G suits; basketweave, multiple capstan, and reticulated foam suit designs were evaluated. Results indicated that owing to engineering incompatibilities involving weight, bulk, sizing, fitting, and effective pressure loss attributable to friction between the interdigitized tapes, the capstan approach is not a practical solution to developing a uniform pressure anti-G garment. The reticulated foam approach shows promise because of a tendency to retain its original shape when pressurized to high pressures. Further development of reticulated foam anti-G designs is recommended. GRA

N88-14856*# Texas A&M Univ., College Station. Dept. of Home Economics.
THE DETERMINATION OF NUTRITIONAL REQUIREMENTS FOR SAFE HAVEN FOOD SUPPLY SYSTEM (EMERGENCY-SURVIVAL FOODS) Final Report
SELINA AHMED *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 18 p Nov. 1987
Avail: NTIS HC A15/MF A01 CSCL 06H

The Space Station Safe Haven Food System must sustain 8 crew members under emergency conditions for 45 days. Emergency Survival Foods are defined as a nutritionally balanced collection of high density food and beverages selected to provide for the survival of Space Station flight crews in contingency situations. Since storage volume is limited, the foods should be highly concentrated. A careful study of different research findings regarding starvation and calorie restricted diets indicates that a minimum nutritional need close to RDA is an important factor for sustaining an individual's life in a stressful environment. Fat, protein, and carbohydrates are 3 energy producing nutrients which play a vital role in the growth and maintenance process of human life. A lower intake of protein can minimize the water intake, but it causes a negative nitrogen balance and a lower performance level. Other macro and micro nutrients are also required for nutritional interrelationships to metabolize the other 3 nutrients to their optimum level. The various options for longer duration than 45 days are under investigation. Author

N88-14867*# Pennsylvania State Univ., University Park. Dept. of Industrial Engineering.
PREDICTION OF PHYSICAL WORKLOAD IN REDUCED GRAVITY ENVIRONMENTS Final Report
JOSEPH H. GOLDBERG *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 20 p Nov. 1987
Avail: NTIS HC A15/MF A01 CSCL 05H

The background, development, and application of a methodology to predict human energy expenditure and physical workload in low gravity environments, such as a Lunar or Martian base, is described. Based on a validated model to predict energy expenditures in Earth-based industrial jobs, the model relies on an elemental analysis of the proposed job. Because the job itself need not physically exist, many alternative job designs may be compared in their physical workload. The feasibility of using the model for prediction of low gravity work was evaluated by lowering body and load weights, while maintaining basal energy expenditure. Comparison of model results was made both with simulated low gravity energy expenditure studies and with reported Apollo 14 Lunar EVA expenditure. Prediction accuracy was very good for walking and for cart pulling on slopes less than 15 deg, but the model underpredicted the most difficult work conditions. This model was applied to example core sampling and facility construction jobs, as presently conceptualized for a Lunar or Martian base. Resultant energy expenditures and suggested work-rest cycles were well within the range of moderate work difficulty. Future model development requirements were also discussed. Author

N88-14882*# Houston Univ., Tex. Dept. of Industrial Engineering.
TOOLS AND TECHNOLOGIES FOR EXPERT SYSTEMS: A HUMAN FACTORS PERSPECTIVE Final Report
NAVARATNA S. RAJARAM *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 18 p Nov. 1987
Avail: NTIS HC A15/MF A01 CSCL 05H

It is widely recognized that technologies based on artificial intelligence (AI), especially expert systems, can make significant contributions to the productivity and effectiveness of operations of information and knowledge intensive organizations such as NASA. At the same time, these being relatively new technologies, there is the problem of transfering technology to key personnel of such organizations. The problems of examining the potential of expert systems and of technology transfer is addressed in the context of human factors applications. One of the topics of interest was the investigation of the potential use of expert system building tools, particularly NEXPERT as a technology transfer medium. Two basic conclusions were reached in this regard. First, NEXPERT is an excellent tool for rapid prototyping of experimental expert systems, but not ideal as a delivery vehicle. Therefore, it is not a substitute for general purpose system implementation languages such a LISP or C. This assertion probably holds for nearly all such tools on the market today. Second, an effective technology transfer mechanism is to formulate and implement expert systems for problems which members of the organization in question can relate to. For this purpose, the LIghting EnGineering Expert (LIEGE) was implemented using NEXPERT as the tool for technology transfer and to illustrate the value of expert systems to the activities of the Man-System Division. Author

N88-14889*# New York Univ., New York. Dept. of Applied Science.
MODELING THE GROWTH DYNAMICS OF FOUR CANDIDATE CROPS FOR CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) Final Report
TYLER VOLK *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 17 p Nov. 1987
Avail: NTIS HC A15/MF A01 CSCL 06H

The production of food for human life support for advanced space missions will require the management of many different crops. The research to design these food production capabilities along with the waste management to recycle human metabolic wastes and inedible plant components are parts of Controlled Ecological Life Support Systems (CELSS). Since complete operating CELSS were not yet built, a useful adjunct to the research developing the various pieces of a CELSS are system simulation models that can examine what is currently known about the possible assembly of subsystems into a full CELSS. The growth dynamics of four crops (wheat, soybeans, potatoes, and lettuce) are examined for their general similarities and differences within the context of their important effects upon the dynamics of the gases, liquids, and solids in the CELSS. Data for the four crops currently under active research in the CELSS program using high-production hydroponics are presented. Two differential equations are developed and applied to the general characteristics of each crop growth pattern. Model parameters are determined by closely approximating each crop's data. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A88-17749
FORMATION OF AMINO ACIDS FROM AMMONIUM SALTS OF CARBOXYLIC ACIDS UNDER CONDITIONS OF DYNAMIC COMPRESSION [OBRAZOVANIE AMINOKISLOT IZ AMMONIINYKH SOLEI KARBONOVYKH KISLOT V USLOVIIAKH DINAMICHESKOGO SZHATIIA]
G. A. ADADUROV, A. A. ZHAROV, V. M. ZHULIN, A. G. KAZAKEVICH, I. I. IAKOVLEVA (AN SSSR, Institut Organicheskoi Khimii, Moscow, USSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 296, no. 5, 1987, p. 1140-1143. In Russian. refs

It has been shown experimentally that the synthesis of amnio acids from ammonium salts of organic acids can occur under the most diverse dynamic-compression regimes of solid reagents. The results confirm the hypothesis that the high-pressure and deformation conditions arising during the collision of cosmic bodies can be responsible for the abiogenic synthesis of amnio acids detected in carbonaceous meteorites. B.J.

A88-17762
THE ANTIQUITY OF LIFE AND COSMOCHEMICAL PREREQUISITES FOR ITS APPEARANCE [DREVNOST' ZHIZNI I KOSMOKHIMICHESKIE PREDPOSYLKI EE VOZNIK-NOVENIIA]
G. V. VOITKEVICH (Rostovskii Gosudarstvennyi Universitet, Rostov-on-Don, USSR) Geokhimiia (ISSN 0016-7525), Aug. 1987, p. 1059-1074. In Russian. refs

Recent paleontological, biochemical, and geochemical findings trace the origin of the photoautotrophic biosphere on earth to an age of at least four billion years, i.e., close to the age of the earth itself. The presence of high-molecular-weight organic compounds in carbonaceous chondrites indicates that the synthesis of these compounds took place early in the history of the solar system. It is suggested that organic compounds of cosmic origin

arrived on the growing earth during the stage of accumulation of carbonaceous chondrites. Subsequent chemical and biomolecular evolution on earth led to the appearance of the first living organisms. I.S.

A88-17784
THE ORGANIC MATTER OF METEORITES [ORGANICHESKOE VESHCHESTVO METEORITOV]
O. V. NIKOLAEVA (AN SSSR, Institut Geokhimii i Analiticheskoi Khimii, Moscow, USSR) Priroda (ISSN 0032-874X), Sept. 1987, p. 41-43. In Russian.

Data are examined which suggest that the organic matter of carbonaceous chondrites (CCs) is the product of nonbiological organic synthesis in space. Certain inconsistencies arise when an attempt is made to form a unified picture of organic and inorganic matter in CCs; this may be due to the traditional assumption that is made, namely, that the CC matter was subjected to thermal metamorphism and hydration in the parent bodies. It is suggested that the CC matter in its entirety should be viewed as a complex of diverse primary formations of the protoplanetary nebula. B.J.

A88-19040
NUCLEAR BETA-DECAY AND THE ORIGIN OF BIOMOLECULAR CHIRALITY
W. J. MEIRING (Groningen, Rijksuniversiteit, Netherlands) Nature (ISSN 0028-0836), vol. 329, Oct. 22, 1987, p. 712-714. ZWO-supported research. refs

Asymmetric decomposition of racemic mixtures of biomolecules by longitudinally polarized beta-rays has been described as a possible mechanism for the origin of homochirality in terrestrial life. Here, an extension is given of former estimates given by Hegstrom (1982) with regard to this process. The energy dependence and sign of the relative asymmetries in radiolysis cross-sections are given for both beta(+) and beta(-) radiation, and the connection of these cross-sections with the decomposition rate constants, are derived. The chiral selectivity of beta rays is compared with that of weak neutral current effects in handed molecules in the light of the amplification model devised by Kondepudi and Nelson. It is argued that the exceptional prebiotic conditions required do not favor asymmetric beta-radiolysis as the selector of the exclusive signature of optical activity in living nature. C.D.

A88-19905* Houston Univ., Tex.
COMETS AND LIFE
J. ORO and J. M. BERRY (Houston, University, TX) (COSPAR, IAU, and IUPAC, Plenary Meeting, 26th, Workshops on Environments of Planetary Bodies and Shuttle, 1st and 12th, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 5, 1987, p. 23-32. refs
(Contract NGR-44-005-002)

Some of the chemical species which have been detected in comets include H2O, HCN, CH3CN, CO, CO2, NH3, CS, C2 and C3. All of these have also been detected in the interstellar medium, indicating a probable relationship between interstellar dust and gas clouds and comets. Laboratory experiments carried out with different mixtures of these molecules give rise to the formation of the biochemical compounds which are necessary for life, such as amino acids, purines, pyrimidines, monosaccharides, etc. However, in spite of suggestions to the contrary, the presence of life in comets is unlikely. On the other hand, the capture of cometary matter by the primitive earth is considered essential for the development of life on this planet. The amount of cometary carbon-containing matter captured by the earth, as calcualted by different authors, is several times larger than the total amount of organic matter present in the biosphere (10 to the 18th g). The major classes of reactions which were probably involved in the formation of key biochemical compounds are discussed. The tentative conclusions are that: (1) comets played a predominant role in the emergence of life on earth, and (2) they are the cosmic connection with extraterrestrial life. Author

A88-20306* Salk Institute for Biological Studies, San Diego, Calif.
THE CASE FOR AN ANCESTRAL GENETIC SYSTEM INVOLVING SIMPLE ANALOGUES OF THE NUCLEOTIDES
GERALD F. JOYCE, LESLIE E. ORGEL (Salk Institute for Biological Studies, San Diego, CA), ALAN W. SCHWARTZ (Nijmegen, Katholieke Universiteit, Netherlands), and STANLEY L. MILLER (California, University, La Jolla) National Academy of Sciences, Proceedings (ISSN 0027-8424), vol. 84, July 1987, p. 4398-4402. refs
(Contract NAGW-20; NGR-05-067-001)

The idea that the first living systems on earth were based on self-replicating RNA molecules has recently become popular as a result of the discovery of ribozymes. However, there are several major problems associated with the prebiotic synthesis of ribonucleotides. In addition, there is the newly recognized problem of enantiomeric cross-inhibition, whereby template-directed polymerization involving one enantiomer of RNA is inhibited strongly by the presence of the other enantiomer. Here, it is proposed that RNA was preceded in the evolution of life by a polymer constructed from flexible, acyclic, probably prochiral nucleotide analogues that were synthesized readily on the primitive earth. Several potentially prebiotic nucleotide analogues are considered in this context, and some of the consequences of this proposal are discussed. Author

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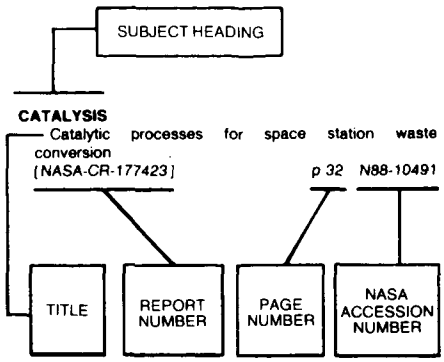

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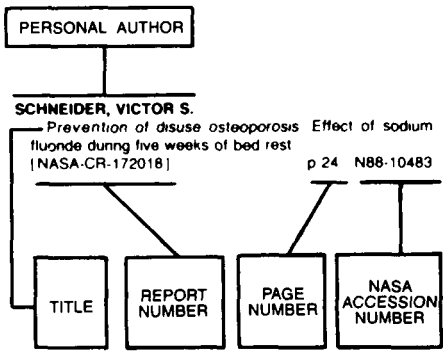

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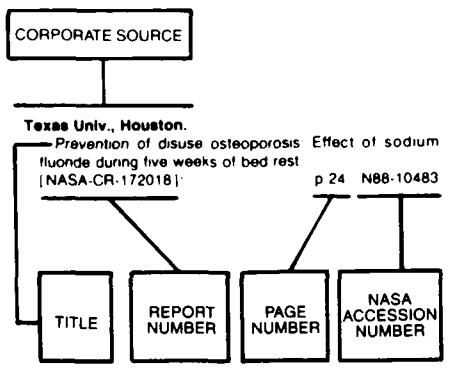

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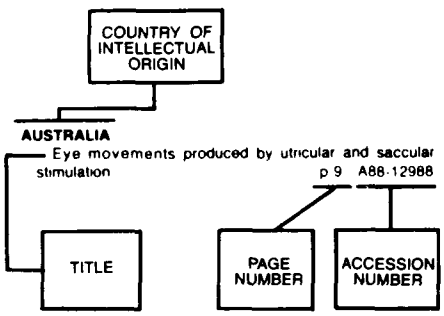

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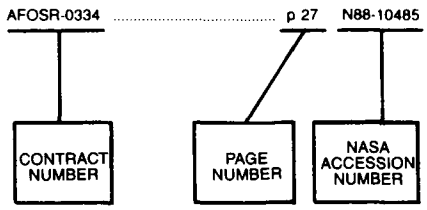

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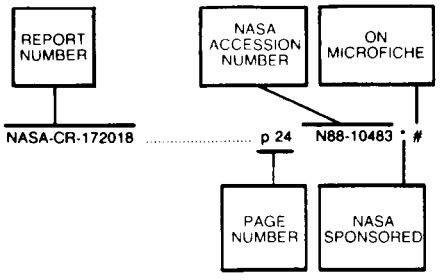

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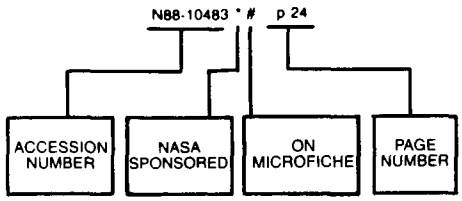

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA SP-7011 (309)		

4. Title and Subtitle	5. Report Date
Aerospace Medicine and Biology A Continuing Bibliography (Supplement 309)	April, 1988
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, DC 20546	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This bibliography lists 136 reports, articles and other documents introduced into the NASA scientific and technical information system in February, 1988.

17. Key Words (Suggested by Authors(s))	18. Distribution Statement
Aerospace Medicine Bibliographies Biological Effects	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price *
Unclassified	Unclassified	60	A04/HC

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