NASA

Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

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Aerospace Medicine & Biology

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

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NASA SP-7011(301)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 301)

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 August 1987 in

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

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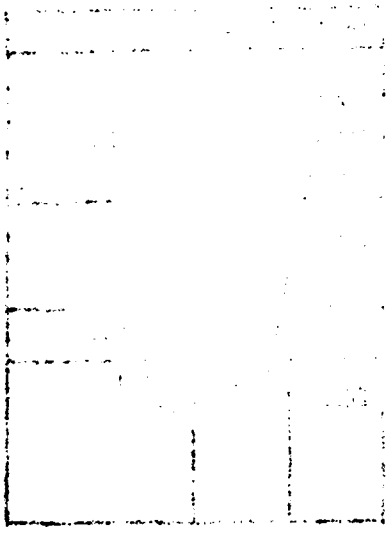

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 217 reports, articles and other documents announced during August 1987 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 1987 Supplements.

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

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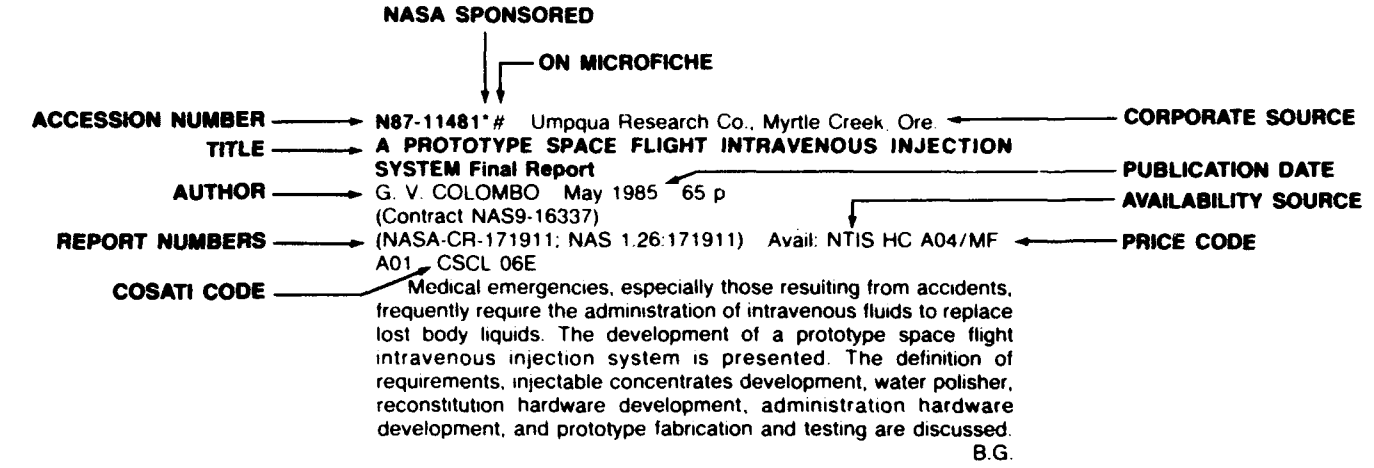
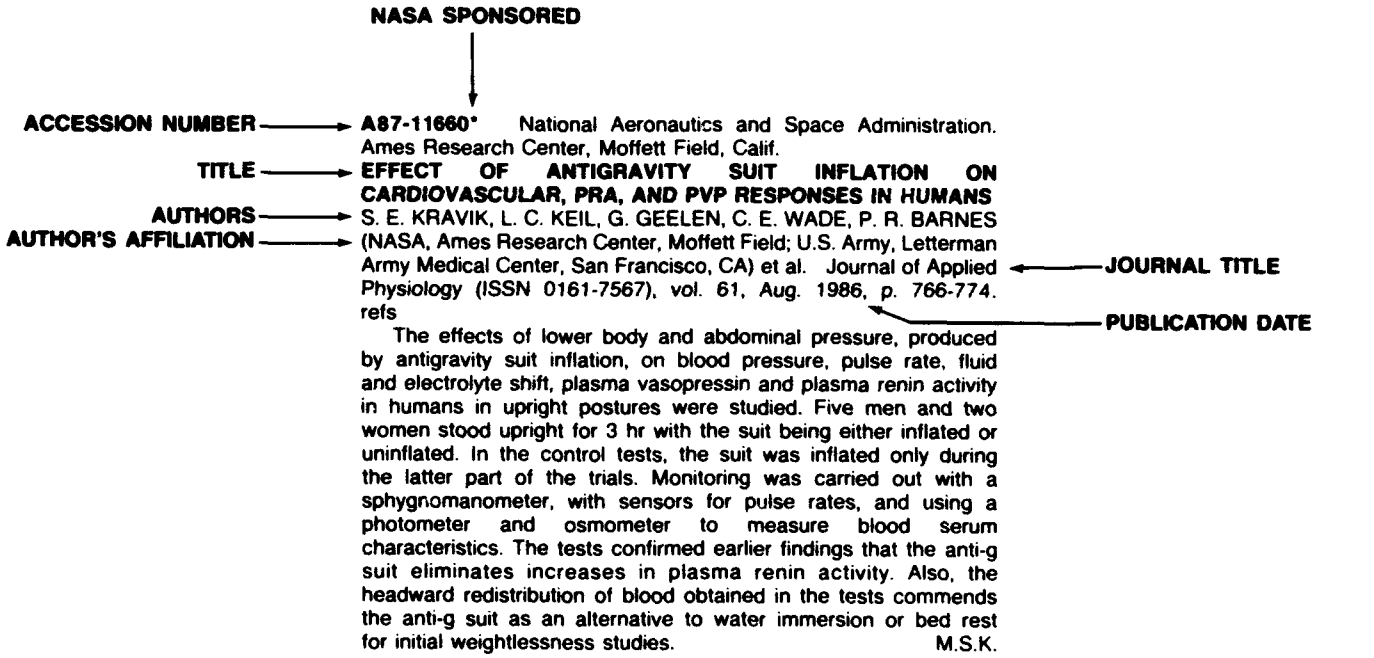
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 301)

SEPTEMBER 1987

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LIFE SCIENCES (GENERAL)

A87-35417
THE EFFECT OF SODIUM PHENYTOIN ON CENTRAL NERVOUS SYSTEM OXYGEN TOXICITY
N. BITTERMAN and A. KATZ (Israiei Naval Hyperbaric Institute; Israel Oceanographic and Limnological Research, Ltd., Haifa) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 224-226. refs

The effect of sodium phenytoin on hyperbaric oxygen (HBO)-induced central nervous system (CNS) toxicity was studied in rats. The latency of the epileptic electroencephalographic discharges was measured in 20 phenytoin-treated rats exposed to 6 ATA of 100 percent oxygen, and compared with that of 20 saline-injected rats exposed to the same pressure of pure oxygen. No statistically significant difference was found in the latency between the two groups. In addition, sodium phenytoin failed to suppress or to modify the clinical seizures. Sodium phenytoin blood levels were determined in the rats, and were found to be within the therapeutic range. It is concluded that sodium phenytoin is ineffective in suppressing HBO-induced CNS oxygen toxicity.
Author

A87-35548
HOW PHOTORECEPTOR CELLS RESPOND TO LIGHT
JULIE L. SCHNAPF (California, University, San Francisco) and DENIS A. BAYLOR (Stanford University, CA) Scientific American (ISSN 0036-8733), vol. 256, April 1987, p. 40-47.

New information about how light energy is changed into neural signals is reviewed. The molecular events involved in the generation of light-evoked hyperpolarization in rods and cones are described. The molecular basis for the change in rod sensitivity that occurs with changing background light intensity is explained, and the sensitivity of rods and cones to light of different wavelengths is examined.
C.D.

A87-35801
KARYOMETRIC CHARACTERISTICS OF THE SENSORIMOTOR CORTEX OF RATS SUBJECTED TO NONUNIFORM GAMMA RADIATION [KARIOMETRICHESKAIA KHARAKTERISTIKA SENSOMOTORNOI KORY KRYS PRI NERAVNOMERNOM GAMMA-OBLUCHENII]
V. P. FEDOROV and I. B. USHAKOV (MZ SSSR, Institut Biofiziki, Moscow, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Jan.-Feb. 1987, p. 52-56. In Russian. refs

The volumetric and structural alterations of the sensorimotor cortical cell nuclei caused in rats by gamma-ray irradiation of the whole body, the trunk, or the head were studied by light and electron microscopies. Irradiaton of the head alone with doses of 50-100 Gy caused an early (2-4 h) increase of nuclear volume without visible structural changes, while at 200 Gy (i.e., at doses at which hyperkinesia and cramps made their appearance) the average nuclear volume decreased. At later times (24-72 h), increases in the nuclear volume were always associated with structural abnormalities (e.g., dispersed chromatin and chromatin clumps). Irradiation of the trunk alone caused early nuclear volume changes which were opposite to those caused by the same doses of irradiation of the head alone (i.e., a decrease in the latter case as opposed to an increase in the former, and vice versa), while irradiation of the whole body caused very early (0.8 h) shrinkage of nuclear volumes followed by moderate volume increases. I.S.

A87-35802
SPONTANEOUS ELECTRICAL ACTIVITY OF THE RAT CEREBRAL CORTEX DURING MICROWAVE IRRADIATION [SPONTANNAIA ELEKTRICHESKAIA AKTIVNOST' KORY GOLOVNOGO MOZGA KRYS VO VREMIA MIKROVOLNOVOGO OBLUCHENIIA]
V. V. VARETSKII, L. N. GALICH, and V. N. DIACHENKO (Nauchno-Issledovatel'skii Institut Obshchei i Kommunal'noi Gigieny, Kiev, Ukrainian SSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Jan.-Feb. 1987, p. 87-91. In Russian. refs

The effect of microwave radiation on the EEG activity of the cerebral cortex were studied in rats irradiated in an anechoic chamber at field densities of 0.1, 1.0, 10, or 35 mW/sq cm. No significant changes were observed at the densities of 0.1 and 1.0 mW/sq cm. At doses of 10 and at 35 mW/sq cm, many of the EEG parameters were found to be altered, with variable and complex changes in different EEG rhythms which depended on the duration and the dose of irradiation. I.S.

A87-35803
INVESTIGATION OF GENETIC EFFECTS PRODUCED BY ACCELERATED CARBON IONS WITH AN ENERGY OF 320 MEV/NUCLEON [ISSLEDOVANIE GENETICHESKIKH EFFEKTOV, VYZVANNYKH USKORENNYMI IONAMI UGLERODA S ENERGIEI 320 MEV/NUKLON]
I. D. ANIKEEVA, A. V. BALAEVA, E. N. VAULINA, A. I. VIKHROV, L. N. KOSTINA (AN SSSR, Institut Obshchei Genetiki; Institut Mediko-Biologicheskikh Problem, Moscow, USSR) et al. Radiobiologiia (ISSN 0033-8192), vol. 27, Jan.-Feb. 1987, p. 103-107. In Russian. refs

The effect of irradiation of seeds of Arabidopsis thaliana, Crepis capillaris, and Lactuca sativa by accelerated carbon ions (320 MeV/nucleon) on the genetic structures of the irradiated seeds and the condition of the young plants grown from these seeds was investigated. In the Lactuca and the Crepis seeds, radiation caused increases of chromosome aberrations and decreases of mitotic activity; in the Arabidopsis, the effect of irradiation was manifested only at the plants' fruiting stage. The observed cytogenic alterations were correlated with the number of direct C-12 hits and the amount of absorbed secondary radiation. I.S.

A87-35804
INTERPHASE DEATH OF THYMUS CELLS CAUSED BY THE COMBINED EFFECTS OF RADIATION AND HEAT AFTER PROPHYLACTIC TREATMENT WITH ALPHA-TOCOPHEROL AND INDOMETACIN [INTERFAZNAIA GIBEL' KLETOK TIMUSA PRI KOMBINIROVANNOM RADIATSIONNO-TERMICHESKOM PORAZHENII NA FONE PROFILAKTICHESKOGO VVEDENIIA ALPHA-TOKOFEROLA I INDOMETATSINA]
R. S. BUDAGOV, N. A. PECHENINA, N. I. RIABCHENKO, L. N. CHUREEVA, and T. I. FILEVA (Nauchno-Issledovatel'skii Institut Meditsinskoi Radiologii, Obninsk, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Jan.-Feb. 1987, p. 121-123. In Russian. refs

A87-35951
BIOLOGY OF THERMOPHILIC MICROORGANISMS [BIOLOGIIA TERMOFIL'NYKH MIKROORGANIZMOV]
A. A. IMSHENETSKII, ED. Moscow, Izdatel'stvo Nauka, 1986, 272 p. In Russian. For individual items see A87-35952 to A87-35970.

The results of studies dealing with morphological and physiological characteristics and ecological requirements of thermophilic bacteria are discussed together with their industrial applications. Consideration is given to thermophilic bacteria that oxidize sulfur and iron, thermophilic sulfate-oxidizing bacteria and their activity in some ecosystems, isolation of methyltrophic bacteria growing at elevated temperatures, and characteristics of a thermophilic methane-forming actetate bacterium. Newly isolated thermal bacteria, including Calderobacterium hydrogenophilum, Flavobacterium thermophilum, and Methanothrix thermoacetophila, are introduced. Particular attention is given to industrial applications of thermophilic bacteria in the fields of mining, agriculture, and sewage treatment. I.S.

A87-35952
THE PRESENT STATE AND PROSPECTS OF STUDIES CONCERNING THE THERMOPHILY OF MICROORGANISMS [SOSTOIANIE I PERSPEKTIVY ISSLEDOVANII V OBLASTI TERMOFILII MIKROORGANIZMOV]
L. G. LOGINOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 5-22. In Russian. refs

Results of recent studies of microorganisms capable of growth at temperatures above 100 C and at high pressures are described, with special attention given to the characteristics of newly discovered thermophiles and to the industrial applications of these organisms. The amino acid contents of bacterial proteins and the enzymatic make-up are discussed together with the structures and metabolites (e.g., pentacyclic triterpenoids and isopranyl-ether lipids) of some of the thermophiles that are similar to those found in ancient bacterial remains (some dating 3.8 billion years), making these thermophiles valuable for evolutionary studies. The high biochemical activity of the thermophilic enzymes at elevated temperatures precludes the growth of contaminating bacteria and makes thermophiles prime candidates for use in industrial applications, which include the biosynthesis of fodder protein, the processing of organic fertilizers, the process of leaching sulfur from coal, and the removal of contaminating chemicals from sewage and coal. I.S.

A87-35953
MICROBIAL COMMUNITIES IN GAS-EXHALING HOT SPRINGS [MIKROBNYE SOOBSHCHESTVA GAZOGIDROTERM]
L. M. GERASIMENKO and G. A. ZAVARZIN (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 22-25. In Russian. refs

The features of thermophilic biocenoses inhabiting hot springs characterized by deep gaseous exhalations (e.g., of H2S or CO2) are discussed together with metabolic reactions of the thermophiles responsible for the chemistry of the exhaled gases and the spring waters. Special consideration is given to the biochemical reactions studied in the hot waters of the Uzon caldera on Kamchatka, in which reactions between hydrogen and sulfur (to produce H2S) and between hydrogen and CO2 (to produce CH4 and acetic acid) were observed. The discovery of fossils of thermophilic microorganisms that were active in the close vicinity of volcanic centers more than 3.5 billion years ago indicates that the gas-transforming processes observed presently in the spring-inhabiting biocenoses played an important role in the evolution processes that took place in early geochemical eras on the earth surface and, possibly, in the hypothetical primeval hot ocean. I.S.

A87-35954
AEROBIC THERMOPHILIC BACTERIA OXIDIZING SULFUR AND IRON COMPOUNDS [AEROBNYE TERMOFIL'NYE BAKTERII, OKISLIAIUSHCHIE SOEDINENIIA SERY I ZHELEZA]
G. I. KARAVAIKO and R. S. GOLOVACHEVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 35-47. In Russian. refs

Morphological and physiological characteristics of known aerobic thermophilic bacteria capable of oxidation of sulfur and iron compounds are described together with the reactions catalyzed by the bacterial enzymes. These thermophilic bacteria include species of extremely thermophilic archaebacteria, which grow at temperatures up to 75-89 C and at low pH (not above 5.5); obligate thermophilic eubacteria, growing at temperatures up to 77-80 C and at pH's of 7.0-7.2; facultative thermophilic eubacteria whose temperature range is within 30-55 C (and the upper ranges of pH are between 3.5 and 8.0); and thermotolerant eubacteria growing optimally between 38 and 45 C and at low (1.9-2.7) pH. The principal locations of the aerobic sulfur and iron-oxidizing thermophiles include hot sulfur springs, the soils in the neighborhood of active volcanoes, and sulfide ores. The use of aerobic thermophiles in hydrometallurgy for leaching metals from ores and concentrates is discussed. I.S.

A87-35955
MACROMOLECULAR FOUNDATIONS OF THERMOPHILY [MAKROMOLEKULIARNYE OSNOVY TERMOFILII]
V. IA. ALEKSANDROV (AN SSSR, Botanicheskii Institut, Leningrad, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 57-63. In Russian. refs

This paper considers chemical and structural characteristics of bacterial macromolecules believed to be responsible for the ability of thermophiles to grow at high temperatures. It is argued that this ability depends on the ability of cellular components such as enzymes, nucleoproteins, and membrane components to maintain their molecular conformations at high temperatures without losing the degree of lability necessary for the performance of metabolic functions. In some thermophilic bacteria, the ability of an enzyme to achieve more rigid conformations was found to reside in a slight change in the primary protein structure (e.g., a single amino acid substitution) and thus in the overall bonding balance of the molecule. Many thermophiles (e.g., those of the Bacillus and Thermus genera) were found to contain, at high growth temperatures, relatively high proportions of GC pairs in their DNA molecules, thus achieving an elevated stability of the genetic apparatus. Rapid changes in the fatty acid compositions of membrane lipids (e.g., greater proportions of saturated fatty acids) are thought to be responsible for an increased stability of cellular membranes at elevated temperatures. I.S.

A87-35956
HEAT-INDUCED DAMAGE IN THE DNA OF THERMOPHILIC BACTERIA [TEPLOVYE POVREZHDENIIA DNK TERMOFIL'NYKH BAKTERII]
O. A. ANDREEV, O. K. KABOEV, and N. V. TOMILIN (AN SSSR, Institut Tsitologii, Leningrad, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 63-70. In Russian. refs

The hypothesis that the high in vivo resistance to heat-induced damage of the DNA of thermophilic bacteria depends on the elevated activity of DNA-repairing enzymes was tested by

comparing the specific activities of apurine endonuclease and uracil-DNA glycosylase extracted from thermophilic, mesophilic, and psychrophilic bacterial species. The results showed no correlation between the enzymatic activities and the optimum growth temperatures of these bacteria. It is suggested that, in thermophiles, the low rate of heat-induced DNA depurinization is due to the presence of heat-protecting molecules, possibly polyamines, specific for these bacteria. I.S.

A87-35957
THE EFFECT OF DIFFERENT DNA-TROPIC AGENTS ON THERMOPHILIC MICROORGANISMS [DEISTVIE RAZLICHNYKH DNK-TROPNYKH AGENTOV NA TERMOFIL'NYE MIKROORGANIZMY]
L. L. GUMANOV, S. M. GAINULLINA, and I. P. TARNOPOLSKAIA (Nauchno-Issledovatel'skii Institut po Biologicheskim Ispytaniiam Khimicheskikh Soedinenii, Kupavna; AN SSSR, Institut Biofiziki, Pushchino, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 70-74. In Russian. refs

The effects of chemical (chlormethine and dimethylsulfate) and physical (gamma rays) DNA-tropic agents on the survival of thermophilic and mesophilic bacteria were tested by growing two strains of Bacillus stearothermophilus and one of Thermus flavus and two strains of E. coli in the presence of the respective mutagens. The resistance of the three thermophiles to both mutagenic chemicals and to gamma radiation was much higher than that of E. coli. It was also found that, in the thermophilic bacteria grown at 62-72 C, the process of DNA denaturation takes place much more slowly than in the mesophiles. It is suggested that thermophilic bacteria possess a universal DNA-protecting system capable of shielding these organisms from a variety of DNA-tropic agents, including heat and chemical mutagens. I.S.

A87-35959
CHARACTERISTICS OF BACTERIA OF THE THERMUS GENUS [KHARAKTERISTIKA BAKTERII RODA THERMUS]
L. A. EGOROVA IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 92-95. In Russian. refs

Several strains of extremely thermophilic bacteria belonging to the Thermus flavus and Thermus ruber species were isolated from hot springs of Tadzhikistan (83 C), Kamchatka (90 C), the Kurile Islands, and Buriatiia using growth media containing very low concentrations of peptone or yeast extracts. The physiological characteristics of these thermophiles were found to be typical of other bacteria of the Thermus genus. Biochemical features responsible for the thermostability of the Thermus bacteria are discussed. I.S.

A87-35960
PHOTOTROPHIC BACTERIA IN HOT SPRINGS [FOTOTROFNYE BAKTERII V TERMAL'NYKH ISTOCHNIKAKH]
V. M. GORLENKO, E. I. KOMPANTSEVA, and N. N. PUCHKOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 96-101. In Russian. refs

The effect of temperature on the population makeup of bacterial communities inhabiting hot springs of the Uzon caldera on Kamchatka and hot springs on the shores of Lake Baikal and in the Lenkoran region was investigated. The physicochemical environments of these springs, which are all characterized by low contents of metal sulfides, are described together with the quantitative makeup of the phototrophic bacterial species found in the spring waters. Special consideration is given to the effect of temperature (i.e., vertical stratification) on the occurrence of purple and green bacteria. It was found that, in the temperature range of 20-45 C, the diversity index varied between 0.52 and 0.83, while in the temperature interval of 45-60 C, the index fell to values between 0.5 and 0.27. At higher temperatures, the diversity index fell to zero, with only Chloroflexus aurantiacus bacteria found among the phototrophs growing in the 60-72 temperature zone. I.S.

A87-35961
THERMOPHILIC SULFATE-REDUCING BACTERIA AND THEIR ACTIVITY IN CERTAIN ECOSYSTEMS [TERMOFIL'NYE SUL'FATVOSSTANAVLIVAIUSHCHIE BAKTERII I IKH DEIATEL'NOST' V NEKOTORYKH EKOSISTEMAKH]
E. P. ROZANOVA and T. N. NAZINA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 101-104. In Russian. refs

The population makeup of thermophilic sulfate-reducing bacteria inhabiting flooded oil-bearing oil field layers is discussed together with the environmental conditions ensuring the growth of these bacteria. Special attention is given to the features of several recently isolated bacterial strains, which are classified here as Desulfostela baculatus and Desulfotomaculum nigrificans species, and to their ecology in the oil-bearing layers. It is concluded that, in these layers, the thermophilic bacteria of the 'lactate' group of the sulfate-reducing species utilize hydrogen which is either present in the layer or formed by mesophilic hydrocarbon-oxidizing bacteria in upper layers. I.S.

A87-35962
THERMOPHILIC MICROORGANISMS IN NATURAL SPRINGS OF SOUTH KAZAKHSTAN [TERMOFIL'NYE MIKROORGANIZMY PRIRODNYKH ISTOCHNIKOV IUZHNOGO KAZAKHSTANA]
K. A. TULEMISOVA (AN KSSR, Institut Mikrobiologii i Virusologii, Alma-Ata, Kazakh SSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 105-109. In Russian. refs

The microbiological makeup of hot (42.4-77.5 C) and ambient-temperature springs of South Kazakhstan was examined. Among thermophiles, bacteria were found to be most prevalent (72 percent). The species of spore-forming thermophilic bacteria found in the hot springs include Bacillus coagulans, Bac. stearothermophilus, Bac. brevis, and Bac. circulans. The nonsporulating bacterial species include recently isolated Thermus ruber. In addition, a bacterium strain of an obligate thermophilic species, hitherto not reported, belonging to the Flavobacterium genus was discovered in one of the sources. Other isolated thermophiles include micellar fungi (mostly of Aspergillus and Penicillium genera) and actinomyces. No yeast cells were isolated. The morphological features and the conditions of cultivation of the isolated thermophiles are described. I.S.

A87-35963
ALGAL-BACTERIAL COMMUNITIES IN THE UZON HOT SPRINGS AND THEIR MODELING UNDER LABORATORY CONDITIONS [AL'GOBAKTERIAL'NYE SOOBSHCHESTVA TERMAL'NYKH ISTOCHNIKOV UZONA I IKH MODELIROVANIE V LABORATORNYKH USLOVIIAKH]
V. K. ORLEANSKII and L. M. GERASIMENKO (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 110, 111. In Russian. refs

A87-35964
MODELING OF A THERMOPHILIC SULFUR BACTERIAL COMMUNITY [MODELIROVANIE TERMOFIL'NOI SUL'FURETY]
V. V. BALASHOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 113-116. In Russian. refs

The paper examines a laboratory-grown biotic community of thermophilic sulfur bacteria, obtained by combining several monocultures (including cultures of Macromonas, a variant of Thiobacterium bovista, and a thermophilic filamentous facultative anaerobic organism similar to the Thermothrix thiopara bacteria). The gray-colored biotic 'mat', cultivated on a mineral agar medium that contained 1 percent $Na_2S_2O_3$, consisted of a slimy mass of Thobacteria cells interspersed with Macromonas cells and interwoven with filaments of the Thermothrix-like organism. The principal metabolic end product of the biotic community was H_2S; methanogenesis was not observed. I.S.

A87-35965
CYTOLOGICAL CHARACTERISTICS OF A THERMOPHILIC METHANE-FORMING ACETATE BACTERIUM [TSITOLOGICHESKIE OSOBENNOSTI TERMOFIL'NOI ATSETATNOI METANOBRAZUIUSHCHEI BAKTERII]
V. I. CHUDINA and A. N. NOZHEVNIKOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 143-146. In Russian.

Morphological features of a unique thermophilic methane-forming acetate bacterium (strain Z-517) isolated from the floor sediment of a thermal chloride-rich lake of the Uzon caldera in Kamchatka are examined. The salient characteristics of the Z-517 strain (which grows at 65 C) include the formation of filaments encased in annulated envelopes and the presence of intracellular gas vesicles. It is suggested that the Z-517 organism can be classified as an independent species, Methanothrix thermoacetophila. I.S.

A87-35966
A NEW EXTREMELY THERMOPHILIC HYDROGEN BACTERIUM [NOVAIA EKSTREMAL'NO-TERMOFIL'NAIA VODORODNAIA BAKTERIIA]
V. R. KRIUKOV, N. D. SAVELEVA, and M. A. PUSHEVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 147, 148. In Russian.

Several newly isolated strains of thermophilic hydrogen bacteria (with a temperature optimum at 74-78 C) obtained from bacterial mats in the gas-exhalation zones of the Uzon caldera and the Geyser Valley in Kamchatka are described. These rod-like bacteria are immobile, gram-negative, and aerobic, and are obligate thermophiles and obligate autotrophs. Hydrogen is used as an electron donor, and CO2 as a carbon source. The cells maintain their viability at 90 C for one hour. Judging by their physiological and morphological features, all isolated strains appear to belong to one species, although they cannot be included in any of the known genera. A new genus, Calderobacterium, and a new species, Calderobacterium hydrogenophilum, are introduced to classify these strains. I.S.

A87-35967
DETAILED CELL-WALL STRUCTURE OF THE THERMOPHILIC BACTERIUM THERMUS RUBER [O TONKOI STRUKTURE KLETOCHNOI STENKI TERMOFIL'NOI BAKTERII THERMUS RUBER]
I. A. SHADRINA, A. V. MASHKOVTSEVA, N. A. KOSTRIKINA, and T. I. BOGDANOVA (AN SSSR, Institut Mikrobiologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 170-172. In Russian. refs

A87-35968
THE GROWTH AND DEVELOPMENT OF A NEW GENUS OF OBLIGATE THERMOPHILIC BACTERIA FLAVOBACTERIUM THERMOPHILUM [ROST I RAZVITIE NOVOGO VIDA OBLIGATNO-TERMOFIL'NYKH BAKTERII FLAVOBACTERIUM THERMOPHILUM]
G. B. USERBAEVA and L. P. MAMONOVA (AN KSSR, Institut Mikrobiologii i Virusologii, Alma-Ata, Kazakh SSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 175, 176. In Russian.

A87-35969
THE HYDROGENASES OF THERMOPHILIC MICROORGANISMS [GIDROGENAZY TERMOFIL'NYKH MIKROORGANIZMOV]
E. E. PINCHUKOVA (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 218-221. In Russian. refs

The thermostability of purified and partially purified hydrogenase preparations from six thermophilic and six mesophilic bacteria was assessed, comparing the half-lives of the enzymatic activity at elevated temperatures and the time of survival of initial activity at moderately high temperatures. Maximal thermostability (8-min half-life at 100 deg and 180-min survival of full enzymatic activity at 70 deg) was reported for a Calderobacterium hydrogenophilum and a hydrogen bacterium of the Z-809 strain, the new strains isolated from the hot springs of Kamchatka. However, many of the hydrogenase preparations isolated from mesophilic hydrogen bacteria were found to be highly thermostable. Biochemical features common to all bacterial hydrogenases which may impart high thermostability to the enzyme protein are discussed. I.S.

A87-35970
T-RNA METHYLTRANSFERASE FROM EXTREME THERMOPHILES OF THE THERMUS GENUS [METILTRANSFERAZA TRNK IZ EKSTREMAL'NYKH TERMOFILOV RODA THERMUS]
I. A. MOROZOV, A. S. GAMBARIAN, T. N. LVOVA, and T. V. VENKSTERN (AN SSSR, Institut Molekuliarnoi Biologii, Moscow, USSR) IN: Biology of thermophilic microorganisms . Moscow, Izdatel'stvo Nauka, 1986, p. 228-236. In Russian. refs

A87-36339
AUDIOMETRIC EFFECTS OF SIMULATED SONIC BOOMS IN GUINEA PIGS
S. REINIS, D. S. WEISS, J. W. FEATHERSTONE, and C. TSAROS (Waterloo, University; Toronto, University, Downsview, Canada) Journal of Sound and Vibration (ISSN 0022-460X), vol. 113, March 8, 1987, p. 347-353. Research supported by the Canadian Ministry of Transport. refs

Changes of hearing thresholds have been studied in guinea pigs following exposure to 100 simulated sonic booms. Simulated sonic booms increased the hearing thresholds at frequencies above 30 kHz. The only structural change observed was an appearance of a small blood clot in the scala tympani of the basal turn of the cochlea. Although these changes may be specific for small laboratory animals only, they indicate that caution is necessary in exposing people to repeated or intense sonic booms. Also, the data indicate that, following the exposure to the sonic booms, the high frequency hearing is influenced first. Therefore, audiometric testing following the sonic boom exposure should not be limited to the routine audiometric curve ending at 8 kHz. Author

A87-36340
LONG-TERM EFFECTS OF SIMULATED SONIC BOOMS ON HEARING IN RHESUS MONKEYS
S. REINIS, D. S. WEISS, J. W. FEATHERSTONE, and C. TSAROS (Waterloo, University; Toronto, University, Downsview, Canada) Journal of Sound and Vibration (ISSN 0022-460X), vol. 113, March 8, 1987, p. 355-363. Research supported by the Canadian Ministry of Transport. refs

Two monkeys of the species Macaca mulatta were exposed to 1 min intervals to five simulated sonic booms lasting 200 ms at 200 Pa overpressure with a 10 ms rise tme. Another group of five monkeys of the same species were exposed to 100 booms. Their hearing thresholds were tested 24 hours, two weeks, one month, two months, four months and six months later. In one animal exposed to five booms, changes of the hearing thresholds were observed 24 hours following the exposure, but not later. All five animals exposed to 100 sonic booms had threshold shifts in the high-frequency range 24 hours following the exposure. Of the three animals followed for the full period of six months, one recovered completely. In the two others, threshold shifts were still observed in the high frequency range. Histological examination revealed destruction of the organ of Corti in the basal turn of the cochlea. These data indicate that there is individual variability in the extent of the damage to the inner ear by the sonic boom (and, perhaps, by other types of impulsive noise). These data also indicate that there is a possibility of similar damage to human inner ears exposed either to sonic booms or to other types of impulsive noise, and that it may go undetected for a long time because the high-frequency hearing defect, over 8 kHz, may be overlooked when routine audiometric methods are used. Author

A87-37240
SKIN TEMPERATURES OF ANIMALS AND THERMAL CONVECTION OF AIR UNDER MAGNETIC FIELDS
GEORG MARET and JEROME ECOCHARD (Max-Planck-Institut fuer Festkoerperforschung, Grenoble, France) (European Physical Society, General Conference of the Condensed Matter Division, 6th, Stockholm, Sweden, Mar. 22-25, 1986) Physica Scripta (ISSN 0281-1847), vol. T13, 1986, p. 169-171. refs

The flow visualization experiments presently conducted indicate that free thermal convection can be substantially modified in the presence of inhomogeneous magnetic fields. The underlying physical mechanism is noted to involve an overcompensation of the convection-driving gravitational force by the magnetic force on paramagnetic O2 molecules. This occurs even in the modest fields of a standard pole piece electromagnet, and may account for the recently reported field-induced skin temperature changes in animals. This phenomenon has been found to be consistent with the observed lack of magnetic field effect on other physiological parameters in pigeons. O.C.

A87-37714#
HYPOKINESIA-INDUCED NEGATIVE NET CALCIUM BALANCE REVERSED BY WEIGHT-BEARING EXERCISE
JOSEPHINE LUTZ, FOU CHEN, and CHRISTINE E. KASPER (Wisconsin, University, Madison) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 308-314.

Negative calcium balance and bone loss occurring with immobilization and hypokinesia have been attributed to a lack of weight bearing on bones. The effects of weight-bearing exercise for promotion of calcium balance after hypokinesia were examined. Rats were randomly assigned to either hypokinetic suspension for 28 d or to a control sedentary group, free to move about their cages at will. After 28 d, the rats in each group were randomly subdivided to either post-hypokinetic forced running (HR), post-hypokinetic sedentary (HS), control forced running (CR), or control sedentary (CS) groups. Net calcium balance was then determined for 25 consecutive days. Net calcium balance of HR was negative for the first 5-d period of recovery and then became positive; that of HS was negative for 25 d; that of CR and CS remained essentially positive. Net calcium absorption paralleled net calcium balance. Forced running was effective in reestablishment of positive net calcium balance after 28 d of decreased weight bearing. Author

A87-37717#
MEASUREMENT OF OXYGEN UPTAKE IN THE NON-STEADY-STATE
SCOTT K. POWERS, JOHN LAWLER, DIXIE THOMPSON, and RALPH BEADLE (Louisiana State University, Baton Rouge) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 323-327.

An open-circuit technique for the measurement of gas exchange in the nonsteady state (during the transition from rest to constant load exercise) was developed. The design employs a mixing chamber to collect the subject's exhaled gases where fractions of O2 and CO2 are determined via electronic gas analyzers. A gasometer is used to measure the inhaled air, and the analog signals from the two gas analyzers and the gasometer are sent to a microcomputer for computation of oxygen intake. To determine the validity of the system, four subjects performed a series of 16 rest-to-work transitions on a cycle ergometer, and the oxygen uptake values determined with the open-circuit technique were compared with those measured by the Douglas bag technique (a procedure which is more cumbersome and time consuming). No significant difference between the two sets of results was found. I.S.

A87-37888*# Illinois Natural History Survey, Champaign.
RIBOSOMAL RNA SEQUENCE SUGGEST MICROSPORIDIA ARE EXTREMELY ANCIENT EUKARYOTES
C. R. VOSSBRINCK (Illinois Natural History Survey, Champaign; Illinois, University, Champaign and Urbana), J. V. MADDOX (Illinois, University; Illinois Natural History Survey, Champaign), S. FRIEDMAN, B. A. DEBRUNNER-VOSSBRINCK, and C. R. WOESE (Illinois, University, Urbana) Nature (ISSN 0028-0836), vol. 326, March 26, 1987, p. 411-414. NASA-supported research.

A comparative sequence analysis of the 18S small subunit ribosomal RNA (rRNA) of the microsporidium Vairimorpha necatrix is presented. The results show that this rRNA sequence is more unlike those of other eukaryotes than any known eukaryote rRNA sequence. It is concluded that the lineage leading to microsporidia branched very early from that leading to other eukaryotes. C.D.

A87-38275#
THE EFFECT OF ALPHA-TOCOPHEROL ACETATE ON THE REACTION OF THE LYSOSOMAL APPARATUS OF NEUTROPHILIC LEUKOCYTES TO IMMOBILIZATION STRESS [VLIIANIE ALPHA-TOKOFEROLA ATSETATA NA REAKTSIIU LIZOSOMAL'NOGO APPARATA NEITROFIL'NYKH LEIKOTSITOV PRI DEISTVII IMMOBILIZATSIONNOGO STRESSA]
N. A. AGAFONOVA and N. V. LUNINA (Voroshilovgradskii Gosudarstvennyi Pedagogicheskii Institut, Voroshilovgrad, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 33, Jan.-Feb. 1987, p. 57-63. In Russian.

The effect of alpha-tocopherol on the adverse reactions of neutrophilic leukocytes to immobilization stress was studied on rabbits subjected for 7 h to immobilization in the supine position. The experimental rabbits were injected daily for 12 days with 1 mg/kg body wt of tocopherol acetate solution; the controls were stressed but not treated. The results have shown that stress-induced neutrophilia, increased granulocytopoiesis, lysosome degranulation, increased serum acid phosphatase, and elevated blood coagulation activity were significantly less pronounced in the tocopherol-treated animals than in controls, and these symptoms returned to normal much sooner. In nontreated rabbits, the mortality on the 3rd to 5th day after the stress application reached 46 percent; treatment with tocopherol reduced this figure to 15 percent. I.S.

A87-38469*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRON TUNNELING THROUGH COVALENT AND NONCOVALENT PATHWAYS IN PROTEINS
DAVID N. BERATAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), JOSE NELSON ONUCHIC, and J. J. HOPFIELD (California Institute of Technology, Pasadena; AT&T Bell Laboratories, Murray Hill, NJ) Journal of Chemical Physics (ISSN 0021-9606), vol. 86, April 15, 1987, p. 4488-4498. CNPq-supported research.

A model is presented for electron tunneling in proteins which allows the donor-acceptor interaction to be mediated by the covalent bonds between amino acids and noncovalent contacts between amino acid chains. The important tunneling pathways are predicted to include mostly bonded groups with less favorable nonbonded interactions being important when the through bond pathway is prohibitively long. In some cases, vibrational motion of nonbonded groups along the tunneling pathway strongly influences the temperature dependence of the rate. Quantitative estimates for the sizes of these noncovalent interactions are made and their role in protein mediated electron transport is discussed. Author

A87-38791*# Wake Forest Univ., Winston-Salem, N.C.
MICROCIRCULATORY FLUID DYNAMICS IN WEIGHTLESSNESS AND SIMULATED WEIGHTLESSNESS
P. M. HUTCHINS, T. H. MARSHBURN, T. L. SMITH, C. D. LYNCH, and S. J. MOULTSBY (Wake Forest University, Medical Center, Winston-Salem, NC) IN: Symposium on Microgravity Fluid Mechanics; Proceedings of the Winter Annual Meeting, Anaheim, CA, Dec. 7-12, 1986 . New York, American Society of Mechanical Engineers, 1986, p. 39, 40.

The method of Smith et al. (1985), which makes it possible to simultaneously measure the macrocirculation and microcirculation in an unanesthetized rat, was used to study the effect of acute hypokinesia on the rat microvascular system. The measurements yielded values of the length, diameter, and number of arteriolar and venular vessels; vascular patterns; branching ratios; and the amplitude and frequency of vasomotion. Early effects (30-60 min after the start of the head-down tilt) include a 10 percent increase in the diameter of arterioles, a slight increase of heart rate and mean arterial blood pressure, and an increase in the heart rate-pulse pressure product, with most of the changes returning to normal after 2-3 h. The baroreceptor reflex index was reduced by almost 50 percent for the first 2 h, but rebounded to almost 3 times the control value after 3 h. This indicates that, in spite of relatively small changes in gross hemodynamic parameters, the cardiovascular function is altered significantly during the acute phase of hypokinesia. I.S.

A87-38792*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ZERO-G FLUID MECHANICS IN ANIMAL AND MAN
H. SANDLER (NASA, Ames Research Center, Moffett Field, CA) IN: Symposium on Microgravity Fluid Mechanics; Proceedings of the Winter Annual Meeting, Anaheim, CA, Dec. 7-12, 1986 . New York, American Society of Mechanical Engineers, 1986, p. 41-43.

Significant cardiovascular change occurs with spaceflight. Loss of normal hydrostatic pressure gradients (head-to-foot), present while upright on earth, results in significant headward fluid shift of vascular and interstitial fluids. The resultant fluid change also shifts the hydrostatic indifference point for the circulation. The persistent distention of neck veins and change in upper body tissue compliance initiates steps to adapt to and compensate for the sensed excess fluid. These result in a loss of intravascular volume through neuro-humoral mechanisms and the presence of a smaller heart size, leading to a state where the subject has a reduced adaptive capacity to stress, particularly to fluid shifts to the lower body as occurs when once again returning to earth. This article reviews what is known about the weightlessness-induced headward fluid shift and its effects on cardiovascular function. Author

A87-39011#
SYNCHRONIZATION BY ENVIRONMENTAL FACTORS OF THE WEIGHT FLUCTUATION RHYTHMS IN GUINEA PIGS AND OF THE MOBILITY RHYTHMS OF DROSOPHILA FLIES [SINKHRONIZATSIIA RITMOV IZMENENIIA VESA MORSKIKH SVINOK I PODVIZHNOSTI DROZOFIL FAKTORAMI VNESHNEI SREDY]
P. V. VASILIK, A. K. GALITSKII, V. B. CHERNYSHEV, and A. A. POPOV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 70, 1986, p. 14-21. In Russian.

The long-term weight fluctuation rhythms in guinea pigs and the mobility rhythms of drosophila flies were correlated with data on periodic changes of solar radiation, cosmic rays, geomagnetic activity, relative humidity, and precipitation collected over the period covering 154 days between January and September of 1980. The flies were also exposed to an artificial electric field (660 V/m at 50 Hz) to determine its effect on the mobility rhythms. In drosophila, the mobility cycle (before electric field application) changed every 7 weeks, indicating the synchronizing effect of the solar activity in the formation and maintenance of the mobility rhythm. The rhythmic fluctuations of weight in the guinea pigs were almost identical to those of the drosophila mobility. The application of the electric field to drosophila resulted in an increase of the mobility cycle to 11 weeks. I.S.

A87-39038#
A MATHEMATICAL MODEL OF CIRCADIAN RHYTHM STABILIZATION IN THE CELLULAR ENERGY METABOLISM [MATEMATICHESKAIA MODEL'STABILIZATSII TSIRKADNOGO RITMA V KLETOCHNOM ENERGETICHESKOM METABOLIZME]
N. V. AVSEENKO, L. IA. LISNICHUK, and E. E. SEL'KOV (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 248-252. In Russian.

A simplified mathematical model of cellular energy metabolism (CEM) was used to analyze circadian self-oscillations in the carbohydrate compartment of the CEM. The self-oscillations occur due to the reciprocal regulation of the 6-phosphofructokinase and the fructose-1,6-bisphosphatase activities by fructose-1,6-bisphosphate. It was shown that the negative feedback mechanisms which control the activities of the key enzymes of carbohydrate metabolism, 6-phosphofructokinase, fructose-1,6-bisphosphatase, pyruvate kinase, and phosphoenolpyruvate carboxykinase render circadian periods insensitive to metabolic disturbances. It was also shown that these mechanisms are synergistic in their action. I.S.

A87-39039#
ENERGY MIGRATION IN PHYCOBILISOME FRAGMENTS OF CYANOBACTERIA NOSTOC MUSCORUM [MIGRATSIIA ENERGII V FRAGMENTAKH FIKOBILISOM TSIANOBAKTERII NOSTOC MUSCORUM]
V. A. SINESHCHEKOV, O. D. BERASOVA, and I. A. MUSLIMOV (Moskovskii Gosudarstvennyi Universitet; AN SSSR, Institut Biokhimii, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 257-262. In Russian.

A87-39040#
TRANSFER OF ELECTRON EXCITATION ENERGY IN THE CHROMATOPHORES OF PURPLE BACTERIA [K VOPROSU O PERENOSE ENERGII ELEKTRONNOGO VOZBUZHDENIIA V KHROMATOFORAKH PURPURNYKH BAKTERII]
S. S. VASIL'EV, E. P. DEL'VER, and V. Z. PASHCHENKO (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 263-268. In Russian.

Fluorescence decay kinetics was studied in chromatophores of Rps. sphaeroides and R. rubrum, as well as in chromatophores of an acarotenoid mutant of R. rubrum (G-9 strain), using picosecond fluorometry. Under soft excitation (at energies less than 3 x 10 to the 12th quanta/sq cm), the fluorescence lifetime was found to be 60-80 ps for all bacterial species and all spectral regions investigated. In chromophores with oxidized reaction centers (RCs), the fluorescence lifetime increased by 1.5-3 times in all spectral regions. At excitation energies above 3 x 10 to the 14th quanta/sq cm, the lifetime was reduced to 30 ps and was independent of the RC oxidation state. The results (obtained under soft excitation) indicate the existence of direct correlation between the length of the bacteriochlorophyll fluorescence and the oxidation state of the RC. I.S.

A87-39041#
THE EFFECT OF EXTRACTS FROM THERMOPHILIC CYANOBACTERIA ON THE ACTIVITIES OF CA(2+)-DEPENDENT ATPASE AND MONOAMINOXIDASE [VLIIANIE EKSTRAKTOV TERMOFIL'NYKH TSIANOBAKTERII NA AKTIVNOST' CA/2+/-ZAVISIMOI ATFAZY I MONONUKLEAZY]
G. M. BARENBOIM, V. KH. BRIKENSHTEIN, A. M. KOROLEVA, L. A. PROTOZANOVA, N. V. SOKOLOVA (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) et al. Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 304-312. In Russian.

The effects of four aqueous fractions separated by paper electrophoresis from extracts of thermophilic blue-green algae

(TBGA) on the activities of Ca(2+)-dependent ATPase (from rabbit sarcoplasmic reticulum) and monoaminoxidase (from mitochondrial membranes) were investigated. All algae were found to contain a positively charged fraction that inhibited the activities of both enzymes, while some algae were found to contain a negatively charged fraction that acted as an activator. The relative amounts of both fractions varied with the algae species. It is proposed that the active molecules extracted from the TBGA might be regulating both enzymes through altering membrane configurations. I.S.

A87-39042#
THE EFFECT OF NEGATIVE HYDROAEROIONS ON THE STRUCTURE AND THE FUNCTIONAL PROPERTIES OF MITOCHONDRIA [VLIIANIE OTRITSATEL'NYKH GIDROAEROIONOV NA STRUKTURU I FUNKTSIONAL'NYE SVOISTVA MITOKHONDRII]
M. N. KONDRASHOVA, E. V. GRIGORENKO, A. V. TEMNOV, E. B. ONON, A. M. BABSKII (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino; AN SSSR, Institut Molekuliarnoi Morfologii i Ek et al. Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 313-322. In Russian.

Electrically uncompensated hydroxyl ions were generated by a hydroaeroionizer and were directed, at a concentration of 250,000/qu cm and 20 distance, towards preparations of native mitochondria from rat liver and rat brain. It was found that the hydroaeroions prevented fine damage of mitochondria observed in control suspensions and effected fast restoration of slightly damaged mitochondria. The protective effect of the OH(-) ions was found to relate to the state of mitochondrial aggregation and was effected by an increased degree of coupling of oxidation and ADP phosphorylation and by accelerated Ca(2+) release. I.S.

A87-39043#
THE MOLECULAR ORGANIZATION OF THE REACTION CENTERS OF PHOTOSYNTHESIZING BACTERIA [MOLEKULIARNAIA ORGANIZATSIIA REAKTSIONNYKH TSENTROV FOTOSINTEZIRUIUSHCHIKH BAKTERII]
V. P. KHOTCHENKOV, N. N. DROZDOVA, and A. A. KRASNOVSKII (AN SSSR, Institut Biokhimii, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 32, Mar.-Apr. 1987, p. 359-368. In Russian.

Modern concepts of the molecular organization of the reaction centers (RCs) in purple photosynthesizing bacteria are discussed. Consideration is given to the contents of various pigments in the RCs and the organization of photoactive molecules in the pigment complexes; the contents and primary structures of the RC proteins and their subunits; the cofactors of the electron transfer; and the lipids of the RC and the photosynthetic membranes. RC topography and molecular organization and the correlation of the RC structure with the RC activity are also discussed. I.S.

A87-39072#
SYNAPSES THAT COMPUTE MOTION
TOMASO POGGIO (MIT, Cambridge, MA) and CHRISTOF KOCH (California Institute of Technology, Pasadena) Scientific American (ISSN 0036-8733), vol. 256, May 1987, p. 46-52.

The way that ganglion cells in the eye compute motion is discussed. Some neurons in the retina are specialized to detect motion in just one direction. The synaptic mechanism, called shunting inhibition, on which this selectivity is based is explained, and experimental evidence in favor of this model is reviewed. C.D.

A87-39110#
ELECTROPHYSIOLOGICAL STUDY OF THE EFFECT OF PROLONGED VIBRATION ON THE RETICULOCORTICAL SYSTEM INTERACTIONS [ELEKTROFIZIOLOGICHESKOE ISSLEDOVANIE RETIKULO-LIMBICHESKIKH VZAIMOOTNOSHENII PRI DLITEL'NOM VOZDEISTVII VIBRATSII]
S. M. MINASIAN and O. G. BAKLAVADZHIAN (Erevanskii Gosudarstvennyi Universitet, Yerevan, Armenian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, Jan. 1987, p. 20-27. In Russian.

The effect of chronic vibration on the reticulocortical system bioelectrical activity was studied in rabbits fitted with implanted brain electrodes and subjected for 3 months to daily 3 h-long vibrations (at 60 Hz frequency and 0.4 mm amplitude). After the 1st month, an activation of the spontaneous electrical activity (EEG) and an increase of the amplitude of reticulocortical evoked potentials (EPs) were observed in several cortical areas, the changes being most pronounced in the neocortex. After 3 months, however, the activity of the reticulocortical system was inhibited, as manifested in the prevalence of the slow waves in the EEGs of the cortical and subcortical structures, a decrease of excitability in the mesencephalic reticular formation, and the inhibition of the reticulocortical EPs. I.S.

A87-39111#
BOMBESIN LOWERS THE BODY TEMPERATURE PRINCIPALLY THROUGH AN INCREASE IN THE PERIPHERAL BLOOD FLOW [BOMBEZIN SNIZHAET TEMPERATURU TELA GLAVNYM OBRAZOM PUTEM UVELICHENIIA PERIFERICHESKOGO KROVOTOKA]
A. T. MAR'IANOVICH, E. V. KUDRIAVTSEVA, I. V. GAIVORONSKII, O. P. MIKHEEV, V. N. GOLUBEV et al. Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, Jan. 1987, p. 111-119. In Russian.

The effect of bombesin on the heat production and heat exchange indices was studied using cold-exposed rabbits injected intracerebroventricularly with the active fragment (the C-terminal nonapeptide) of bombesin. The values of the muscle electrical activity, rectal temperature, oxygen consumption and CO2 generation, and peripheral blood flow were recorded periodically. It was found that, compared to noninjected cold-exposed animals, bombesin increases hypothermia, causes a 25-percent depression in the increase of oxygen consumption (with no changes in the shivering thermogenesis), and induces a 3.5-fold to 5-fold increase in the cross-sectional area of ear blood vessels accompanied by an increase in the blood flow velocity. It is concluded that the peripheral blood flow is the principal effector of the bombesin-induced hypothermia. I.S.

A87-39112#
THE EFFECT OF THE INCREASED HEAT CONTENT OF AN ORGANISM ON THE CUTANEOUS AND SUBCUTANEOUS TEMPERATURES IN VARIOUS BODY REGIONS [VLIIANIE POVYSHENIIA TEPLOSODERZHANIIA ORGANIZMA NA TEMPERATURU NA POVERKHNOSTI KOZHI I POD NEI V RAZLICHNYKH UCHASTKAKH TELA]
N. A. SLEPCHUK (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, Jan. 1987, p. 120-123. In Russian.

N87-22113*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANIMAL STUDIES ON SPACELAB-3
C. SCHATTE, R. GRINDELAND, P. CALLAHAN, W. BERRY, G. FUNK, and W. LENCKI (Management and Technical Services Co., Philadelphia, Pa.) *In* NASA. Marshall Space Flight Center Spacelab 3 Mission Science Review p 75-83 Feb. 1987 Previously announced as N86-16889
Avail: NTIS HC A05/MF A01 CSCL 06C

The flight of two squirrel monkeys and 24 rats on Spacelab-3 was the first mission to provide hands-on maintenance on animals in a laboratory environment. With few exceptions, the animals

grew and behaved normally, were free of chronic stress, and differed from ground controls only for gravity dependent parameters. One of the monkeys exhibited symptoms of space sickness similar to those observed in humans, which suggests squirrel monkeys may be good models for studying the space adaptation syndrome. Among the wide variety of parameters measured in the rats, most notable was the dramatic loss of muscle mass and increased fragility of long bones. Other interesting rat findings were those of suppressed interferom production by spleen cells, defective release of growth hormone by somatrophs, possible dissociation of circadian pacemakers, changes in hepatic lipid and carbohydrate metabolism, and hypersensitivity of marrow cells to erythropoietin. These results portend a strong role for animals in identifying and elucidating the physiological and anatomical responses of mammals to microgravity. Author

N87-22389*# Research Triangle Inst., Research Triangle Park, N.C.
APPLICATIONS OF AEROSPACE TECHNOLOGY Final Report, 23 Nov. 1982 - 31 Dec. 1983
DORIS J. ROUSE May 1984 73 p
(Contract NAS1-17214)
(NASA-CR-172346; NAS 1.26:172346) Avail: NTIS HC A04/MF A01 CSCL 06B

The objective of the Research Triangle Institute Technology Transfer Team is to assist NASA in achieving widespread utilization of aerospace technology in terrestrial applications. Widespread utilization implies that the application of NASA technology is to benefit a significant sector of the economy and population of the Nation. This objective is best attained by stimulating the introduction of new or improved commercially available devices incorporating aerospace technology. A methodology is presented for the team's activities as an active transfer agent linking NASA Field Centers, industry associations, user groups, and the medical community. This methodology is designed to: (1) identify priority technology requirements in industry and medicine, (2) identify applicable NASA technology that represents an opportunity for a successful solution and commercial product, (3) obtain the early participation of industry in the transfer process, and (4) successfully develop a new product based on NASA technology. Author

N87-22390*# Management and Technical Services Co., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 11
LYDIA RAZRAN HOOKE, ed., VICTORIA GARSHNEK, ed., MIKE RADTKE, ed., RONALD TEETER, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, D. C.) Washington NASA May 1987 126 p
(Contract NASW-3676)
(NASA-CR-3922(13); NAS 1.26:3922(13)) Avail: NTIS HC A07/MF A01 CSCL 06B

This is the eleventh issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 54 papers recently published in Russian language periodicals and bound collections and of four new Soviet monographs. Selected abstracts are illustrated. Additional features include the translation of a paper presented in Russian to the United Nations, a review of a book on space ecology, and report of a conference on evaluating human functional capacities and predicting health. Current Soviet Life Sciences titles available in English are cited. The materials included in this issue have been identified as relevant to 30 areas of aerospace medicine and space biology. These areas are: adaptation, aviation physiology, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cosmonaut training, developmental biology, endocrinology, enzymology, equipment and instrumentation, gastrointestinal systems, group dynamics, genetics, hematology, human performance, immunology, life support systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, and radiobiology. Author

N87-22391*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES LABORATORY EQUIPMENT CATALOG
Jun. 1987 34 p
(NASA-TM-89289; NAS 1.15:89289) Avail: NTIS HC A03/MF A01 CSCL 06B

A composite inventory of equipment available from the Ames Research Center for microgravity experiments using the Shuttle Transportation System (STS) Middeck and Spacelab is provided. B.G.

N87-23128# Joint Publications Research Service, Arlington, Va.
SPLIT CIRCADIAN RHYTHM OF SIMIAN BODY TEMPERATURE DURING ANTIORTHOSTATIC HYPOKINESIA
A. M. ALPATOV and V. YA. KLIMOVITSKIY *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 50-55 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 37-41
Avail: NTIS HC A07/MF A01

A rhesus monkey was restrained in the prone position with the head kept at -6 deg. The day:night cycle was 16:8 and an ambient temperature 20 to 22 C. Skin temperature (ST) in the ankle area and body temperatue (BT) in the armpit were measured by thermistors every 16 min during 14 days. Mean daily values of both temperatures decreased continuously beginning with day 5 and reached a minimum on day 11. Between days 5 and 11 the BT rhythm was split into two components, i.e., morning and evening (with the 12 hour periodicity being predominant in the spectrum). The amplitude of the ST rhythm declined and reached a minimum on day 4. On that day the rhythm phase was sharply shifted and thereafter the amplitude and phase of the ST rhythm gradually restored. The above effects can be explained by a transient attenuation of the relationship of circadian oscillators due to a greater load of the mechanisms of adaptation to simulated microgravity. Author

N87-23129# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOKINESIA ON INTENSITY OF GLUCONEOGENESIS IN CORTICAL LAYER OF RAT KIDNEY
S. M. YERSHIKOV *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 56-61 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 41-44
Avail: NTIS HC A07/MF A01

The rate of gluconeogenesis was measured in the cortical layer of kidneys of 95 white rats on hypokinesia days 1, 3, 7, 15, 30, and 60. At early stages of hypokinesia the rate of glucose formation from aspartic, glutamic, pyruvic, alpha-ketoglutaric acids and glycerol increased, specifically on hypokinesia day 3. The rate of glucose formation from the amino acids on hypokinesia day 30 was identical to that in the controls. The rate of glucose formation from alpha-ketoglutaric and succinic acids increased and that from pyruvic acid significantly decreased. On hypokinesia day 30 the rate of glucose formation from every substrate used, except for pyruvic acid, increased. The glucose concentration in serum was higher on hypokinesia days 1 to 7 and lower on hypokinesia days 15 to 60. The changes in the rate of glucose formation in the kidneys make inexplicable stable hypoglycemia seen at later stages of hypokinesia. Author

N87-23130# Joint Publications Research Service, Arlington, Va.
CORTICAL ULTRASTRUCTURE OF RAT CEREBELLAR NODULUS FOLLOWING FLIGHT ABOARD COSMOS-1514 BIOSATELLITE
I. B. KRASNOV and L. N. DYACHKOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 62-66 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 45-48
Avail: NTIS HC A07/MF A01

The ultrastructure of moss fibers and granule cells of the cortex of the cerebellum nodulus of rats flown for 5 day onboard the biosatellite Cosmos-1514 and exposed to 1 g for 6 to 8 hours upon return to Earth is indicative of an excess excitation of terminals of moss fibers and excitation of granule cells. The excitation of moss fiber terminals reflects the excitatory state of hair cells of the otolith apparatus and neurons of the vestibular ganglion produced by the effect of 1 g after exposure to microgravity. This state can be viewed as evidence of a greater sensitivity of the hair cell of the otolith organ - neuron of the vestibular ganglion system during exposure to microgravity. It is hypothesized that the sensitivity of this system of other mammals may also increase in microgravity. Author

N87-23133# Joint Publications Research Service, Arlington, Va.
REACTION TO VIBRATION OF RAT KINESTHETIC ANALYZER NEUROCYTES
V. V. ANTIPOV, V. I. DROBYSHEV, I. B. USHAKOV, and T. P. STEPANOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 86-92 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 60-64
Avail: NTIS HC A07/MF A01

By neurohistological, morphometric and electron microscopic methods the effect of vibration of 80 Hz applied at an acceleration of 8 m/sq sec on the nerve cell and conduction components of the kinesthetic analyzer was investigated. After a single exposure to vibration nerve cells of the sensorimotor cortex showed some changes. Exposure to vibration for as long as a week caused reactive changes in every structure of the kinesthetic analyzer investigated. After 1 month exposure the changes were more disseminated and became destructive, after 2 month exposure the process developed at a slower rate, and after 3 month exposure it remained at the same level. However, after 3 month exposure the morphological equivalent of compensatory adaptive reactions was seen. Author

N87-23138# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS IN FORMATION OF MICROBIAL COMPLEX IN NUTRIENT SOLUTIONS OF HIGHER PLANTS AFTER USE OF STRAW MINERALIZATION PRODUCTS
N. A. DRUGOVA, L. S. YUNUSOVA, and YU. I. SHAYDOROV *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 117-122 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 81-84
Avail: NTIS HC A07/MF A01

The effect of a product of wheat straw mineralization, e.g., ecothole, on the formation of a microbial complex that is concomitant with lettuce plants during 7 vegetations (i.e., 189 days) was investigated. The plants were grown by the subirrigation-aeroponic method on nutrient solutions that were not replaced throughout the study. It was found that in the course of lettuce ontogenesis the count of microorganisms, fungi and actinomycetes varied in the range of 100,000 to 1,000,000, 100 to 10,000 and 100 to 100,000 cells per ml solution, respectively. During all lettuce vegetations 19 bacterial species were isolated. During the first vegetation a stable microbial complex with predominant gram-negative bacteria developed. However, addition of ecothole caused an increase in the count of spore forming bacteria, whereas in the control the count of nitrogen fixing bacteria grew. Author

N87-23141# Joint Publications Research Service, Arlington, Va.
SOME BIOCHEMICAL AND MORPHOLOGICAL CHANGES IN RAT BLOOD WITH EXPOSURE TO VARIABLE MAGNETIC FIELD AT INFRALOW FREQUENCY
V. G. SIDYAKIN, N. A. TEMURYANTS, and YE. V. YEVSTAFYEVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 132-133 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20 no. 5, Sep. - Oct. 1986 p 90-91
Avail: NTIS HC A07/MF A01

In recent years it was found that a variable magnetic field (VMF) at a frequency of 8 Hz at a voltage 10 to 100 times greater than that of the geomagnetic field causes some biological functional changes varying in complexity. Experiments were conducted on white rats to investigate these findings. Author

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AEROSPACE MEDICINE

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

A87-35413
THE EFFECTS OF LONG-TERM AEROBIC CONDITIONING ON +GZ TOLERANCE
JAMES E. WHINNERY and MICHAEL J. PARNELL, USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 199-204. refs

In this study, 27 long-term (2 years of running) aerobically conditioned subjects were tested for gradual (1 G/15 s) and rapid onset (1 G/s) +Gz tolerance. Maximum VO2 and percent body fat measurements were also performed and correlated to the +Gz-tolerance measurements. No relationship was observed between aerobic condition (VO2 max) and +Gz tolerance. An increased susceptibility to motion sickness was found to be associated with long-term aerobic conditioning. Certain individuals were found to be predisposed to cardiac rate and rhythm disturbances (A-V dissociation and transient asystole) which could potentially alter +Gz-tolerance. Author

A87-35414
PHYSIOLOGIC RESPONSES OF PILOTS FLYING HIGH-PERFORMANCE AIRCRAFT
P. COMENS, D. REED, and M. METTE (131st Tactical Air Command Hospital, Bridgeton, MO) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 205-210. refs

This study deals with the physiologic responses to stress in F-4 fighter pilots and aircrew engaged in surface attack training (SAT) missions. Blood levels of HDL-cholesterol, LDH and LDH isoenzymes, CPK, and myoglobin were determined before and after each mission. Continuous EKG and transcutaneous PO2 recordings were made during briefing, preflight, and inflight. The personal history and habits of each participant were recorded. Each mission consisted of six successive bomb deliveries at 80-s intervals and at increasingly steep dive angles, each terminating in 5.5-6 +Gz during pull-up. Results revealed no apparent effect on HDL, CPK isoenzymes, and LDH isoenzymes. Many myoglobin levels dropped as much as 50 percent. EKG recordings revealed ST elevations, ST depressions, T wave inversions, and marked sinus arrhythmias in some, while others showed increases in cardiac rate. Pilots flying these SAT missions in F-4C aircraft were found not to be significantly physiologically stressed. Author

A87-35415
CARDIOVASCULAR REFLEXES DURING ISOMETRIC EXERCISE - ROLE OF MUSCLE MASS AND GRAVITATIONAL STRESS
TOMOKO SADAMOTO, FLEMMING BONDE-PETERSEN, and YOJI SUZUKI (Rigshospitalet; Copenhagen, University, Denmark) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 211-217. Research supported by Rumudvalget. refs

Six healthy males performed sustained static contractions of five arm and leg muscle groups for 2 min at 40 percent maximum voluntary contraction sitting and supine. Delta heart rate, blood pressure, forearm vascular resistance, and cardiac output increased during contraction, incrementing increasingly in the following order: dorsi flexion of ankle, plantar flexion, third finger flexion, handgrip, and knee extension. Muscle ischemia during recovery did not change this order. The cardiovascular responses to static contraction did not relate to muscle mass involved in a simple rectilinear manner. The increments in cardiovascular responses were not reduced in the supine position, although the values were at a lower level, probably due to the combination of a decreased sympathetic nervous activity in the supine position and an increased aortic baroreceptor stimulation induced by the increased stroke volume. Author

A87-35416
THE COMBINED EFFECT OF CINNARIZINE AND DOMPERIDONE ON VESTIBULAR SUSCEPTIBILITY
W. J. OOSTERVELD (Amsterdam, Universiteit, Netherlands) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 218-223. refs

Four test medications were randomly examined in 25 volunteers for the depressant effect on the labyrinth during stimulation in a rotation chair as well as in a parallel swing. The medications, placebo (pl), Domperidone 30 mg (D), Cinnarizine 40 mg (C), and Touristil (40 mg C + 30 mg D), were tested at 1-week intervals, the duration and amplitude of nystagmus having been recorded 15 min, 30 min, and 1, 2, 3, and 4 h after intake of the medication. In both tests Touristil (C+D) was significantly (p less than 0.01) to very significantly (p less than 0.0001) more potent, more rapid, and longer working than placebo and the separate components (C) and (D). Touristil was specifically superior to Cinnarizine. It appears that the new preparation Touristil approaches the profile of the ideal drug against motion sickness more closely than any other medication. Author

A87-35418
HEART RATE RESPONSES TO MODERATE LINEAR BODY ACCELERATIONS CLINICAL IMPLICATIONS IN AEROMEDICAL EVACUATION
JES BRUUN LAURITZEN, AXEL LENDORF, SOREN VESTERHAUGE, and TORBEN STAEHR JOHANSEN (Royal Danish Air Force, Aeromedical Services, Vaerloese AFB, Denmark) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 248-251. refs

Linear accelerations during take-off and landing were measured in both civilian and military aircraft usually involved in aeromedical evacuations in Denmark. Accelerations of similar durations and magnitudes were induced in six healthy subjects transported in an ambulance in different supine positions. Heart rate responses recorded depended significantly on the position of the subject. It was concluded that seriously ill patients must be positioned transversely to the axis of acceleration during aeromedical evacuation. Author

A87-35419
VISUAL ACUITY, CORRECTIVE LENSES, AND ACCIDENTS IN HELICOPTER PILOTS
PAUL FROOM, JOSEPH RIBAK, ABRAHAM BURGER, and MOSHE GROSS (Israel Air Force, Aeromedical Center, Ramat Gan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 252, 253. refs

The visual acuity of 38 helicopter pilots experiencing serious air accidents was compared to that of a control group of 72 pilots matched for age, aircraft, and hours of flight. Decrease in visual acuity was divided into two groups: (1) minor decreases in vision up to 20/25 (not requiring corrective lenses); and (2) visual acuity of 20/30 or less with correction to 20/20. Minor decreases in visual acuity were found in 23.7 percent of those in the accident group compared to 25.0 percent in the control group. There were more pilots in the control group who needed corrective lenses (12.5 percent versus 2.8 percent, p less than 0.07). It is concluded that helicopter pilots with corrective lenses or minor uncorrected decreases in visual acuity are not at increased risk for serious air accidents. Author

A87-35420
PREDICTIVE VALUE OF THE RESTING ELECTROCARDIOGRAM FOR MOBITZ TYPE 1ATRIO-VENTRICULAR BLOCK ON HOLTER MONITORING IN ISRAELI AIR FORCE PERSONNEL
MORDECHAI BAR-DAVID, JOSHUA BARZILAY, MOSHE GROSS, PAUL FROOM, SHAUL MARGALIOT (Israel Air Force, Aeromedical Center, Ramat Gan; Hadassah University Hospital, Jerusalem) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 254-256. refs

During 1981-1984, a total of 52 airpersonnel had 24-h continuous ambulatory electrocardiographic (ECG) monitoring at the Israel Air Force Aeromedical Center because of an incidental finding of a first- or second-degree atrio-ventricular (AV) block on a resting 12-lead ECG. There were 230 other airpersonnel without AV block on the resting ECG monitored during the same period. Altogether 17 cases of second-degree Mobitz type I (Wenckebach) block were identified. Mobitz type I was detected on Holter monitoring in two of the 230 cases with a normal PR interval on the resting ECG, in six of 39 cases with a PR interval of 0.22-0.25 s, in five of nine cases with a PR interval of 0.26 s or more, and in all four cases with Mobitz type I on the resting ECG. It is concluded that the PR interval on the resting ECG may be useful in predicting an intermittent Mobitz type I AV block on Holter monitoring. Author

A87-35422
THE USE OF EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY IN AVIATORS
MICHAEL J. PALETTA (Michigan Air National Guard, Selfridge Air National Guard Base) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 260-262. refs

Nephrolithiasis presents a common management problem for the flight surgeon, whose patients must be excluded from flying duties for weeks or months during diagnosis and treatment. Extracorporeal shock wave lithotripsy (ESWL) has recently become available for clinical use and represents a totally noninvasive method of managing urinary tract calculi. The extremely low risk and rapid recovery time associated with ESWL make it preferable not only to conservative medical management and conventional surgical treatment but also to the newer invasive procedures, such as percutaneous nephrolithotomy. A case is described in which a military pilot is eligible for return to flying status within three weeks of initial consultation following treatment of symptomatic nephrolithiasis with ESWL. The contraindications and potential complications of ESWL are also discussed. Author

A87-35546
A THEORETICAL STUDY OF ARTERIAL DISEASE BY TRANSFER FUNCTION ANALYSIS
ENZO BELARDINELLI, GIANNI GNUDI (Bologna, Universita, Italy), and ATTILIO EVANGELISTI (Firenze, Universita, Florence, Italy) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. BME-34, March 1987, p. 199-211. Research supported by the Ministero della Pubblica Istruzione. refs

A method, based on the theory of approximation, for a theoretical evaluation of the hemodynamic effects of stenosis on the arterial subsystem is described. A model of the arterial system is derived by applying the Womersley theory; the model is applied to two cases of stenosis in order to study the relation between the upstream-downstream blood velocity transfer function and the arterial parameters and peripheral resistances. The zeros and poles of the transfer function are calculated. It is observed that this method is applicable to the study of the influence of arterial stenosis on peripherial hemodynamics. I.F.

A87-35547
AN IMAGE PROCESSING METHOD FOR CARDIAC MOTION ANALYSIS
R. SAI PRASAD and T. M. SRINIVASAN (Indian Institute of Technology, Madras, India) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. BME-34, March 1987, p. 244-247. refs

A new image processing method is developed to process two-dimensional ultrasound B-scan echo images which makes possible the delineation of the displacement of cardiac boundaries for the precise assessment of infarcted/ischemic regions. An economic image processing system is designed for the purpose. An algorithm to compute the direction and amplitude of the displacement vector at any point in the cardiac image, given two frames of the image at two different time instants, is developed. The performance of the algorithm is examined with synthesized images. Displacement amplitudes along the boundaries of the left ventricle are plotted and compared for normal and diseased conditions. Author

A87-35600
WHEN THE DOCTOR IS 200 MILES AWAY
LES DORR, JR. Space World (ISSN 0038-6332), vol. X-3-279, March 1987, p. 33-36.

Severe medical problems which may be encountered by crewmembers during Space Station tours of duty are discussed, as are the capabilities planned for the Station Health Maintenance Facility (HMF). Heart muscles lose tone and mass during long periods in microgravity, and bones inexorably lose calcium in a demineralization process. An increasing frequency of humans spending long periods of time in space introduces the possiblity of occurrence of acute illnesses such as cardiovascular problems or kidney stones precipitating from bone calcium suspended in the blood. A prototype HMF has a defibrillator, ECG, pulse oximeter, patient restraints, CRT readouts, an IV system capable of long-term use, and exercise apparatus to offset the deconditioning effects of long-term spaceflight. All the equipment will be amenable to use by astronauts with paramedic training. M.S.K.

A87-35805
INVESTIGATION OF THE MECHANISM OF 'LIGHT FLASHES' INDUCED IN THE HUMAN EYE BY IONIZING PARTICLES [K IZUCHENIIU MEKHANIZMA 'VSPYSHEK SVETA', INDUTSIROVANNYKH U CHELOVEKA IONIZIRUIUSHCHIMI CHASTITSAMI]
P. V. GRAMENITSKII and I. N. FETISOV (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR) Radiobiologiia (ISSN 0033-8192), vol. 27, Jan.-Feb. 1987, p. 133, 134. In Russian. refs

A87-35825
THE FUNCTIONAL SIGNIFICANCE AND THE PHYSIOLOGICAL MECHANISMS OF THE VARIABILITY OF THE BARORECEPTOR REFLEX [FUNKTSIONAL'NOE ZNACHENIE I FIZIOLOGICHESKIE MEKHANIZMY IZMENCHIVOSTI BARORETSEPTIVNOGO REFLEKSA]
N. A. STEPOCHKINA (Leningradskii Korablestroitel'nyi Institut, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, Nov. 1986, p. 1473-1485. In Russian. refs

Data obtained on the functional role of the aortic and carotid sinus baroreceptors and on the modulations of the baroreceptor reflex effected by the skeletal muscle contractions are analyzed. Special attention is given to the suppressive effects of muscular activity, pain stimuli, and various cortical areas on the baroreceptor reflex. The effect of respiration on the baroreflex is examined together with the role of the baroreceptor reflex in the onset of nonrespiratory sinusal arrhythmia. I.S.

A87-36122
UPGRADING THE EFFICIENCY OF THE DYNAMIC MEDICAL MONITORING OF FLIGHT PERSONNEL [O POVYSHENII DEISTVENNOSTI DINAMICHESKOGO MEDITSINSKOGO KONTROLIA ZA LETNYM SOSTAVOM]
N. I. FROLOV, A. N. KOLTSOV, and V. A. SERGEEV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Nov. 1986, p. 38-40. In Russian.

In view of the connection between stressful conditions and the loss of work capacity (and sometimes the appearance of clinical conditions) in flight personnel, the need for continuous monitoring of the working schedules and the physiological and medical conditions of the personnel is emphasized. It is recommended that, for each pilot, a record be kept of working and rest-period schedules, illness occurrences, psychological traumas, the degree of social adjustment, stressful living conditions, and harmful habits. These personal data banks should include information concerning the psychophysiological reactions of a pilot to specific training and flight situations, and the efficiency displayed in stressful situations. Particular functional diagnostics tests are recommended. I.S.

A87-36123
THE ANTIALCOHOL TREATMENT OF MILITARY FLIGHT PERSONNEL [OPYT PROVEDENIIA ANTIALKOGOL'NYKH MEROPRIIATII V AVIATSIONNYKH CHASTIAKH]
A. F. PAKHOMOV, V. F. DIKUSAR, and V. M. IANOVSKII Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Nov. 1986, p. 55-57. In Russian.

A87-37712#
A COMPARISON OF POSTMORTEM CORONARY ATHEROSCLEROSIS FINDINGS IN GENERAL AVIATION PILOT FATALITIES
C. F. BOOZE, JR. and C. M. STAGGS (FAA, Civil Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 297-300.

The autopsy reports of 710 pilots involved in fatal general aviation accidents for the years 1980-1982 were reviewed to appraise the age-specific prevalence of coronary atherosclerosis. Of the autopsies on pilots killed in aircraft accidents, 69 percent indicated some degree of coronary atherosclerosis, ranging from minimal to severe. This finding is higher than for a similar group of pilots studied for the years 1975-1977. However, only about 2.5 percent of the 1980-1982 study group were found to have severe coronary atherosclerosis, compared with 5 percent in the previous study. Prevalence of severe coronary atherosclerosis increased with age from 5.8 per 1,000 for ages less than 40 years to 73.9 for age 50 years and above, also reflecting lower age-specific rates for severe coronary atherosclerosis than were found in the previous study. Author

A87-37713#
DETERMINING THE RATE OF BODY HEAT STORAGE BY INCORPORATING BODY COMPOSITION
NAOSHI KAKITSUBA and IGOR B. MEKJAVIC (Simon Fraser University, Burnaby, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 301-307. Research supported by the British Columbia Science Council.

A theoretical approach for determining the rate of body heat storage (S, in kcal/sq m per h) is described, which takes into account both biological variations (i.e., the proportions of different tissues in a body) and thermal states of the body. In this method, a two-compartment (core and shell) model is adopted. The specific heat capacities, mass fractions, and changes in the temperatures of the two compartments are combined, and S is defined as a function of adiposity. The results obtained with the equations developed (one for cold or warm exposures and one for cool exposures) were compared with data derived from a series of cold water immersion trials, with good agreement between the predicted and the experimental values of S. I.S.

A87-37715#
LOW BACK PAIN IN THE AH-1 COBRA HELICOPTER
PAUL FROOM, RAN HANEGBI, JOSEPH RIBAK, and MOSHE GROSS (Israel Air Force, Aeromedical Centre, Tel Hashomer, Israel) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 315-318.

The effect of posture on the prevalence and intensity of low back pain was investigated in eighteen AH-1 Cobra helicopter pilots who flew alternate missions of equal duration in both the gunner and the pilot positions. In the gunner's position (front seat), the AH-1 pilot maintains a vertical sitting position, whereas in the pilot's seat (rear), the pilot leans forward and to the left in order to operate the controls. Compared to the gunner's position, a flight in the pilot's position resulted in an increased incidence of pain (72.2 versus 55.6 percent), quicker onset of pain, and greater pain intensity. I.S.

A87-37719#
ATROPINE SULFATE EFFECTS ON AVIATOR PERFORMANCE AND ON RESPIRATORY-HEART PERIOD INTERACTIONS
JOHN A. DELLINGER, HENRY L. TAYLOR, and STEPHEN W. PORGES (Illinois, University, Savoy) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 333-338.

In this study, 20 human volunteers received a placebo and atropine doses of 0.5, 1.0, 2.0, and 4.0 mg/75 kg in a Latin square double blind design, and effects were monitored for 3 h postinjection. The 2.0 mg and the 4.0 mg doses resulted in significant flight simulator performance decrements beginning at 1 h postinjection with only minimal recovery by 3 h postinjection. Electrocardiogram data were used to estimate the amplitude of respiratory sinus arrhythmia, which was more sensitive than mean heart period or mean heart period variance to the effects of atropine. These parasympathetic effects were relatively rapid in onset and peaked within the first 40-min period for the 2.0 and 4.0-mg doses. The onset of performance effects were delayed 1 h 40 min for the 2.0 mg and 1 h 00 min for the 4.0 mg treatments. Author

A87-37720#
THE EFFECT OF CYCLOPLEGIA ON THE VISUAL CONTRAST SENSITIVITY FUNCTION
WILLIAM G. BACHMAN and ISAAC BEHAR (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, AL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 339-342.

Contrast sensitivity assessment is one of several emergent techniques being considered for inclusion in a visual standards test battery for the Army, particularly for the evaluation of Army aviators. Since a cycloplegic refraction is required for initial selection of candidates for Class I and Class IA flying duty, it is important to determine what effect, if any, cycloplegia has on the contrast sensitivity function. There were 12 subjects tested, all officers in preparation for flight training who had passed a recent Class I flight physical. Contrast sensitivity functions were obtained under normal ambient conditions and in the presence of a glare source both under manifest and cycloplegic conditions. Cyclopegia produced a small reduction in contrast sensitivity under normal ambient conditions, and a greater reduction under glare conditions. For both conditions, the cycloplegia effect was greater for the higher spatial frequency gratings than for the lower. Author

A87-37721#
VITAL CAPACITY AND AIRFLOW MEASURED FROM PARTIAL FLOW-VOLUME CURVES DURING 5-DEG HEAD-DOWN TILT
M. B. DIKSHIT and J. M. PATRICK (Nottingham University, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 343-346.

Ten healthy young males were subjected to 7 min of 5-deg head-down tilt, during which their forced vital capacity, peak flow rate (from complete flow-volume curves), and MEF 40 percent and 25 percent (airflows when 40 percent and 25 percent of the vital capacity remains in the lungs) from the partial curves were measured. The values of these variables and the heart rate and blood pressure were not significantly different from the values obtained in the supine position. In view of these findings it is concluded that the increase in the intra-thoracic blood volume, known to occur with 5-deg head-down tilt used as a model for simulating weightlessness, does not embarass respiratory mechanics. Author

A87-37723#
SIMULATOR SICKNESS - A PROBLEM FOR ARMY AVIATION
JOHN S. CROWLEY (U.S. Army, Hanau Army Airfield, Hanau, West Germany) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 355-357.

'Simulator sickness' describes a symptom complex frequently reported by pilots during or after flight simulator training. There were 112 helicopter pilots at a U.S. Army AH-1 Cobra Flight Weapons Simulator (FWS) who completed a symptom-oriented subjective questionnaire. Of these, 40 percent reported symptoms of dysequilibrium; pilots developing simulator sickness had significantly more total and AH-1 flight time. Adaptation to the syndrome occurred with increasing FWS experience. The history and aeromedical significance of simulator sickness are briefly reviewed, and a case report presented. A mandatory grounding policy in use locally is described. Potential treatment strategies are briefly discussed. Author

A87-37724#
TWENTY YEARS OF TREATING DECOMPRESSION SICKNESS
R. D. GREEN and D. R. LEITCH (Institute of Naval Medicine, Alverstoke Gosport, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 362-366.

Twenty years of treatment records were searched for cases of serious decompression sickness (DCS). Spinal cord DCS was the most common presentation. The efficacy of various treatment tables were compared. Oxygen tables were found to be as effective as long air tables in treating cases presenting within 12 h of the onset of symptoms and were superior for cases presenting later. Using RN 61 (USN 5) to treat serious decompression sickness resulted in a high post-treatment relapse rate. Other inappropriate practices such as in-water air treatment and nontreatment of spontaneously recovering cases resulted in a high incidence of deterioration or relapse. Author

A87-37950#
G-LOC - TAMING THE KILLER
MIKE GAINES Flight International (ISSN 0015-3710), vol. 131, March 28, 1987, p. 27-30.

Several pilots have been killed by G-induced loss of consciousness, or 'G-loc', which is directly related to brain oxygenation level decreases when the heart's ability to pump blood at a pressure of at least 22 mm Hg at eye level is overcome. Centrifuge tests have shown that G-loc often has no warning symptoms; attention has accordingly been given to the design of

helmet-mounted pre-G-loc condition warning sensors. Additional research is being conducted into the design improvement of the anti-G suit worn by pilots, involving rapid inflation of the suit from the bottom up under the command of microprocessors. O.C.

A87-38713#
ENERGY EXPENDITURE DURING SIMULATED EVA WORKLOADS
REBECCA S. INDERBITZEN (USAF, School of Aerospace Medicine, Brooks AFB, TX) and JAMES J. DECARLIS, JR. IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 109-112.
(SAE PAPER 860921)

In ongoing decompression sickness studies at the USAF School of Aerospace Medicine, an exercise regimen is used in which EVA is simulated. A ground-based study was undertaken in order to assess, for the protocol, the currently accepted value of energy expenditure (150-200 kcal/hr) which was based on very limited data. Six male and five female subjects performed an hour of exerise comprised of three tasks analogous to actual tasks performed by astronauts during EVA. Metabolic data were collected using an open-loop oxygen consumption meter during rest and exercise. Gender differences in energy expenditure during performance disappeared when the values were expressed in terms of added energy cost, body weight or lean-body mass. Author

A87-38714*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE MOTION SICKNESS STATUS REPORT
JOHNSON SPACE CENTER NASA, HOUSTON, TX IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 119-121.
(SAE PAPER 860923)

The space motion sickness (SMS) component of the multifactor space adaptation syndrome is anticipated to be a major problem in the spaceflight and habitation conditions that will be encountered in NASA Space Station tours and Mars voyages. The minimization of maladaptive physiological responses while enhancing those mechanisms that can best cope with the gravitoinertial conditions of space flight will require an intimate knowledge of the physiology of adaptive processes. The homeostatic mechanisms involved in SMS are inherent in human physiology. O.C.

A87-38715*# National Aeronautics and Space Administration, Washington, D.C.
RADIATION DOSE PREDICTION FOR SPACE STATION
PERCIVAL D. MCCORMACK (NASA, Office of the Space Station, Washington, DC) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 123-140.
(SAE PAPER 860924)

A detailed examination is conducted of the basis for the significant differences in Space Station radiation dose predictions that result from magnetic field model extrapolations into the future, with attention to the radiation attenuation effects of the residual atmospheric layer at altitudes of less than 1000 km. A model adjustment is proposed to supplant the arbitrary procedure of magnetic field extrapolation into the future. At altitudes below 500 km and low inclination, and with nominal module wall thicknesses, the new predictions for a 90-day Space Station tour are found to be well within current radiation dose limit guidelines. O.C.

A87-38768#
PHYSIOLOGICAL ASPECTS OF EVA
PAUL A. FURR, CONRAD B. MONSON, WILLIAM J. SEARS, and FRED J. ABELES (Grumman Aerospace Corp., Space Systems Div., Bethpage, NY) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 711-718.
(SAE PAPER 860991)

Extravehicular activity (EVA) has become increasingly complex since the days of Gemini. Crewmembers may accumulate as many as 250 hours EVA during a 90 day mission. Physiological parameters and operational variables which were of little or no concern on Shuttle EVAs may become major factors for Space Station EVAs in terms of limiting man's productivity and thus impact EVA scheduling, tasks, and safety. Repeated decompressions, suit oxygen and carbon dioxide levels, metabolic requirements for optimization of work, thermal balance and comfort, and waste collection and management are discussed in this paper. The physiologist must determine the limits of man's adaptation to the space environment within the context of defined, measurable parameters of work performance, or define the change in performance when given an altered environment as the independent variable. Author

A87-38793#
CARDIOVASCULAR ADAPTATION TO ZERO-G
J. C. BUCKEY (Texas, University, Dallas) IN: Symposium on Microgravity Fluid Mechanics; Proceedings of the Winter Annual Meeting, Anaheim, CA, Dec. 7-12, 1986 . New York, American Society of Mechanical Engineers, 1986, p. 45, 46.

The in-flight and postflight effects of zero gravity on the cardiovascular system are discussed. The major cardiovascular event upon entering zero-G is a headward shift of body fluid, which activates a number of regulatory mechanisms leading to reduced plasma volume, higher resting heart rates, and a reduction of central venous pressure and left ventricular end-diastolic volume below supine levels. The net result of the in-flight adaptation to zero-G is a decrease in orthostatic tolerance that becomes manifest upon return to earth. I.S.

A87-38794*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MICROGRAVITY INDUCED FLUID AND ELECTROLYTE BALANCE CHANGES
R. W. PHILLIPS (NASA, Johnson Space Center, Houston, TX; Colorado State University, Fort Collins) IN: Symposium on Microgravity Fluid Mechanics; Proceedings of the Winter Annual Meeting, Anaheim, CA, Dec. 7-12, 1986 . New York, American Society of Mechanical Engineers, 1986, p. 47, 48.

The effect of reduced gravity on the fluid and electrolyte balance in astronauts is discussed. The acquired data indicate an early and marked sodium and potassium loss and a negative water balance. The conditions in astronauts may be likened to the syndrome of inappropriate secretion of antidiuretic hormone, but the mechanisms by which weightlessness causes a continued negative water and electrolyte balance, after the early shifts have occurred, are not clear. It is suggested that a transient increase in the release of the atrial naturetic factor and the altered gastrointestinal function may play a role in the initial and continued fluid and electrolyte changes, respectively. I.S.

N87-21977# Joint Publications Research Service, Arlington, Va.
YEAR-LONG HYPOKINESIA EXPERIMENT IN PROGRESS: DAILY LIFE OF PARTICIPANTS DESCRIBED
L. REPIN *In its* USSR Report: Space (JPRS-USP-87-001) p 121-126 19 Feb. 1987 Transl. into ENGLISH from Kosmolskaya Pravda (Moscow, USSR), 10 Aug. 1986 p 4
Avail: NTIS HC A11/MF A01

Ten volunteer subjects were tested to determine the effects of hypokinesia on the body, by being immobilized for an extended

period. Interviews with four of the test subjects are presented.
B.G.

N87-22392# Illinois Univ., Chicago. Coll. of Medicine.
ROLE OF ADENOSINE ANALOGS AND GROWTH HORMONE IN WAKING AND SLEEP Annual Report, 15 Sep. 1985 - 15 Sep. 1986
MIODRAG RADULOVACKI 2 Feb. 1987 4 p
(Contract AF-AFOSR-0349-85)
(AD-A177385; AFOSR-87-0078TR) Avail: NTIS HC A02/MF A01 CSCL 06A

The mechanism of hypnotic action of adenosine was investigated. Rats deprived of rapid-eye-movement sleep (REMS) show an increase in adenosine receptors in two brain regions, the cerebral cortex and the corpus striatum. At the same time there is no change in brain adenosine concentration. Chronic administration of diazepam stimulated adenosine receptors and decreased the number of A1 receptors in hippocampus and A2 receptors in the striatum. GRA

N87-22393# Army Research Inst. of Environmental Medicine, Natick, Mass.
OPERATION EVEREST 2: LACK OF AN EFFECT OF EXTREME ALTITUDE ON VISUAL CONTRAST SENSITIVITY
JOHN L. KOBRICK, EDITH CROHN, BARBARA SHUKITT, and CHARLES S. HOUSTON Jan. 1987 26 p
(AD-A177577) Avail: NTIS HC A03/MF A01 CSCL 06S

Contrast sensitivity thresholds were studied during gradual ascent over 40 days to a simulated altitude of 25,000 feet in a decompression chamber. Only ambient pressure, and thus inspired oxygen pressure was varied, thereby eliminating many of the confounding effects of cold, dehydration, malnutrition and exhaustion, inevitably encountered on very high mountains. Contrast sensitivity thresholds measured by the Ginsburgh Vistech test showed no overall impairment as altitude increased. These results are in contrast to findings of other previously reported vision studies involving shorter exposures and lower altitudes than those of the present study. However, our findings can be reconciled with previous contrary results on the basis of the higher stimulus luminances used in our contrast sensitivity testing. Compared to the luminance levels involved in previously reported night vision testing, our stronger stimuli would be less likely to be affected by hypoxia. GRA

N87-22394# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTS OF VARIOUS ENVIRONMENTAL STRESSORS ON COGNITIVE PERFORMANCE
L. E. RANDERET, B. L. SHUKITT, E. A. CROHN, R. L. BURSE, and D. E. ROBERTS 27 Jan. 1987 6 p
(AD-A177587) Avail: NTIS HC A02/MF A01 CSCL 06N

Rigorous testing instruments and psychometric methods are required to assess the effects of enviromental stressors upon cognitive performance. This paper presents findings and illustrates our methodology for evaluating the effects of several types of environmental stressors. Various cognitive performances were investigated experimentally with paper and pencil tasks in repeated-measures paradigms for several high altitudes, altitude-treatment strategy, dehydration cold, atropine in a hot environment. Cognitive performances was to decreases in the rate of performance rather than increased errors, e.g., problem solving rates decreased linearly from 4500 to 7600 m (15,000 to 25,000) high altitude during a 40-day progressive exposure. Recovery of performance during 2 days at 4600 m depended upon the task; not all tasks improved fully. A treatment strategy (tyrosine) minimized altitude-induced performance impairments on some tasks. Our results suggest even well-practiced and overlearned tasks deteriorate with environmental stressors. Adequate stressor levels, enough subjects practiced tasks with demonstrated stability and sensitivity, appropriate time sampling, and the recruitment of maximum performance before experimentation are critical factors for our approach. GRA

N87-22395# Army Research Inst. of Environmental Medicine, Natick, Mass.
A SYSTEM FOR CONTROLLED PRESENTATION OF THE ARDEN CONTRAST SENSITIVITY TEST
JOHN L. KOBRICK, HARRY I. ZELTZER, and STEPHEN MULLEN 3 Dec. 1986 16 p
(AD-A177640; USARIEM-M-15/87) Avail: NTIS HC A02/MF A01 CSCL 20F

The visual detection of differences in brightness, also called contrast sensitivity, is increasingly recognized in recent years as a phenomenon of potentially great significance both for explaining the visual perception process and for diagnosing visual disorders. The contrast sensitivity function (CSF) is generally recognized as a useful index of the process, and is considered to be based mainly on detection of spatial frequencies contained in the luminance contrast patterns of visual stimuli striking the retina. The Arden test of contrast sensitivity was recognized as a simple and easily administered technique for measurement of this process. However, the customary method of administration of this test involves manual manipulation and considerable individual subjectivity. The instrument described in this report was designed and developed to minimize variability in the testing procedure due to differences in individual testing techniques, and to standardize testing conditions, ambient illumination, viewing distance and rates of presentation. The CSF can provide information about the status of the human visual system which cannot be obtained from visual acuity measurements. GRA

N87-22396# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A MOTION SICKNESS PREDICTION MODEL AND SYSTEM DESCRIPTION M.S. Thesis
DANA R. HARTLE Dec. 1986 201 p
(AD-A177716; AFIT/GCS/ENG/86D-3) Avail: NTIS HC A10/MF A01 CSCL 06R

The existing biophysical data acquisition system was modified and refined to improve data collection and analysis. Several of the parameter sensors were redesigned and several new sensors were added. Several of the previously used sensors such as thoracic and diaphragmatic respiration, temperature, and pallor were calibrated to provide a quantifiable range of data. The calibrated values can now be equated to recognizable values, such as volume (CC) for thoracic and diaphragmatic respiration, degrees fahrenheit for temperature, and the percentage of minimum to maximum blood flow for pallor. The electrical schematics of the sensors were updated to match the existing equipment. The collected data parameters were analyzed spectrally and statistically to produce a motion sickness prediction model. The data results for each parameter are discussed in depth with the onset of motion sickness. GRA

N87-22397# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MOTION SICKNESS: A STUDY OF ITS ETIOLOGY AND A STATISTICAL ANALYSIS M.S. Thesis
ROBERT D. MILLER Dec. 1986 154 p
(AD-A177786; AFIT/GCS/ENG/86D-2) Avail: NTIS HC A08/MF A01 CSCL 06S

The affects of motion induced sickness on the human physiology are investigated. Physiologic data were collected from 12 test volunteers who were spun in a multiaxis rotating chair to elicit a motion sickness response. The data collected were statistically analyzed using linear regression techniques to develop a model that can be used to predict the onset of motion sickness. Evidence indicates that many of the classical physiologic parameters studied are strongly correlated to each other and as a result, must be studied together in order to effectively piece together the complex interrelationships of motion sickness. Major recommendations for future AFIT research include analyzing the data through the use of other multivariant techniques, including nonlinear regression, as well as testing the model developed during this research against actual experimental data. Another recommendation includes integrating a computer, either a

mainframe or a personal computer, along with an analog to digital conversion board and associated software and data acquisition and data analysis software to the current system to enhance collection and analysis capabilities. GRA

N87-22398# California Univ., Berkeley. Lawrence Berkeley Lab.
INTERACTION MECHANISMS, BIOLOGICAL EFFECTS AND BIOMEDICAL APPLICATIONS OF STATIC AND EXTREMELY-LOW-FREQUENCY MAGNETIC FIELDS
T. S. TENFORDE Apr. 1986 60 p Presented at the 22nd Annual Meeting of the National Council on Radiation Protection and Measurements, Washington, D.C., 2 Apr. 1986
(Contract DE-AC03-76SF-00098)
(DE87-006946; LBL-22321; CONF-860451-2) Avail: NTIS HC A04/MF A01

A major stimulus for research on the bioeffects of static magnetic fields has been the effort to develop technologies for energy production and storage that utilize intense magnetic fields. In addition, the rapid emergence of magnetic resonance imaging as a new clinical diagnostic procedure has provided a strong rationale for defining the possible biological effects of magnetic fields with high intensities. The numerous sources of time-varying magnetic fields with frequencies in the extremely-low-frequency (ELF) range has also led to an increased emphasis on defining the interactions of these fields with biosystems. Of particular interest has been the potential biological effects of fields with 50 and 60 Hz frequencies. However, fields with other frequencies in the ELF range are also of interest because of their use in communication systems and in certain medical procedures. In this report the principal interaction mechanisms of static and time-varying magnetic fields are described, and a summary is provided of the current state of knowledge on the biological effects of these fields based on laboratory studies. The final section describes several useful applications of magnetic fields in medicine and biological research. DOE

N87-22399*# Stanford Univ., Calif. Dept. of Psychology.
COMPUTATIONAL MODELS OF HUMAN VISION WITH APPLICATIONS Final Report, 1 Nov. 1984 - 31 Oct. 1986
BRIAN A. WANDELL 1987 4 p
(Contract NCC2-332)
(NASA-CR-180924; NAS 1.26:180924) Avail: NTIS HC A02/MF A01 CSCL 06P

The research program supported by this grant was initiated in 1977 by the Joint Institute for Aeronautics and Acoustics of the Department of Aeronautics and Astronautics at Stanford University. The purpose of the research was to study human performance with the goal of improving the design of flight instrumentation. By mutual agreement between the scientists at NASA-Ames and Stanford, all research activities in this area were consolidated into a single funding mechanism, NCC 2-307 (Center of Excellence Grant, 7/1/84 - present). This is the final report on this research grant. Author

N87-23106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIAL FEATURES IN REGULATING RESPIRATION UNDER NORMAL CONDITIONS AND CONDITIONS OF ALTERED GAS MEDIUM
M. V. SERGIYEVSKIY 25 Mar. 1987 24 p Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSSR (USSR), v. 57, no. 12, Dec. 1971 p 1780-1787
(AD-A179216; FTD-ID(RS)T-0189-87) Avail: NTIS HC A02/MF A01 CSCL 06P

Arguments are presented for these conclusions: Under physiological conditions an automatic and adaptable control of the respiratory functional system is provided by an elaborate complex of reflex reactions at different levels. When the gaseous medium is changed against the background of developing hypoxia the products of partial oxidation have a significant effect on the cerebral cortex of brain, and then on the medulla oblongata. Under the conditions of hypoxia the receptor zones in the tissues of the brain, including in the venous sinuses and bulbus venae jugularis acquire special importance. They are the first receptors to receive the effect of the products of partial oxidation, which are generated in the cortex, and because of them the preferential oxygen supply to the cells of the cortex occurs. With changed gaseous medium first of all the activity of the cortex is disturbed, which ensures formation of functionally mobile constellations of nerve centers, which integrate the adaptation of the functional systems to varied conditions of vital activity. GRA

N87-23107# Oxford Univ. (England). Dept. of Physiology.
THE PERCEPTION OF BRIGHTNESS AND COLOUR: NEUROPHYSIOLOGY, PSYCHOPHYSICS AND COMPUTATION Final Scientific Report, 1 Sep. 1985 - 31 Aug. 1986
A. J. PARKER, M. J. HAWKEN, and C. B. BLAKEMORE 27 Feb. 1987 69 p
(Contract F12878-85-C-00014; AF-AFOSR-0296-85)
(AD-A179217; KK-8F-161; EOARD-85-0056) Avail: NTIS HC A04/MF A01 CSCL 06P

Progress in research in 3 areas of computational visual neuroscience is summarized. The first project has assessed the receptive field organization of neurons in the primate striate cortex. A new model is proposed for cortical receptive fields based on linear combinations of difference of Gaussian functions. The second project is directed towards measuring the chromatic properties of cortical cell receptive fields. The third project is assessing current computational models of the perception of three dimensional surfaces using psychophysical techniques with human observers. GRA

N87-23108# Dayton Univ., Ohio. Research Inst.
ASYMMETRIES IN THE CONTROL OF SACCADIC EYE MOVEMENTS TO BIFURCATING TARGETS Final Report, Mar. 1983 - Mar. 1984
YEHOSHUA Y. ZEEVI, PAUL A. WETZEL, and GEORGE A. GERI Apr. 1987 21 p
(Contract F33615-84-C-0066)
(AD-A179270; AFHRL-TR-86-54) Avail: NTIS HC A02/MF A01 CSCL 05I

The task of responding to one of two simultaneously presented targets often reveals unexpected yet profound preferences in the direction of saccadic eye movements. A simple experimental paradigm is used in which a single point of light bifurcates symmetrically to the left and right of the fixation point. Under these conditions, most subjects show an eye movement response preference to either the left or right. Data show that this preference can be eliminated by delaying the onset of the target, presented in the preferred direction, by about 40 milliseconds. This indicates that in the sequence of events occurring prior to the execution of a saccade, a window of time of this duration is allocated for decisions concerning direction, of response even when targets are presented to both visual hemifields. It was also found that the bifurcating targets interact to significantly increase response latencies in both the preferred and nonpreferred directions. Further, the interaction is asymmetrical, in that a target presented in the preferred direction has a greater effect than a target in the nonpreferred direction on responses in the counter direction. Results suggest an asymmetry in hemispheric interaction. GRA

N87-23109# Army Research Inst. of Environmental Medicine, Natick, Mass.
RELATIONSHIP BETWEEN A TWO MILE RUN AND MAXIMAL OXYGEN UPTAKE
ROBERT P. MELLO, MICHELLE M. MURPHY, and JAMES A. VOGEL Feb. 1987 25 p
(AD-A179343) Avail: NTIS HC A02/MF A01 CSCL 06P

The relationship between a maximal effort two-mile run for time and maximal oxygen uptake (VO2 max) as measured by treadmill running is examined. Subjects were 44 males (aged 20-51) and 17 females (aged 20-37) of various fitness and activity levels. All subjects performed a timed two mile run and a treadmill running test for maximal oxygen uptake. The coefficient of correlation between the treadmill maximal test and the two mile run test for

all subjects was -0.91. Separate regression analyses for male and female data also displayed significant correlations (r sub m -0.91, r sub f -0.89). The addition of such variables as age, height, weight, and % body fat did not improve the predictability of the equations. However, inclusion of body weight in the male equation did increase its predictive accuracy (SEE = 3.31 to 2.69). The high degree of correlation between VO2 max and two mile run time thus permits the estimation of either component with significant accuracy from the direct measurement of the other. This study confirms the usefulness and validity of a timed 2 mile run test to indicate the level of aerobic fitness capacity when the test is properly supervised and the subjects are well motivated. GRA

N87-23110# Anthropology Research Project, Yellow Springs, Ohio.
SELECTION OF DIMENSIONS FOR AN ANTHROPOMETRIC DATA BASE. VOLUME 2: DIMENSION EVALUATION SHEETS Final Report, Sep. 1984 - Oct. 1985
CHARLES E. CLAUSER, JOHN T. MCCONVILLE, CLAIRE C. GORDON, and ILSE O. TEBBETTS 30 May 1986 420 p
(Contract DAAK60-84-C-0086)
(AD-A179472; NATICK-TR-86/054) Avail: NTIS HC A18/MF A01 CSCL 06N

Anthropometric dimensions measured in 14 major foreign and domestic military and civilian surveys were reviewed in detail for possible inclusion in an anthropometric survey of U.S. Army men and women. Detailed review of each dimension included the following information: a description of the dimension, subject position, and landmarks required; type of instrument used; significant technique differences among different surveys; alternative dimensions that could serve the same function in a data base; summary statistics from surveys that included the dimensions; notation of significant gender or racial differences for the dimension; ease of reproducibility, and factors contributing to reproducibility problems (if any); and a rating (with rationale) of the dimension's relative utility for a U.S. Army data base. Review sheets summarizing this information comprise Volume 2 of this report. GRA

N87-23111# Boston Univ., Mass. Center for Adaptive Systems.
WORKSHOP SYMPOSIUM ON NEURAL MODELS OF SENSORY-MOTOR CONTROL Final Report, 1 Jul. 1986 - 30 Jun. 1987
DANIEL BULLOCK and STEPHEN GROSSBERG 6 Mar. 1987 222 p Workshop held in Cambridge, Mass., 19-20 Aug. 1986
(Contract AF-AFOSR-0228-86)
(AD-A179501; AFOSR-87-0457TR) Avail: NTIS HC A10/MF A01 CSCL 05J

The Symposium on Neural Models of Sensory-Motor Control was held on August 19 and 20, 1986, at Harvard University as part of the annual meeting of the Society for Mathematical Psychology. The Symposium was divided into two sessions, each with four 50-minute presentations. The first session focused on neural models of the human oculo-motor system. The second session began with two papers on arm movement planning. GRA

N87-23112# Anthropology Research Project, Yellow Springs, Ohio.
SELECTION OF DIMENSIONS FOR AN ANTHROPOMETRIC DATA BASE. VOLUME 1: RATIONALE, SUMMARY, AND CONCLUSIONS Final Report, Sep. 1984 - Oct. 1985
CHARLES E. CLAUSER, JOHN T. MCCONVILLE, CLAIRE C. GORDON, and ILSE O. TEBBETTS May 1986 65 p
(Contract DAAK60-84-C-0086)
(AD-A179566; NATICK-TR-86/053-VOL-1) Avail: NTIS HC A04/MF A01 CSCL 06N

A large number of body size variables were examined and rated for their usefulness in an anthropometric data base designed to serve present and future needs of the U.S. Army. These dimensions are assembled in groups representing various uses to which the Army might put these data, ranging from the design of clothing, personal protective equipment, and workspaces, to the development of link systems and human analogs. A total of 362 dimensions analyzed in this study were rated as marginal, useful or essential to one or more of these applications. Some 194 dimensions are suggested as candidates for measurement in a proposed new large-scale multipurpose survey of Army personnel. Sources for the study included 34 anthropometric surveys of U.S. and foreign military and civilian subjects, as well as questionnaire surveys and interviews with clothiers, modelers, design engineers, physical anthropologists, and others experienced in the application of anthropometric data to military design problems. Dimension lists from fourteen large-scale surveys were selected for detailed review. Descriptions and analyses of all the dimensions measured in these surveys appear in Volume 2 of this report. GRA

N87-23113# Washington Univ., Seattle. Dept. of Psychology.
IMAGE SIZE AND RESOLUTION IN FACE RECOGNITION
AMY JO BILSON 1987 128 p
Avail: NTIS HC A07/MF A01

The effect of image size on the resolution threshold for face recognition is investigated using a large and relatively heterogeneous set of faces. Three experiments were run: a two alternative forced choice (2AFC) study, yes/no (Y/N) study, and a sixteen alternative forced choice (16AFC) study. The results of these three studies indicated that, for images subtending 1 to 4 deg, the resolution threshold for face recognition is approximately 4 cycles per face width (c/fw), and that this value is independent of image size. Images subtending 0.5 deg were not reliably recognized at any resolution. This lower bound on scale invariant image recognition, 0.5 deg, can be at least partially explained in terms of the Contrast Sensitivity Function (CSF) for human foveal vision. Author

N87-23114* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 298)
Jun. 1987 64 p
(NASA-SP-7011(298); NAS 1.21:7011(298)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 173 reports, articles, and other documents introduced into the NASA scientific and technical information system in May, 1987. Author

N87-23115# Cornell Univ., New York, N.Y. Dept. of Applied Physics.
FUNDAMENTAL STUDIES IN THE MOLECULAR BASIS OF LASER INDUCED RETINAL DAMAGE Annual Report, 1 May 1985 - 30 Apr. 1986
AARON LEWIS 31 Dec. 1986 35 p
(Contract DAMD17-85-C-5136; DA PROJ. 3E1-62772-A-878)
(AD-A178453) Avail: NTIS HC A03/MF A01 CSCL 06R

Progress on the fundamental effects of femtosecond laser pulses with retinal pigments, new insights into the detailed interactions of light with photoreceptor cells, and tremendous advances in new forms of super-resolution microscopy are discussed. The common Nd:YAG laser pumping a dye laser is used. GRA

N87-23116# School of Aerospace Medicine, Brooks AFB, Tex.
F-16 CONTROL STICK RESPONSE DURING +G SUB Z-INDUCED LOSS OF CONSCIOUSNESS Interim Report, Dec. 1985 - Apr. 1986
JAMES E. WHINNERY Nov. 1986 19 p
(AD-A178474; USAFSAM-TR-86-26) Avail: NTIS HC A02/MF A01 CSCL 06B

The stick input has been analyzed during deliberate self-induced +Gz loss of consciousness (G-LOC) on the USAF School of Aerospace Medicine human centrifuge. An F-16A stick was utilized with output of + or - pitch, + or - roll, an on-off binary sensory being obtained in 1/8-second intervals during G-LOC and recovery. The results are applicable to emerging aircraft autorecovery technology. The currently known physiologic aspects of G-LOC and their time relationships are viewed in relation to the potential

use of stick force as a rather simplistic G-LOC physiologic monitoring technique. GRA

N87-23117# Naval Aerospace Medical Research Lab., Pensacola, Fla.
VISUAL ACUITY AND REACTION TIME IN NAVY FIGHTER PILOTS
A. MORRIS and P. V. HAMILTON Dec. 1986 32 p
(AD-A178485; NAMRL-1324) Avail: NTIS HC A03/MF A01
CSCL 06P

This report summarizes data on selected visual measures for Navy fighter pilots. The vision of 163 pilots was measured using an Automated Vision Test Battery housed in a Mobile Field Laboratory. All pilots were involved in training at the Tactical Air Combat Training System (TACTS) range, NAS Oceana, Va. Data on simple visual reaction time, spot detection ability, static visual acuity under several conditions are reported, and the influences of age and spectacles on vision are examined. The average high contrast acuity score was 0.40 minutes of visual angle, or 20/8 Snellen; no pilot had worse than 20/15 acuity. These findings, together with other data, suggest that Navy fighter pilots have better vision than non-aviators of the same age, and possibly better vision than Student Naval Aviators. Correlational analyses suggest that acuity threshold, simple visual reaction time, and threshold stressed reaction time, are independent measures of visual functioning. Spectacled pilots had poorer vision than non-spectacled pilots, and older pilots tended to have poorer vision than younger pilots. GRA

N87-23118# Wright State Univ., Dayton, Ohio. Div. of Human Biology.
IDENTIFICATION AND VALIDATION OF NEW ANTHROPOMETRIC TECHNIQUES FOR QUANTIFYING BODY COMPOSITION Final Report, Aug. 1984 - Jul. 1985
ALEXANDER F. ROCHE, WILLIAM C. CHUMLEA, and SHUMEI GUO 16 Oct. 1986 231 p
(Contract DAAK60-84-C-0054)
(AD-A178753) Avail: NTIS HC A11/MF A01 CSCL 06N

This study validates estimates of body composition from bioelectrical impedance (RJL Model BIA-101) against corresponding estimates of body composition from densitometry in a sample of 177 young men and women, of whom 14% were black. Also, comparisons are made between measures of subcutaneous adipose tissue thickness using a portable ultrasound machine (EchoScan 1502) and Lange skinfold calipers in the same sample. In separate samples, measures of machine reliability were conducted between pairs of impedance machines and between pairs of ultrasound machines. In addition, tests were made of the possible effects of physiological noise factors on measures of impedance. Bioelectric impedance is highly reliable as are measures of subcutaneous adipose tissue with Lange skinfold calipers. Ultrasonic measures of subcutaneous adipose tissue are not reliable and do not improve predictions of body composition over that of corresponding skinfold measurements. Bioelectric impedance is not affected by physiological factors such as diet, time of day, exercise of the menstrual cycle. However, in those women who do not participate in some form of regular exercise, predictions of body composition from Stature/Resistance plus anthropometry do differ significantly from those of women who do exercise regularly. The addition of bioelectric impedance does improve the predictions of body composition from anthropometry alone compared to corresponding estimates from densitometry. GRA

N87-23119# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A COLLECTION AND STATISTICAL ANALYSIS OF BIOPHYSICAL DATA TO PREDICT MOTION SICKNESS INCIDENCE M.S. Thesis
MICHAEL R. MCPHERSON Dec. 1986 187 p
(AD-A178874; AFIT/GCS/ENG/86D-21) Avail: NTIS HC A09/MF A01 CSCL 06S

Biophysical data were collected on humam volunteers to study the effects of the motion sickness syndrome. Physiological parameters were analyzed by descriptive statistical methods and by means of a spectrum analyzer. Descriptive statistical analysis showed at least five separate physiological parameters were linearly correlated to a motion sickness symptom index. Spectral analysis showed definite frequency and amplitude shifts during the onset of motion sickness for various parameters. Low frequency brain wave activity on the order of 0.1 Hz was discovered as the subject approached nausea. A multiple linear regression model was constructed from the correlated data obtained by descriptive statistics. Six separate physiological parameters were useful in describing a predictive motion sickness model that can be used as a major construct in developing a complete biofeedback system for countering effects of motion sickness. GRA

N87-23120# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 20, NO. 5, SEPTEMBER - OCTOBER 1986
16 Dec. 1986 147 p *Transl. into ENGLISH of Kosmicheskaya* Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 96 p
(JPRS-USB-86-007) Avail: NTIS HC A07/MF A01

The translation of a Russian journal is presented. The articles mainly concern themselves with the biological effects of space flight on humans. Methods of testing for these effects are also given. Extensive coverage of experimental and general theoretical research is presented.

N87-23121# Joint Publications Research Service, Arlington, Va.
PROBLEMS AND FEASIBILITY OF DRUG CORRECTION OF ORTHOSTATIC TOLERANCE IN SPACE MEDICINE
V. S. SHASHKOV and A. YU. MODIN *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 1-11 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep.-Oct. 1986 p 4-11
Avail: NTIS HC A07/MF A01

Published data concerning physiological mechanisms of man's orthostatic tolerance and its decline under the influence of space flight factors are reviewed. The principles, goals and potentialities of drug correction of orthostatic intolerance are presented. The applicability of selected drugs used separately or in combination with traditional countermeasures is discussed. Author

N87-23122# Joint Publications Research Service, Arlington, Va.
STRUCTURE AND FUNCTION OF OTOLITHS
A. A. SHIPOV and A. V. KONDRACHUK *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 12-22 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 11-19
Avail: NTIS HC A07/MF A01

Current data on the structure and function of the otoliths are reviewed. The function of the otolith organ in microgravity is discussed. Biophysical approaches to its study are presented. Theoretical and practical theories, which may be important, because they may help clarify certain aspects of space motion sickness are presented. Author

N87-23123# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF HEMOSTASIS SYSTEM IN AIR TRAFFIC CONTROLLERS AS RELATED TO DIFFERENT AIR TRAFFIC CONDITIONS
I. V. KUZNETSOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 23-28 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 19-23
Avail: NTIS HC A07/MF A01

The system of hemostasis of air traffic controllers responsible for the control of air traffic of varying intensity was investigated. The response of the system depended on its initial state: a higher workload led to hypercoagulation and a lower workload, to hypocoagulation. Author

N87-23125# Joint Publications Research Service, Arlington, Va.
EFFECT OF SHORT-TERM SPACEFLIGHTS ON ACTIVITY OF RENIN-ANGIOTENSION-ALDOSTERONE SYSTEM, CONCENTRATION OF CYCLIC NUCLEOTIDES AND PROSTAGLANDINS IN BLOOD
B. V. AFONIN, A. I. GRIGORYEV, and E. A. PAVLOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 33-38 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v 20, no. 5, Sep. - Oct. 1986 p 27-30
Avail: NTIS HC A07/MF A01

After short term flights renal excretion of aldosterone increased, thus suggesting its enhanced production and metabolism. An adequate increase of aldosterone synthesis was accompanied by an increase of its concentration in blood. An inadequate activation of mineralocorticoids manifested as a lower concentration of blood aldosterone and greater excretion of aldosterone in the urine. These differences in the mineralocorticoid activity were determined by the renin-angiotensin system whose activit y was associated not only with fluid-electrolyte metabolism but also with changes in the concentration of cyclic nucleotides and prostaglandins that reflect the vascular tone and sympatho-adrenal activity. An increase activity of the renin-angiotensin system seen in most cosmonauts at an acute stage of readaptation was correlated with a higher concentration of cAMP and a lower concentration of depressor prostaglindins. The acitivity of the renin-angiotensin system declined in parallel with the decrease of the blood content of cAMP.
Author

N87-23126# Joint Publications Research Service, Arlington, Va.
NUTRITIONAL CORRECTION OF HISTAMINE AND SEROTONIN LEVELS AS RELATED TO EXPOSURE TO HYPOKINESIA AND NEURO-EMOTIONAL STRESS
S. KALANDAROV, V. P. BYCHKOV, and I. D. FRENKEL *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 39-44 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 31-34
Avail: NTIS HC A07/MF A01

The content of histamine and serotonin was measured in test of subject exposed to: (1) bed rest at an angle of +6, -2, or -6 deg; (2) neuro-emotional stress; (3) an increased concentration of ammonium in the enclosure. The exposure to the factors that simulated space flight stress (i.e., orthostatic hypokinesia at -6 deg and neuro-emotional stress and anticipation of rotation in the centrifuge) led to an increase of histamine and serotonin and a decrease of histaminepectic activity. Consumption of selected nutritional agents a day before and on the day of exposure to the neuro-emotional stress improved the content of histamine and serotonin as well as histaminepectic activity. Author

N87-23127# Joint Publications Research Service, Arlington, Va.
SOME PARAMETERS OF HUMAN LIPID METABOLISM DURING ANTIORTHOSTATIC HYPOKINESIA AND THEIR CORRECTION
K. V. SMIRNOV, I. L. MEDKOVA, O. V. ZHIZNEVSKAYA, V. P. BYCHKOV, L. I. MOSYAKINA, and O. S. KHOKHLOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 45-49 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 34-37
Avail: NTIS HC A07/MF A01

Twenty-one test subjects exposed to head down tilt for 120 days were subdivided to four groups: (1) nine subjects used as controls; (2) three bed rested subjects who performed regular exercises; (3) four bed rested subjects who were given selected drugs, including Vitamin F-99 that influenced lipid metabolism; (4) four bed rested subjects who performed regular exercised and received Vitamin F-99. At different stages of bed rest and recovery the content of lipoprotein fractions and lipids of different classes in serum was measured by thin layer chromatography. The concentration of cholesterol in biliary lipids was determined. In group 1 and 2 subjects bed rest led to a drastic and significant increase of cholesterol esters in blood, a decrease of phospholipids, variations of triglycerides and nonesterified fatty acids, and a lower percentage content of alpha-lipoproteins. The use of Vitamin F-99 produced positive changes in the above parameters of lipid metabolism. In group 4 subjects the effect of exercises combined with drugs was most distinct. Author

N87-23131# Joint Publications Research Service, Arlington, Va.
CHEMICAL SENSITIVITY OF MEDIAL VESTIBULAR NUCLEAR NEURONS TO ENKEPHALINS, ACETYLCHOLINE, GABA AND L-GLUTAMATE
V. V. YASNETSOV and V. A. PRAVDIVTSEV *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 75-81 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 53-57
Avail: NTIS HC A07/MF A01

The effect of enkephalins, morphine and some neurotransmitters on spontaneous and evoked activity of neurons of the medial ventricular nucleus was investigated. The evoked activity was produced by an adequate stimulation of the vestibular apparatus. It was shown that neurons of this nucleus were highly sensitive to enkephalins, morphine, acetylcholine, GABA, and L-glutamate. It was found that activation and depression effects of opioid peptides and morphine occurred due to the stimulation of mu- and delta-opiate receptors. It can be concluded that enkephalins modulate cholinergic and glutamatergic synaptic transfer in the medial vestibular nucleus. Together with opiate receptors, they participate in the perception and processing of vestibular information at the level of neurons of this nucleus.
Author

N87-23132# Joint Publications Research Service, Arlington, Va.
PHARMACOLOGICAL CORRECTION OF CENTRAL NERVOUS SYSTEM FUNCTIO DURING EXPOSURE TO CORIOLIS ACCELERATIONS
N. N. KARKISHCHENKO, N. A. DIMITRIADI, and V. V. MOLCHANOVSKIY *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 82-85 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 57-59
Avail: NTIS HC A07/MF A01

Healthy volunteers with a low vestibular tolerance were exposed to Coriolis acceleration. Potassium orotate, pyracetame and riboxine were used as prophylactic measures against disorders in the function of the vestibular apparatus and higher compartments of the higher nervous system. The central nervous system function was assessed with respect to the spectral powder of electroencephalograms, short term memory and mental

performance. Potassium orotate given at a dose of 40 mg/kg body weight/day during 12 to 14 days as well as pyracetame given at a dose of 30 mg/kg body weight/day during 3 or 7 days increased significantly statokinetic tolerance and produced a protective effect on the central nervous function against Coriolis acceleration. Author

N87-23134# Joint Publications Research Service, Arlington, Va.
EVALUATION OF EFFECT OF POSITIVE INTRAPULMONARY PRESSURE ON RESPIRATORY FUNCTION OF MAN
I. S. BRESLAV, G. G. ISAYEV, A. V. KOCHUBEYEV, and YE. A. SOKOL *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 93-99 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 64-69
Avail: NTIS HC A07/MF A01

The parameters characterizing lung ventilation and electrical activity of expiratory muscles were investigated in six healthy young men exposed to the positive intrapulmonary pressure 20, 30 or 40 mm Hg. Gas mixtures with a varying oxygen content were used. The effect of two compensatory devices that applied different counterpressures to the body surface was evaluated. It was found that the parameter that can best characterize the respiratory function in the case of a positive intrapulmonary pressure is electrical activity of expiratory muscles. The hypoxic effect makes no important contribution to the change of respiratory pressure 20, 30 or 40 mm Hg. The different methods of applying compensation do not influence changes in the above respiratory parameters. Author

N87-23135# Joint Publications Research Service, Arlington, Va.
EVALUATION OF SKELETOMUSCULAR SYSTEM FUNCTION IN SELF-CONTAINED LIFE-SUPPORT SYSTEM ON THE BASIS OF BLOOD BIOCHEMISTRY
V. V. MAKAROVSKIY, A. F. KHALANGOT, YU. A. SHAFRANSKIY, and G. F. KRYZHANOVSKAYA *In its USSR Report: Space Biology* and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 100-107 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p. 69-75
Avail: NTIS HC A07/MF A01

The functional state of the musculoskeletal system of healthy male volunteers of three ages group was evaluated. The subjects were kept in an enclosure for 30 days. Creatine phosphokinase (CPK), lactate dehydrogenase (LDH), alkaline phosphatase, aspartate aminotransferase (AAT), calcium, P sub 1 were measured in blood. The test subjects of the three groups showed a decrease of CPK, LDH, AAT and creatinine. The correlation coefficient between the enzymes varied from 0.64 to 1.00. By the end of the study alkaline phosphatase increased in the group 1 and 2 subjects and decreased in the group 3 subjects. Calcium variations were less distinct. The P sub 1 content declined significantly in the group 3 subjects. Some of the group 3 subjects who performed regular exercises during the study exhibited smaller decreases of CPK, LDH, AAT and greater stability of calcium and phosphorus. Author

N87-23139# Joint Publications Research Service, Arlington, Va.
HORMONAL AND METABOLIC STATUS OF MAN IN THE EXTREME NORTH
YU. F. KRYLOV and R. A. TIGRANYAN *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 123-127 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biolgoiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 85-88
Avail: NTIS HC A07/MF A01

The concentrations of hormones (ACTH, cortisol, aldosterone, thyrotrophin, thyroxine, triiodothyronine, growth hormone, insulin, prolactine and testosterone), electrolytes (Na and K) as well glucose and triglycerides were measured in 10 athletes who made a 380 km ski expedition in the Far North at ambient temperatures of -32 to -34 C. Human adaptation to the geographic and climatic conditions of high latitudes was accompanied by noticeable changes in the incretory function of the adenopituitary, thyroid gland, adrenals and gonads. The data obtained indicate that a ski trip in the Far North produces a distinct stress with physical and cold components being predominant. Author

N87-23140# Joint Publications Research Service, Arlington, Va.
HUMAN BLOOD SERUM PROTEOLYTIC ENZYME ACTIVITY AFTER STAY IN HYPOXIC ENVIRONMENT
V. D. VLASOV, I. G. DLUSSKAYA, V. V. KRASHUTSKIY, and A. A. DOMNIKOVA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 128-131 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 88-90
Avail: NTIS HC A07/MF A01

Diminished appetite, various dyspeptic manifestations and temporary weight loss in man and animals submitted to chronic and intermittent hypoxic hypoxia at low barometric pressure are indicative of disturbances in processes of digestion, assimilation and resynthesis of proteins in the body. This is confirmed by development of a negative nitrogen balance in man and animals under hypoxic conditions. Changes in activity of proteolytic and certain other enzymes in blood serum of healthy males 19 to 21 years of age after exposure to hypoxic environment at low barometric pressure was investigated. Brief details concerning methods, results and conclusions are given. Author

N87-23142# Joint Publications Research Service, Arlington, Va.
BIOCHEMICAL ASPECTS OF SOME NEUROHUMORAL SYSTEM FUNCTIONS DURING LONG-TERM ANTIORTHOSTATIC HYPOKINESIA
N. A. DAVYDOVA, S. K. SHISHKINA, N. V. KORNEYEVA, YE. V. SUPRUNOVA, and A. S. USHAKOV *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 134-140 16 Dec. 1986 Transl. into ENGLISH from Koshmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 91-95
Avail: NTIS HC A07/MF A01

The sympathoadrenal (SAS) and cholinergic (CS) systems play an important part in processes of neurohumoral regulation of changes that occur during long term restriction of motor activity. Investigation of these system using modern methods and criteria for evaluating their functional activity makes it possible to find approaches to the solution of some problems of prevention and correction of metabolic changes. The objective was to investigate human SAS and CS activity during long term antiorthostatic hypokinesia. A brief account of the methods used are given along with results and discussion of those results. Author

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BEHAVIORAL SCIENCES

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

A87-35421
A METHOD FOR THE RECOVERY OF MISHAP RELATED EVENTS LOST TO AMNESIA
RICHARD A. LEVY (USAF, Regional Hospital, Sheppard AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 257-259.

The author describes a nonhypnotic, nonpharmacologic method employed in the recovery of memories blocked by amnesia following an aircraft accident. A detailed account of the method used during the investigation of two mishaps is provided. Memories were fully recovered. In addition, a description of the use of this

technique in enhancing the recall of a witness to a fatal aircraft accident is provided. Author

A87-35423
A HISTORICAL REVIEW OF THE FEAR OF FLYING AMONG AIRCREWMEN
TIMOTHY S. STRONGIN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, March 1987, p. 263-267. refs

The term fear of flying (FOF) has been applied to many sets of symptoms. Confusion has resulted from the use of the term FOF to describe problems arising from anxiety disorders, traumatic stress, exhaustion, psychosis, and motivational changes. This literature review describes the history and development of the term FOF, and suggests an approach to its evaluation by clinicians and administrators. Representative works from the last 65 years are reviewed in their historical contexts. Author

A87-36124
PREVENTION OF VESTIBULOGENIC ILLUSIONS [O PROFILAKTIKE ILLIUZII VESTIBULIARNOGO GENEZA]
E. V. LAPAEV and O. A. VOROBEV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Dec. 1986, p. 44-46. In Russian. refs

Vestibulogenic spatial position illusions (SPIs) occurring in flight personnel during turns, loops, and steep climbs of an aircraft were found to take place in about 71 percent of surveyed pilots and to adversely affect performance in about 55 percent of them. Among the factors inducing the SPIs, the incorrect allotment of attention among the items on the control panel, prolonged periods of surveying the outer space without reference points, loss of conditioning due to training interruptions, and fatigue were found to be of the foremost importance. Various psychological devices (such as the mental visualization of the horizon line as seen in horizontal flights and mental analysis of the actual aircraft movement) and distracting maneuvers (such as specific eye and head movements) are discussed. It is suggested that education of the flight personnel should include information concerning the causes and the mechanisms of the SPI occurrences, and the means of their prevention and amelioration. I.S.

A87-37718#
SOME EFFECTS OF ALCOHOL AND SIMULATED ALTITUDE ON COMPLEX PERFORMANCE SCORES AND BREATHALYZER READINGS
WILLIAM E. COLLINS, HENRY W. MERTENS, and E. ARNOLD HIGGINS (FAA, Civil Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 328-332.

The effects of alcohol (2.2 ml/kg body wt) and simulated altitude (12,500 ft) on complex performance scores were investigated using 17 male subjects in four experimental sessions: ground level with and without alcohol, and simulated altitude with and without alcohol. In addition, the breath alcohol levels were assessed, under both the ground level and altitude conditions, using an intoxilyzer. Each man was trained on seven tasks in the Civil Aeromedical Institute Multiple Task Performance Battery. There was no effect of altitude on breathalyzer readings. Alcohol at ground level resulted in significantly impaired performance; the performance scores were further depressed by the addition of altitude to the alcohol condition, but to about the same extent as in the control subjects, indicating that there is no synergistic interactive effect of alcohol and altitude on either performance or breathalyzer readings. I.S.

A87-37722#
THE HEALTHY MOTIVATION TO FLY - NO PSYCHIATRIC DIAGNOSIS
ROBERT R. ADAMS and DAVID R. JONES (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 350-354.

Aircrew mission effectiveness may uniquely be influenced by subtle psychological factors not ordinarily brought to the attention of psychiatrists. Pilots tend to be bright, articulate, and anxious to resume their aviation duties when grounded. However, these patients are usually well defended, and rarely psychologically attuned or introspective. Greater insight into what constitutes the normal, healthy motivation to fly will help those who make judgments regarding the return of grounded aviators to flying duty. *A review of associated birth order, personality theory, industrial* and business psychology, aerospace, and psychoanalytic literature is presented. Highlighted are the difficulties inherent in examining the motivation of a healthy, well-defended population. The conclusion: an examiner's counter-transferential feelings are the best available tool for measurement of healthy motivation. Author

A87-37769#
NIGHT VISION ISSUES IN 23 AF
DAVID L. HAMMER (USAF, Scott AFB, IL) SAFE Journal, vol. 17, Spring 1987, p. 10-12.

Night vision difficulties encountered by 23 AF are examined. The types of aircraft and missions flown by 23 AF, and their visual standard requirements are described. The need for optometrists, opthamologists, and physiologist to consider the mission requirements of 23 AF when addressing night vision problems is discussed. I.F.

N87-22112*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AUTOGENIC-FEEDBACK TRAINING: A PREVENTIVE METHOD FOR SPACE ADAPTATION SYNDROME
PATRICIA S. COWINGS, JOSEPH C. SHARP, WILLIAM B. TOSCANO, JOE KAMIYA, and NEAL E. MILLER (*Yale Univ.*, New Haven, Conn.) *In* NASA. Marshall Space Flight Center Spacelab 3 Mission Science Review p 84-90 Feb. 1987
Avail: NTIS HC A05/MF A01 CSCL 05I

The progress made to date on the reduction of data for Spacelab 3 Shuttle experiment, No. 3AFT23 is reported. Four astronauts participated as subjects in this experiment. Crewmen A and B served as treatment subjects (i.e., received preflight training for control of their own motion sickness symptoms) and Crewmen C and D served as control (i.e., did not receive training). A preliminary evaluation of Autogenic Feedback Training (AFT) was made from visual inspections of graphs that were generated from the preflight and inflight and inflight physiological data which included: (1) Baseline rotating chair tests for all crewmen; (2) Posttraining rotating chair tests of treatment groups subjects; (3) Preflight data from Joint Integrated Simulations for all crewmen; and (4) Flight data for all crewmen during mission days 0 through 4, and mission day 6 for treatment subjects only. A summary of the findings suggested by these data is outlined. Author

N87-22400# Northwestern Univ., Evanston, Ill. Neuroscience Lab.
PERCEPTION OF MOTION IN STATISTICALLY-DEFINED DISPLAYS (ENHANCING SENSITIVITY TO VISUAL MOTION) Final Report, 1 Oct. 1980 - 30 Sep. 1985
ROBERT SEKULER 5 Jan. 1987 100 p
(Contract AF-AFOSR-0246-80)
(AD-A177310; AFOSR-87-0045TR) Avail: NTIS HC A05/MF A01 CSCL 05E

The grant supported three complementary major studies of motion perception, each designed to educiate a different aspect of the mechanisms that underline such perception. Project One: Directional-specific improvement in motion discrimination (Karlene Ball and Robert Sekuler). Project Two: Coherent global motion from stochastic local motions (Douglas Williams and Tobert Sekuler). Project Three: Exploring motion perception by means of *psychophysical matches between physically different stimuli* (metamers) (Douglas Williams, Scott Tweeten, Robert Sekuler). GRA

N87-22401# Army Research Inst. of Environmental Medicine, Natick, Mass.
DEVELOPMENT OF COGNITIVE TESTS FOR REPEATED PERFORMANCE ASSESSMENT
L. E. BANDERET, K. P. BENSON, and D. M. MACDOUGALL Jun. 1986 24 p
(AD-A177591; USARIEM-T-17/86) Avail: NTIS HC A02/MF A01 CSCL 05J

Two cognitive performance tests, Computer Interaction (CI) and Tower of Hanoi (HT), were generated as paper and pencil tests with alternate forms. The CI Test evaluates a person's transactions with a computer system (Radio Shack desk-top calculator EC-2004). The HT Test, a popular puzzle and test of logical reasoning, was adapted for discrete, forced-choice responses. In testing situations subjects are instructed and practiced extensively before independent variables are manipulated. Both tests are always timed. Our studies indicate these tests have high task definitions and stabilities. Repeated assessment produced stability (reliability) coefficients of greater than 0.70 and 0.80 for CI and HT, respectively. Stability was achieved on CI and HT (decision of POSSIBLE after 30 to 60 min of practice, i.e., 5 to 10 administrations. The decision of OPTIMAL on Ht required 60 to 90 min (10 to 15 administrations). The HT Test was also programmed on a briefcase computer (NEC PC-8201A) but this version has not been evaluated systematically. These methods produce tests with functional properties that may be useful to military or civilian psychometricians. GRA

N87-22402# Technische Univ., Berlin (West Germany). Fachbereich Verkehrswesen.
REPORT ON THE WORKING ORGANIZATION AND DEVELOPMENT OF A FLIGHT CREW IN CIVIL AIRCRAFT Ph.D. Thesis [BEITRAG ZUR BEURTEILUNG DER ARBEITSORGANISATION BEI DER ARBEITSPROZESS - ENTWICKLUNG FUER DIE COCKPIT-BESATZUNG ZIVILER TRANSPORT FLUGZEUGE]
CHRISTIAN VEES 1984 168 p In GERMAN
(ETN-87-99341) Avail: NTIS HC A08/MF A01

A simulation (Monte Carlo method) of intra-cockpit communication, based on the queueing model and referring to the pilot's decision making in a multitask situation is presented. The application of the model is shown on a two-man crew, but its functional mechanisms are insufficient. Solutions are discussed and ways of evaluation and instruction in civil pilot training are proposed. ESA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A87-36764
INTRAOCULAR PRESSURE UNDER MICROGRAVITY CONDITIONS [DER INTRAOKULARE DRUCK UNTER MIKRO-G-BEDINGUNGEN]
J. DRAEGER, H. WIRT, and R. SCHWARTZ (Universitaets-Augenklinik, Hamburg, West Germany) IN: Yearbook 1986 I; DGLR, Annual Meeting, Munich, West Germany, Oct. 8-10, 1986, Reports. Bonn, Deutsche Gesellschaft fuer Luftund Raumfahrt, 1986, p. 106-111. In German. refs
(DGLR PAPER 86-174)

During the German D 1 space mission, the intraocular pressure experienced during spaceflight by three payload specialists was measured. The first measurements, which occurred one hour after launch, revealed a mean pressure rise of 30 percent. Measurements made during the first two mission days demonstrated alteration of the normal diurnal rhythm observed on earth. Problems related to the measurement of intraocular pressure under microgravity conditions are discussed. C.D.

A87-36786
THE POSSIBLE USE OF ARTIFICIAL INTELLIGENCE IN THE COCKPITS OF MODERN AIRCRAFT [MOEGLICHER EINSATZ DER 'KUENSTLICHEN INTELLIGENZ' IM COCKPIT MODERNER VERKEHRSFLUGZEUGE]
KARL-J. PROTZE (Vereinigung Cockpit, Frankfurt am Main, West Germany) IN: Yearbook 1986 I; DGLR, Annual Meeting, Munich, West Germany, Oct. 8-10, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 290-295. In German.
(DGLR PAPER 86-160)

The use of artificial intelligence in various cockpit emergency procedures is discussed. The emergency situations considered include cargo compartment smoke, equipment bay smoke, abnormal engine vibration, forced landing, evacuation, landing with abnormal landing gear configuration, and engine fire or damage. Sample instructions are given, and the roles of man and machine in each case are described. C.D.

A87-37300*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANNED SPACECRAFT AUTOMATION AND ROBOTICS
JON D. ERICKSON (NASA, Johnson Space Center, Houston, TX) IEEE, Proceedings (ISSN 0018-9219), vol. 75, March 1987, p. 417-426.

The Space Station holds promise of being a showcase user and driver of advanced automation and robotics technology. The author addresses the advances in automation and robotics from the Space Shuttle - with its high-reliability redundancy management and fault tolerance design and its remote manipulator system - to the projected knowledge-based systems for monitoring, control, fault diagnosis, planning, and scheduling, and the telerobotic systems of the future Space Station. Author

A87-37716#
FLIGHT TRIAL OF A HELMET-MOUNTED DISPLAY IMAGE STABILISATION SYSTEM
M. J. WELLS and M. J. GRIFFIN (Southampton, University, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 58, April 1987, p. 319-322.

An image stabilization system for improving reading performance with a helmet-mounted display (HMD) during whole-body vibration was tested at night in a helicopter. Six subjects read arrays of 50 numerals as quickly and as accurately as possible while flying in three different flight conditions. The mean reading time for each array while stationary on the ground was approximately 21 s, and the mean reading error was 0.4 percent without stabilization. In-flight mean reading time increased to approximately 40 s, and reading error was 18 percent without the stabilization system. Stabilizing the image significantly reduced the mean in-flight reading time to approximately 25 s with a 4 percent reading error. Data from the flight trial support the results of previous experiments, which suggest that HMD reading performance with vibration and night viewing conditions may be inferior to performance with daylight conditions. Author

A87-37771#
HUMAN TOLERANCE ENHANCEMENT IN HIGH ONSET RATE, HIGH SUSTAINED +GZ WITH A PULSATING SERVO ANTI-G VALVE
W. B. ALBERY, R. E. VAN PATTEN, T. A. GORDON, J. W. FRAZIER (USAF, Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and CHUCK GOODYEAR (Systems Research Laboratories, Inc., Dayton, OH) SAFE Journal, vol. 17, Spring 1987, p. 24-31.

The protective effects of the high flow only (HFO) valve, the bang-bang servo anti-G valve (BBSV), and the BBSV cycled at intervals of 4, 8, and 12 seconds following initial triggering are evaluated using six males ranging between 22 and 31 years. The heart rate, muscular activity, Doppler temporal artery flow, and

peripheral vision angle of the subjects were monitored. It is observed that cycling the BBSV every 4 seconds provides better protection than the HFO for subjects wearing a standard anti-G suit and exposed to 3 G/sec onset rates; tolerance with the BBSV was 5.72 G and 4.35 G with the HFO valve. A second experiment was conducted to determine if the improved G protection was due to the pulsating pressure or increased mean anti-G suit pressure (10-11 psi). The data reveal that the higher pressure, nonpulsating anti-G suit servo valve is as effective as the 4 second BBSV in providing G protection. I.F.

A87-37773#
ADAM - THE NEXT STEP IN DEVELOPMENT OF THE TRUE HUMAN ANALOG
RICHARD P. WHITE, JR. and AILEEN M. BARTOL (Systems Research Laboratories, Inc., Dayton, OH) SAFE Journal, vol. 17, Spring 1987, p. 50-57.

The characteristics, design, and fabrication of the advanced dynamic anthropomorphic manikin (ADAM) designed for ejection testing are described. The anthropometry, flexible spine/viscera system, body articulation, and instrumentation systems of ADAM are examined, and compared with those of the Hybrid III manikin. Vibration, and impact, acceleration, and thermal durability tests are proposed for evaluating ADAM's capabilities. A diagram of ADAM is presented. I.F.

A87-37925#
THE FLIGHT OF ESA'S VESTIBULAR SLED ON THE GERMAN SPACELAB D1 MISSION
K. WEDDE-MUEHLHAUSEN, H. BAUER (DFVLR, Cologne, West Germany), and H. BROGL (ESA, Cologne, West Germany) ESA Bulletin (ISSN 0376-4265), no. 49, Feb. 1987, p. 51-60.

The six-country research program for the Vestibular Sled, launched aboard the German D1 Spacelab mission, is described. The sled, consisting of a moveable carriage on rails and a Vestibular helmet (which provides various controlled stimuli and records responses), is designed to investigate contributions to the different sensory systems to spatial orientation in order to assess human sensory motor adaptation to weightlessness. Results showed the gain in Opto-Kinetic Nystagmus response to dramatically increase in the free-float mode, and subjects reported increased vection. Thresholds for the detection of movement were found to be increased for 48 hours after return to earth. The data suggest that during weightlessness the nervous system attaches greater significance to visual and somatosensory information, and ignores otolithic information. R.R.

A87-38696#
SIMULATION OF PASSENGER RESPONSE IN TRANSPORT AIRCRAFT ACCIDENTS
D. H. LAANANEN (Arizona State University, Tempe) IN: Symposium on Vehicle Crashworthiness Including Impact Biomechanics; Proceedings of the Winter Annual Meeting, Anaheim, CA, Dec. 7-12, 1986 . New York, American Society of Mechanical Engineers, 1986, p. 47-56.

A three-dimensional mathematical model of a transport aircraft seat, occupants, and restraint system has been developed for use in crashworthiness analyses. The finite element seat model can accommodate large displacements, nonlinear material behavior, and local buckling of tubular elements. Provision for simulation of floor warping has also been included. One, two, or three passengers can be simulated. The model of each passenger consists of twelve segments whose dimensions and inertial properties have been determined from studies of human body anthropometry and from measurements of anthropomorphic dummies. The paper discusses the use of the model in evaluation of the injury potential of a transport aircraft seating system, using the results of a dynamic test in which a dummy was seated behind a three-passenger seat. Author

A87-38701#
AEROSPACE ENVIRONMENTAL SYSTEMS; PROCEEDINGS OF THE SIXTEENTH INTERSOCIETY CONFERENCE ON ENVIRONMENTAL SYSTEMS, SAN DIEGO, CA, JULY 14-16, 1986
Conference sponsored by SAE. Warrendale, PA, Society of Automotive Engineers, Inc. (SAE P-177), 1986, 908 p. For individual items see A87-38702 to A87-38784.
(SAE P-177)

The present conference discusses integrated aircraft fuel thermal management, aircraft fog control systems, food and nutrition in manned spacecraft, a NASA Space Station health maintenance facility, Space Station personal hygiene, radiation dose prediction for the Space Station, the NASA Space Station's Habitation Module, an analysis of crew functions as an aid in Space Station interior layout, the thermal performance of Giotto, systems aspects of Columbus thermal control, and regenerative life support system hardware testing. Also considered are a comparison of environmental control and life support systems requirements for nuclear submarines and the NASA Space Station, space suit reach and strength envelope considerations, an EVA universal work station, a thermal analyzer for two-phase loops, a cryogenic methane heat pipe diode, Space Station air revitalization, long duration botanical experiments in space, plant and animal accommodations aboard the Space Station, spacecraft water recovery, physiological aspects of EVA, the integrated management of water and wastes, and advanced extravehicular crew enclosures. O.C.

A87-38708*# Vigyan Research Associates, Inc., Hampton, Va.
EFFECTS OF VARYING ENVIRONMENTAL PARAMETERS ON TRACE CONTAMINANT CONCENTRATIONS IN THE NASA SPACE STATION REFERENCE CONFIGURATION
DANA A. BREWER (Vigyan Research Associates, Inc., Hampton, VA) and JOHN B. HALL, JR. (NASA, Langley Research Center, Hampton, VA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 57-66.
(SAE PAPER 860916)

An evaluation is made of the NASA Space Station Reference Configuration trace contaminant production and depletion level effects of CO2, O2, humidity, temperature, and pressure variations, on the basis of a computer model of the Reference Configuration's chemical reactions and physical processes as functions of time. The effects of changes in the initial concentrations of such contaminants as nonmethane hydrocarbons and nitrogen oxides are also examined, and these are found to result in more significant changes in the concentration levels of trace contaminants than pressure and humidity variations. O2 and CO2 changes are found to have negligible effects on trace contaminant concentrations. O.C.

A87-38709*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS AND COMPOSITION OF A MODEL TRACE GASEOUS MIXTURE FOR A SPACECRAFT
M. R. SCHWARTZ and S. I. OLDMARK (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 67-73.
(SAE PAPER 860917)

Growing concern over trace gaseous contaminant accumulations in the enclosed atmospheres of long duration spacecraft missions has prompted the development of a trace contaminant data base on the basis of gas, lithium hydroxide, and charcoal samples collected on Space Shuttle missions. A model trace contaminant gas mixture containing 14 compounds was chosen with the aid of a FORTRAN program, on the strength of contaminant chemical and toxicological categories, frequency of occurrence, and worst-case concentration. The model gas mixture

can be used to test trace contaminant control hardware for a manned spacecraft environment. O.C.

A87-38710*# Life Systems, Inc., Cleveland, Ohio.
EDC DEVELOPMENT AND TESTING FOR THE SPACE STATION PROGRAM
R. B. BOYDA and S. P. HENDRIX (Life Systems, Inc., Cleveland, OH) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 75-86. NASA-sponsored research.
(SAE PAPER 860918)

NASA's development of electrochemical CO2 concentration technology has led to the creation of subsystem hardware and control and monitoring instrumentation that are ideally suited to Space Station program applications; only seven orbital replacement units, for instance, are required for the performance of process functions. This process simplification leads to superior reliability and enhanced maintainability. Hardware and software features that enhance subsystem reliability through fault detection and isolation have been emphasized in the course of development. Further power, weight, and volume savings, together with enhanced maintainability, are also foreseen in prospective developments of these subsystems. O.C.

A87-38716#
FOODS AND NUTRITION IN SPACE
PAUL C. RAMBAUT (NIH, National Cancer Institute, Bethesda, MD) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 141-149.
(SAE PAPER 860926)

The present evaluation of manned space flight experience with nutritional effects on crew metabolism from Mercury to Mir indicates that low caloric intakes contributed in some measure to the biochemical and physiological changes observed in early flights, and that some deteriorative or adaptive processes accompanying space flight can affect nutritional requirements to the point where intakes appropriate in ground conditions become suboptimal. Body mass declines and the elemental constituents of bone and muscle continue to be lost. The assumption that humans require a diet of great complexity is reexamined in light of experimental evidence that individuals can be kept on a simple nutrient source for many years without ill effects. O.C.

A87-38717#
HYPERBARIC OXYGEN THERAPY FOR DECOMPRESSION ACCIDENTS - POTENTIAL APPLICATIONS TO SPACE STATION OPERATION
ANDREW A. PILMANIS (Southern California, University, Catalina, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 151-160.
(SAE PAPER 860927)

The USN's hyperbaric oxygen treatment consists of the administering of 100 percent O2 intermittently to a subject in a hyperbaric chamber, at pressures of 2.73 and 1.82 ATA, and equal parts N2 and O2 at 6.0 ATA. Attention is presently given to the pathophysiology of air embolism and decompression sickness, the basic rationale and goals of hyperbaric oxygen therapy, and the specific treatment tables used by the USN Hyperbaric Chamber Facility, with a view to the application of hyperbaric oxygen therapy for EVA decompression accidents in the future NASA Space Station. O.C.

A87-38718#
HABITATION MODULE FOR THE SPACE STATION
GARY JOHNSON, HARRY L. WOLBERS, JR., and WILLIAM L. MILES (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 161-174.
(SAE PAPER 860928)

The habitability requirements of the NASA Space Station, which must support crews for minimum periods of 90 days, are conditioned by the drawing of crewmembers from a wider population than that of the professional astronaut community and the requirement for high crew productivity. Modularity, interchangeability of functional units, commonality of hardware and software, and reconfigurability for changing mission needs and expansion, are additional requirements. The architecture presently proposed consists of longitudinally arranged standoff structural elements attached to the cylindrical pressure wall, through which the common utilities are distributed and to which the modular equipment racks and functional units are attached. O.C.

A87-38720*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE STATION FOOD SYSTEM
BEVERLY A. THURMOND (NASA, Johnson Space Center, Houston, TX), DOUGLAS J. GILLAN, MICHELE G. PERCHONOK (Lockheed Engineering and Management Services Co., Inc., Houston, TX), BETH A. MARCUS (Arthur D. Little, Inc., Cambridge, MA), and CHARLES T. BOURLAND (Technology, Inc., Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 179-183.
(SAE PAPER 860930)

A team of engineers and food scientists from NASA, the aerospace industry, food companies, and academia are defining the Space Station Food System. The team identified the system requirements based on an analysis of past and current space food systems, food systems from isolated environment communities that resemble Space Station, and the projected Space Station parameters. The team is resolving conflicts among requirements through the use of trade-off analyses. The requirements will give rise to a set of specifications which, in turn, will be used to produce concepts. Concept verification will include testing of prototypes, both in 1-g and microgravity. The end-item specification provides an overall guide for assembling a functional food system for Space Station. Author

A87-38721*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE STATION PERSONAL HYGIENE STUDY
STEPHEN E. PREJEAN (Presearch, Inc., Houston, TX) and CLETIS R. BOOHER (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 185-200.
(SAE PAPER 860931)

A personal hygiene system is currently under development for Space Station application that will provide capabilities equivalent to those found on earth. This paper addresses the study approach for specifying both primary and contingency personal hygiene systems and provisions for specified growth. Topics covered are system definition and subsystem descriptions. Subsystem interfaces are explored to determine which concurrent NASA study efforts must be monitored during future design phases to stay up-to-date on critical Space Station parameters. A design concept for a three (3) compartment personal hygiene facility is included as a baseline for planned test and verification activities. Author

A87-38722*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE STATION GALLEY DESIGN
RUDY TRABANINO (NASA, Johnson Space Center, Houston, TX), GEORGE L. MURPHY, and M. M. YAKUT (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 201-206.
(SAE PAPER 860932)

An Advanced Food Hardware System galley for the initial operating capability (IOC) Space Station is discussed. Space Station will employ food hardware items that have never been flown in space, such as a dishwasher, microwave oven, blender/mixer, bulk food and beverage dispensers, automated food inventory management, a trash compactor, and an advanced technology refrigerator/freezer. These new technologies and designs are described and the trades, design, development, and testing associated with each are summarized. Author

A87-38723#
A MAINTENANCE WORK STATION FOR SPACE STATION
M. JUNGE (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 207-213.
(SAE PAPER 860933)

The 20-year life cycle of the NASA Space Station calls for the maintenance and repair of critical items in orbit. Attention is presently given to the Maintenance Work Station (MWS), which will be a centralized location for maintenance and repair activities that will contain all tools, equipment, and support functions. The MWS must be integrated into an overall Space Station data management subsystem incorporating direct communication with the inventory control management subsystem, and must exhibit human levels of decisionmaking expertise in order to enhance human operator productivity and reduce task times. O.C.

A87-38724*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ANALYSIS OF CREW FUNCTIONS AS AN AID IN SPACE STATION INTERIOR LAYOUT
A. L. STEINBERG, THOMAS S. TULLIS, and BARBRA BIED (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 215-224.
(SAE PAPER 860934)

The Space Station must be designed to facilitate all of the functions that its crew will perform, both on-duty and off-duty, as efficiently and comfortably as possible. This paper examines the functions to be performed by the Space Station crew in order to make inferences about the design of an interior layout that optimizes crew productivity. Twenty-seven crew functions were defined, as well as five criteria for assessing relationships among all pairs of those functions. Hierarchical clustering and multidimensional scaling techniques were used to visually summarize the relationships. A key result was the identification of two dimensions for describing the configuration of crew functions: 'Private-Public' and 'Group-Individual'. Seven specific recommendations for Space Station interior layout were derived from the analyses. Author

A87-38729*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE STATION ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM DISTRIBUTION AND LOOP CLOSURE STUDIES
WILLIAM R. HUMPHRIES, JAMES L. REUTER, and RICHARD G. SCHUNK (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 285-296.
(SAE PAPER 860942)

The NASA Space Station's environmental control and life support system (ECLSS) encompasses functional elements concerned with temperature and humidity control, atmosphere control and supply, atmosphere revitalization, fire detection and suppression, water recovery and management, waste management, and EVA support. Attention is presently given to functional and physical module distributions of the ECLSS among these elements, with a view to resource requirements and safety implications. A strategy of physical distribution coupled with functional centralization is for the air revitalization and water reclamation systems. Also discussed is the degree of loop closure desirable in the initial operational capability status Space Station's oxygen and water reclamation loops. O.C.

A87-38730*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATUS OF THE SPACE STATION ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM DESIGN CONCEPT
C. D. RAY and W. R. HUMPHRIES (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 297-308.
(SAE PAPER 860943)

The current status of the Space Station (SS) environmental control and life support system (ECLSS) design is outlined. The concept has been defined at the subsystem level. Data supporting these definitions are provided which identify general configuratioons for all modules. Requirements, guidelines and assumptions used in generating these configurations are detailed. The basic 2 US module 'core' Space Station is addressed along with system synergism issues and early man-tended and future growth considerations. Along with these basic studies, also addressed here are options related to variation in the 'core' module makeup and more austere Station concepts such as commonality, automation and design to cost. Author

A87-38731*# Life Systems, Inc., Cleveland, Ohio.
ENVIRONMENTAL CONTROL LIFE SUPPORT FOR THE SPACE STATION
CRAIG W. MILLER and LICIA S. KOVACH (Life Systems, Inc., Cleveland, OH) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 309-319. NASA-supported research.
(SAE PAPER 860944)

The preliminary design of the nation's Space Station is presently being developed. The Environmental Control and Life Support System (ECLSS), consisting of regenerative and nonregenerative technologies, has progressed through a series of trade studies including evaluation of the closure and distribution within the evolutionary Space Station configuration. The analysis has included the identification of the time-critical functions, redundancy (backup) management, definition of common subsystem interfaces and quantification of technology options for the process equipment. Each technology has been characterized by its physical characteristics of weight, power, volume, heat rejection, etc. Summaries of the trade study findings for the overall ECLSS in

terms of physical characteristics and the impact of selected technologies is presented. Author

A87-38732#
NUCLEAR POWERED SUBMARINES AND THE SPACE STATION - A COMPARISON OF ECLSS REQUIREMENTS
ROBERT N. ROSSIER (Martin Marietta Corp., Denver, CO) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 321-329.
(SAE PAPER 860945)

Both the NASA Space Station and current nuclear-powered submarines are required to sustain 90-day missions with their environmental control and life support systems (ECLSSs); their failure tolerance requirements are also similar. Detailed comparisons are presently undertaken for submarine and Space Station water, crew and power resources, pressurization requirements, shock and vibration environments, acoustics and noise considerations, external contamination prevention, and survivability. Subsystem design considerations encompass loop closure and the mass balance, reliability, CO2 removal and processing, oxygen generation, water recovery, atmospheric monitoring and contaminant control, waste management, and fire detection and suppression. O.C.

A87-38733*# Life Systems, Inc., Cleveland, Ohio.
INTEGRATED AIR REVITALIZATION SYSTEM FOR SPACE STATION
R. B. BOYDA, C. W. MILLER (Life Systems, Inc., Cleveland, OH), and M. R. SCHWARTZ (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 331-343. NASA-supported research.
(SAE PAPER 860946)

Fifty-one distinct functions are encompassed by the Space Station's Environmental Control and Life Support System; one exception to this noninteractivity of functions is the regenerative air revitalization system that removes and reduces CO2 and generates O2. The integration of these interdependent functions, and of humidity control, into a single system furnishes opportunities for process simplification as well as for power, weight and volume requirement reductions by comparison with discrete subsystems. Attention is presently given to a system which quantifies these integration-related savings and identifies additional advantages that accrue to this integrating design method. O.C.

A87-38734*# United Technologies Corp., Windsor Locks, Conn.
REGENERABLE NON-VENTING THERMAL CONTROL SUBSYSTEM FOR EXTRAVEHICULAR ACTIVITY
GEORGE J. ROEBELEN, STEPHEN A. BAYES (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT), and B. MIKE LAWSON (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 345-355.
(SAE PAPER 860947)

Routine and complex EVAs call for more effective heat rejection systems in order to maximize mission productivity; an optimum EVA mobility unit (EMU) thermal control subsystem must require no expendables and introduce no contaminants into the environment, while conforming to minimum size limits and allowing easy regeneration. Attention is presently given to two thermal control subsystems, one of which can be integrated with the existing Space Shuttle Orbiter EMU to provide a 3-hour nonventing heat rejection capability, while the other can furnish the entire heat rejection capability requirement for an 8-hour Space Station EVA. O.C.

A87-38735#
EVALUATION OF REGENERATIVE PORTABLE LIFE SUPPORT SYSTEM OPTIONS
JOSEPH A. CIOCCA (Grumman Corp., Space Systems Div., Bethpage, NY) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 357-365.
(SAE PAPER 860948)

An evaluation is made of the prospects for nonventing regenerative processes for Space Station application, in order to address the prohibitively high transportation costs associated with consumables resupply and the unacceptable contamination levels created by water-sublimating heat rejection devices. These regenerative processes are sought in CO2 removal, humidity control, and heat rejection; specific capacities as well as weight, volumes and power allocations are quantified for each of these categories, and representative packaging geometries are arrived at. Process interactions, candidate regeneration techniques, and potential cost savings are discussed. O.C.

A87-38736#
SPACE STATION LIFE SUPPORT OXYGEN GENERATION BY SPE WATER ELECTROLYZER SYSTEMS
ALBERT C. ERICKSON and JAMES F. MCELROY (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 367-373.
(SAE PAPER 860949)

Life support oxygen generation by water electrolysis is being considered for the Space Station program. On board oxygen generation from reclaimed water would be a major step toward closing the life support loop. An SPE electrolyzer, within which solid polymer membranes are the sole electrolyte, is a candidate for Space Station life support oxygen generation. The SPE electrolyzer, of the type currently qualified and in use for life support in nuclear submarines, has been modified for use in the zero gravity space environment. The proposed SPE electrolyzer configurations have addressed the difficulties of two phase separation and minimization of maintenance. Two variations of SPE electrolyzers are described. One for supplying oxygen and hydrogen at a few hundred psi for use within the space habitat, and one for supplying 3000 psi oxygen for the extravehicular mobility unit. Author

A87-38737#
SPACE SUIT REACH AND STRENGTH ENVELOPE CONSIDERATIONS
ROBERT J. GRAY (ILC Industries, Inc., ILC Dover, Frederica, DE) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 375-381.
(SAE PAPER 860950)

Major difficulties exist in establishing a database for space-suited astronauts' reach and length; ideally, all such data should be obtained in a microgravity environment. Attention is presently given to the equipment and data presentation techniques formerly and currently used by NASA and the USAF in their human strength and reach capability researches. Future requirements for more detailed determinations of pressure suit capabilities are assessed and practical steps for the implementation of such experimental efforts are recommended. O.C.

A87-38738#
DESIRABILITY OF ARMS-IN CAPABILITY IN SPACE SUITS
YVETTE M. BEGIAN (ILC Industries, Inc., ILC Dover, Frederica, DE) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 383-396.
(SAE PAPER 860951)

Retracting one or both arms from a space suit's sleeves into its torso has been envisioned as a means to enhance a crewperson's performance during repeated extended duration extravehicular activity (EVA). The purpose of this paper is to present considerations germane to the incorporation of an arm/arms-in feature in a space suit. It assesses what can be done with one and two arms-in; it presents the expected impacts to the wearer and the suit; and it discusses the operational feasibility of employing arm/arms-in. Author

A87-38739#
THE DEVELOPMENT OF AN EVA UNIVERSAL WORK STATION
MILES MOFFATT and FRED ABELES (Grumman Corp., Bethpage, NY) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 397-403.
(SAE PAPER 860952)

The design requirements for a Space Station-associated EVA Universal Work Station (UWS) which will reduce the overhead costs accruing to multiple trips to and from work sites while increasing crew safety, are discussed. The requirements are established by the variety of work sites and many different EVA tasks, which are characterizable in terms of EVA duration, job performance requirements, work envelope considerations, and translation times. As a result of mission analyses, several design recommendations are made for the EVA UWS system; setup and breakdown time at the work site is noted to be greatly reduced by implementing dedicated work stations at areas of frequent EVA. Tools stored on the UWS, and procedures that are assessed via display system, allow the astronauts to perform the required tasks productively and autonomously. O.C.

A87-38740*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SCIENCE AND PAYLOAD OPTIONS FOR ANIMAL AND PLANT RESEARCH ACCOMMODATIONS ABOARD THE EARLY SPACE STATION
JOHN D. HILCHEY (NASA, Marshall Space Flight Center, Huntsville, AL), ROGER D. ARNO (NASA, Ames Research Center, Moffett Field, CA), EDITH GUSTAN (Boeing Aerospace Co., Seattle, WA), and C. E. RUDIGER (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 405-426.
(SAE PAPER 860953)

The resources to be allocated for the development of the Initial Operational Capability (IOC) Space Station Animal and Plant Research Facility and the Growth Station Animal and Plant Vivarium and Laboratory may be limited; also, IOC accommodations for animal and plant research may be limited. An approach is presented for the development of Initial Research Capability Minilabs for animal and plant studies, which in appropriate combination and sequence can meet requirements for an evolving program of research within available accommodations and anticipated budget constraints. O.C.

A87-38741#
SPECIAL CONSIDERATIONS IN OUTFITTING A SPACE STATION MODULE FOR SCIENTIFIC USE
CARL E. RUDIGER, CINDY J. HARRIS, and PAUL C. DOLKAS (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 427-433.
(SAE PAPER 860956)

This paper addresses some of the key issues involved with outfitting a space station module for life sciences research, namely the integration of a large diameter centrifuge for holding control specimens at 1 G (or fractions thereof); accommodating international participation in the design and construction of key elements of the lab module (including the module itself); and maintaining biological isolation between the experimental animals and the crew. Several design concepts are presented that address these specific issues. Centrifuge vibration - once thought to be a major problem in a station that also houses materials technology experiments - will be virtually eliminated by the use of an active magnetic suspension and automated rotor balancing. Bioisolation is provided by housing the animals in special isolator cages and performing all experimental work in a laminar flow isolation hood. Author

A87-38747#
PHYSIOLOGICAL REQUIREMENTS AND PRESSURE CONTROL OF A SPACEPLANE
LOUIS LEMAIGNEN, CATHERINE FAGOT, and MARC WEIBEL (Avions Marcel Dassault Breguet Aviation, Saint-Cloud, France) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 475-484.
(SAE PAPER 860965)

After a short presentation of the different functions of the Environmental Control and Life Support System (ECLSS), the paper shows the driving role of the atmosphere delivery and pressure control subsystem. The main physiological requirements of environmental control are presented: oxygen delivery, total pressure and total pressure variations, carbon dioxide concentration. The acceptable limits of the different parameters are discussed and a comparison is made with the operational requirements of existing space vehicles. From this analysis a selection is made for nominal, degraded and emergency modes. A safety philosophy is presented and application is made to different emergency situations. For emergency situations, the proposed solution is intermediate between the Orbiter choice and the Soyuz approach. A mathematical model of the vehicle's partial pressures is presented. This computer program is used to optimize the pressure management in the emergency modes and in transient conditions like EVA prebreathing and airlock operation. Author

A87-38748#
COLUMBUS LIFE SUPPORT SYSTEM AND ITS TECHNOLOGY DEVELOPMENT
H. P. LEISEIFER, A. I. SKOOG, and H. PREISS (Dornier System GmbH, Friedrichshafen, West Germany) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 485-497. ESA-BMFT-supported research.
(SAE PAPER 860966)

The ESA's Columbus program element of the NASA Space Station employs a Pressurized Module (PM) whose Environmental Control and Life Support Subsystem (ECLSS) baseline is presently discussed for the case of PM attachment to the Space Station and in view of comparisons with the Spacelab ECLSS. A systems approach is used in these considerations, and technology readiness and development requirements are identified in light of hardware-related ECLSS design factors. Technology implementation goals are then formulated. The PM ECLSS

undertakes atmospheric pressure and composition control, CO2 management, atmospheric contamination management, cabin temperature and humidity management, avionics and experiment cooling, fire detection and suppression, water and waste management, and power and thermal budgeting. O.C.

A87-38749#
LIFE SUPPORT SUBSYSTEM CONCEPTS FOR BOTANICAL EXPERIMENTS OF LONG DURATION
H. R. LOSER (MBB-ERNO Raumfahrttechnik GmbH, Bremen, West Germany) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 499-514.
(SAE PAPER 860967)

For botanical experiments with durations of several months (Eureca Botany Facility and Columbus Gravitational Biology Facility) consumables like water, carbon dioxide, oxygen, and phytotoxin-removal gas may contribute significantly to the weight of a Life Support Subsystem (LSS). Since the amount of such consumables has a significant influence on the optimum choice of the LSS, a literature survey has been performed to obtain realistic values which may be used for preliminary design purposes. Based on a comparison of the likely performance requirements of the LSS of orbital botanical facilities and the environmental control and life-support subsystem (ECLSS) of the carrier, various LSS concepts are discussed which interact to a varying degree with the ECLSS. Interaction means in this case that the ECLSS is used as a resource for the consumables needed by the LSS. Advantages and disadvantages of such interaction, in particular weight savings and technical complexity, are addressed. Author

A87-38750#
AN EVOLUTIONARY APPROACH TO THE DEVELOPMENT OF A CELSS BASED AIR REVITALIZATION SYSTEM
ROBIN C. HUTTENBACH, MARTIN L. PRATT (Nelson Space Services, Ltd., England), and CHRIS BUCKE (LH Bioprocessing, Ltd., England) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 515-530.
(SAE PAPER 860968)

The NASA Space Station's three-man Initial Operating Configuration's various conventional Air Revitalization System alternatives are presently compared with a biologically based system, with a view to the practical engineering requirements of this radical alternative. While the proposed biological system does not offer advantages in overall equivalent weight, it establishes the basis for a totally safe system that combines air, water, and waste management functions. The hardware employed includes an algal bioreactor, which may constitute the developmental starting-point for the long-term development of a controlled ecological life support system. O.C.

A87-38751*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CONCEPTUAL PLANNING FOR SPACE STATION LIFE SCIENCES HUMAN RESEARCH PROJECT
GARY R. PRIMEAUX (NASA, Johnson Space Center, Houston, TX), LADONNA J. MILLER, and ROGER B. MICHAUD (GE Management and Technical Services Co., Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 531-537.
(SAE PAPER 860969)

The Life Sciences Research Facility dedicated laboratory is currently undergoing system definition within the NASA Space Station program. Attention is presently given to the Humam Research Project portion of the Facility, in view of representative experimentation requirement scenarios and with the intention of accommodating the Facility within the Initial Operational Capability configuration of the Space Station. Such basic engineering questions as orbital and ground logistics operations and hardware maintenance/servicing requirements are addressed. Biospherics, calcium homeostasis, endocrinology, exercise physiology, hematology, immunology, muscle physiology, neurosciences, radiation effects, and reproduction and development, are among the fields of inquiry encompassed by the Facility. O.C.

A87-38752*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES RESEARCH FACILITY AUTOMATION REQUIREMENTS AND CONCEPTS FOR THE SPACE STATION
DARYL N. RASMUSSEN (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 539-552.
(SAE PAPER 860970)

An evaluation is made of the methods and preliminary results of a study on prospects for the automation of the NASA Space Station's Life Sciences Research Facility. In order to remain within current Space Station resource allocations, approximately 85 percent of planned life science experiment tasks must be automated; these tasks encompass specimen care and feeding, cage and instrument cleaning, data acquisition and control, sample analysis, waste management, instrument calibration, materials inventory and management, and janitorial work. Task automation will free crews for specimen manipulation, tissue sampling, data interpretation and communication with ground controllers, and experiment management. O.C.

A87-38753#
HABITABILITY ISSUES FOR THE SCIENCE LABORATORY MODULE
GORDON V. FOGLEMAN (General Electric Co., Fairfield, CT), JOHN M. RIGSBY (Grumman Aerospace Corp., Bethpage, NY), and ROBERT L. CURTIS IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 553-559.
(SAE PAPER 860971)

Attention is given to concepts for Space Station Science Laboratory Module control console layout, crew restraints, trash management, and emergency eye washes and showers, in light of experience obtained during the Skylab and Spacelab programs and with a view to the far greater experimental complexity, longer mission duration, and largely civilian (rather than professional astronaut) status of Space Station crews. Work environment color and decoration has been found to have a profound effect on crew moods, attitudes, and productivity. Also essential in view of Skylab and Spacelab experience is crew privacy, which ensures concentration in analytical thought tasks associated with research and/or operations of a critical nature. O.C.

A87-38756*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCE RESEARCH FACILITY MATERIALS MANAGEMENT REQUIREMENTS AND CONCEPTS
CATHERINE C. JOHNSON (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 579-585.
(SAE PAPER 860974)

The Advanced Programs Office at NASA Ames Research Center has defined hypothetical experiments for a 90-day mission on Space Station to allow analysis of the materials necessary to conduct the experiments and to assess the impact on waste processing of recyclable materials and storage requirements of samples to be returned to earth for analysis as well as of nonrecyclable materials. The materials include the specimens themselves, the food, water, and gases necessary to maintain them, the expendables necessary to conduct the experiments,

and the metabolic products of the specimens. This study defines the volumes, flow rates, and states of these materials. Process concepts for materials handling will include a cage cleaner, trash compactor, biological stabilizer, and various recycling devices.
Author

A87-38757*# Boeing Aerospace Co., Seattle, Wash.
PLANT AND ANIMAL ACCOMMODATION FOR SPACE STATION LABORATORY
RICHARD L. OLSON, EDITH A. GUSTAN, and LOWELL F. WILEY (Boeing Aerospace Co., Seattle, WA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 587-601.
(SAE PAPER 860975)

An extended study has been conducted with the goals of defining and analyzing relevant parameters and significant tradeoffs for the accommodation of nonhuman research aboard the NASA Space Station, as well as conducting tradeoff analyses for orbital reconfiguring or reoutfitting of the laboratory facility and developing laboratory designs and program plans. The two items exerting the greatest influence on nonhuman life sciences research were identified as the centrifuge and the specimen environmental control and life support system; both should be installed on the ground rather than in orbit. O.C.

A87-38761*# Umpqua Research Co., Myrtle Creek, Ore.
PRE- AND POST-TREATMENT TECHNIQUES FOR SPACECRAFT WATER RECOVERY
DAVID F. PUTNAM, GERALD V. COLOMBO (Umpqua Research Co., Myrtle Creek, OR), and CINDA CHULLEN (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 627-634.
(SAE PAPER 860982)

Distillation-based waste water pretreatment and recovered water posttreatment methods are proposed for the NASA Space Station. Laboratory investigation results are reported for two nonoxidizing urine pretreatment formulas (hexadecyl trimethyl ammonium bromide and Cu/Cr) which minimize the generation of volatile organics, thereby significantly reducing posttreatment requirements. Three posttreatment methods (multifiltration, reverse osmosis, and UV-assisted ozone oxidation) have been identified which appear promising for the removal of organic contaminants from recovered water. O.C.

A87-38762*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RESULTS ON REUSE OF RECLAIMED SHOWER WATER
CHARLES E. VEROSTKO, RAFAEL GARCIA, DUANE L. PIERSON (NASA, Johnson Space Center, Houston, TX), RICHARD P. REYSA (Boeing Aerospace Co., Houston, TX), and ROBERT IRBE (Northrop Services, Inc., Microbiology Dept., Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 635-643.
(SAE PAPER 860983)

The Waste Water Recovery System that has been used in conjunction with a microgravity whole body shower to test a closed loop shower water reclamation system applicable to the NASA Space Station employs a Thermoelectric Integrated Hollow Fiber Membrane Evaporation Subsystem. Attention is given to the suitability of a Space Shuttle soap for such crew showers, the effects of shower water on the entire system, and the purification qualities of the recovered water. The chemical pretreatment of the shower water for microorganism control involved activated carbon, mixed ion exchange resin beds, and iodine bactericide dispensing units. The water was recycled five times, demonstrating the feasibility of reuse. O.C.

A87-38763*# Bend Research, Inc., Oreg.
A MEMBRANE-BASED SUBSYSTEM FOR VERY HIGH RECOVERIES OF SPACECRAFT WASTE WATERS
RODERICK J. RAY, SANDRA E. RETZLAFF, LYN RADKE-MITCHELL, DAVID D. NEWBOLD (Bend Research, Inc., OR), and DONALD F. PRICE (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 645-659.
(SAE PAPER 860984)

This paper describes the continued development of a membrane-based subsystem designed to recover up to 99.5 percent of the water from various spacecraft waste waters. Specifically discussed are: (1) the design and fabrication of an energy-efficient reverse-osmosis (RO) breadboard subsystem; (2) data showing the performance of this subsystem when operated on a synthetic wash-water solution - including the results of a 92-day test; and (3) the results of pasteurization studies, including the design and operation of an in-line pasteurizer. Also included in this paper is a discussion of the design and performance of a second RO stage. This second stage results in higher-purity product water at a minimal energy requirement and provides a substantial redundancy factor to this subsystem. Author

A87-38764*# Chamberlain Mfg. Corp., Waterloo, Iowa.
DEVELOPMENT OF A WATER RECOVERY SUBSYSTEM BASED ON VAPOR PHASE CATALYTIC AMMONIA REMOVAL (VPCAR)
P. BUDININKAS, F. RASOULI (Chamberlain Manufacturing, Inc., GARD Div., Niles, IL), and T. WYDEVEN (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 661-667.
(SAE PAPER 860985)

An integrated engineering breadboard subsystem for the recovery of potable water from untreated urine was designed, fabricated and tested. It was fabricated from commercially available components without emphasis on weight, volume and power requirement optimization. Optimizing these parameters would make this process competitive with other spacecraft water recovery systems. Unlike other phase change systems, this process is based on the catalytic oxidation at elevated temperatures of ammonia and volatile hydrocarbons to innocuous products; therefore, no urine pretreatment is required. The testing program consisted of parametric tests, one month of daily tests, and a continuous run of 165 hours. The recovered water is low in ammonia, hydrocarbons and conductivity and requires only adjustment of its pH to meet drinking water standards. Author

A87-38765#
PHASE CHANGE WATER RECOVERY FOR SPACE STATION - PARAMETRIC TESTING AND ANALYSIS
ED M. ZDANKIEWICZ and JAMES CHU (Life Systems, Inc., Cleveland, OH) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 669-679.
(SAE PAPER 860986)

A parametric testing and a hardware improvement program have been conducted by NASA for a Vapor Compression Distillation Subsystem (VCDS) applicable to the Space Station for phase change recovery of potable water from waste water. This VCDS was designed to reclaim 95 percent of the available waste water at a nominal water recovery rate of 1.36 kg/hr and 308 K condenser temperature; a 300-percent improvement in water production rate, however, with a correspondingly lower specific energy, was achieved following incorporation of several improvements. O.C.

A87-38766*# AiResearch Mfg. Co., Torrance, Calif.
AIR EVAPORATION CLOSED CYCLE WATER RECOVERY TECHNOLOGY - ADVANCED ENERGY SAVING DESIGNS
GWYNDOLYN MORASKO (AiResearch Manufacturing Co., Torrance, CA), DAVID F. PUTNAM (Umpqua Research Co., Myrtle Creek, OR), and ROBERT BAGDIGIAN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 681-690.
(SAE PAPER 860987)

The Air Evaporation water recovery system is a visible candidate for Space Station application. A four-man Air Evaporation open cycle system has been successfully demonstrated for waste water recovery in manned chamber tests. The design improvements described in this paper greatly enhance the system operation and energy efficiency of the air evaporation process. A state-of-the-art wick feed design which results in reduced logistics requirements is presented. In addition, several design concepts that incorporate regenerative features to minimize the energy input to the system are discussed. These include a recuperative heat exchanger, a heat pump for energy transfer to the air heater, and solar collectors for evaporative heat. The addition of the energy recovery devices will result in an energy reduction of more than 80 percent over the systems used in earlier manned chamber tests. Author

A87-38770*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERCRITICAL WATER OXIDATION - CONCEPT ANALYSIS FOR EVOLUTIONARY SPACE STATION APPLICATION
JOHN B. HALL, JR. (NASA, Langley Research Center, Hampton, VA) and DANA A. BREWER (Vigyan Research Associates, Inc., Hampton, VA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 733-745.
(SAE PAPER 860993)

The ability of a supercritical water oxidation (SCWO) concept to reduce the number of processes needed in an evolutionary Space Station design's Environmental Control and Life Support System (ECLSS), while reducing resupply requirements and enhancing the integration of separate ECLSS functions into a single Supercritical Water Oxidation process, is evaluated. While not feasible for an initial operational capability Space Station, the SCWO's application to the evolutionary Space Station configuration would aid the integration of eight ECLSS functions into a single one, thereby significantly reducing program costs. O.C.

A87-38771*# Life Systems, Inc., Cleveland, Ohio.
ENVIRONMENTAL CONTROL AND LIFE SUPPORT TECHNOLOGIES FOR ADVANCED MANNED SPACE MISSIONS
F. T. POWELL, R. A. WYNVEEN (Life Systems, Inc., Cleveland, OH), and C. LIN 03NASA, Johnson Space Center, Houston, TX, IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 747-759.
(SAE PAPER 860994)

Regenerative environmental control and life support system (ECLSS) technologies are found by the present evaluation to have reached a degree of maturity that recommends their application to long duration manned missions. The missions for which regenerative ECLSSs are attractive in virtue of the need to avoid expendables and resupply requirements have been identified as that of the long duration LEO Space Station, long duration stays at GEO, a permanently manned lunar base (or colony), manned platforms located at the earth-moon libration points L4 or L5, a Mars mission, deep space exploration, and asteroid exploration. A comparison is made between nonregenerative and regenerative ECLSSs in the cases of 10 essential functions. O.C.

A87-38772*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
AN ADVANCED CARBON REACTOR SUBSYSTEM FOR CARBON DIOXIDE REDUCTION
GARY P. NOYES (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT) and ROBERT J. CUSICK (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 761-768.
(SAE PAPER 860995)

An evaluation is presented of the development status of an advanced carbon-reactor subsystem (ACRS) for the production of water and dense, solid carbon from CO2 and hydrogen, as required in physiochemical air revitalization systems for long-duration manned space missions. The ACRS consists of a Sabatier Methanation Reactor (SMR) that reduces CO2 with hydrogen to form methane and water, a gas-liquid separator to remove product water from the methane, and a Carbon Formation Reactor (CFR) to pyrolize methane to carbon and hydrogen; the carbon is recycled to the SMR, while the produce carbon is periodically removed from the CFR. A preprototype ACRS under development for the NASA Space Station is described. O.C.

A87-38773*# General Electric Co., Houston, Tex.
INTEGRATED WASTE AND WATER MANAGEMENT SYSTEM
R. W. MURRAY (General Electric Co., Houston, TX) and R. L. SAUER (NASA, Johnson Space Center, Houston, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 769-774.
(SAE PAPER 860996)

The performance requirements of the NASA Space Station have prompted a reexamination of a previously developed integrated waste and water management system that used distillation and catalytic oxydation to purify waste water, and microbial digestion and incineration for waste solids disposal. This system successfully operated continuously for 206 days, for a 4-man equivalent load of urine, feces, wash water, condensate, and trash. Attention is given to synergisms that could be established with other life support systems, in the cases of thermal integration, design commonality, and novel technologies. O.C.

A87-38774#
CELSS WASTE MANAGEMENT SYSTEMS EVALUATION
THOMAS J. SLAVIN, FREDERICK A. LIENING, and MELVIN W. OLESON (Boeing Aerospace Co., Space Systems Div., Seattle, WA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 775-790.
(SAE PAPER 860997)

This report compares parametric data for the following six waste management subsystems, as considered for use on the Space Station: (1) dry incineration, (2) wet oxidation, (3) supercritical water oxidation, (4) vapor compression distillation, (5) a 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. The six waste treatment subsystems modeled in this program are sized to process the wastes for a 90-day Space Station mission with a crew of eight persons and an emergency supply period of 28 days. Author

A87-38777*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE WASTE MANAGEMENT SYSTEM DESIGN IMPROVEMENTS AND FLIGHT EVALUATION
H. EUGENE WINKLER, JERRY R. GOODMAN (NASA, Johnson Space Center, Houston, TX), ROBERT W. MURRAY (General Electric Co., Space Div., Houston, TX), and MATHEW E. MCINTOSH (Rockwell International Corp., Space Div., Downey, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 817-823.
(SAE PAPER 861003)

The Space Shuttle waste management system has undergone a variety of design changes to improve performance and man-machine interface. These design improvements have resulted in more reliable operation and hygienic usage. Design enhancements include individual urinals, increased urine collection airflows, increased solids storage capacity, easier access to personal hygiene items, and additional wet trash stowage. The development and flight evaluation of these improvements are described herein. The Space Shuttle Orbiter has proved to be an invaluable test bed for development and in-flight evaluation of life support and habitability concepts which involve transport or separation of solids, liquids, and gases in a zero-g environment.
Author

A87-38780#
AN EVALUATION OF OPTIONS TO SATISFY SPACE STATION EVA REQUIREMENTS
JOSEPH J. THOMPSON, KENNETH S. BROSSEL (Boeing Aerospace Co., Seattle, WA), and BRUCE W. WEBSTER (SRI International, Menlo Park, CA) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 845-861.
(SAE PAPER 861008)

The Space Station mission requirements for initial frequent use of EVA require the modification of the existing Shuttle suit and the Shuttle Extravehicular Mobility Unit (EMU). Options for a Space Station EVA space suit are described and evaluated in light of the Space Station mission human and environmental requirements. The evaluation is made to select the most cost-effective and technologically feasible alternative that meets the requirements. Requirements considered include: (1) the heavy, almost industrial use, of the suit; (2) long operational life; (3) on-orbit maintenance and fit check; (4) high mobility; (5) rapid don/doff; (6) high pressure for zero pre-breath; (7) radiation protection; (8) micrometeoroid/space debris protection; (9) thermal insulation; (10) contamination/decontamination factors; (11) automatic checkout; and (12) low development and recurring costs. Author

A87-38781#
AN EVALUATION OF ADVANCED EXTRAVEHICULAR CREW ENCLOSURES
RONALD E. RENMAN and RONALD A. BO (Grumman Aerospace Corp., Bethpage, NY) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 863-871.
(SAE PAPER 861009)

The advanced EVA suits under development by NASA for tasks requiring high levels of mobility and manual dexterity operate at pressures approaching that of the Space Station interior, thereby obviating the oxygen prebreathing otherwise needed to prevent decompression sickness. Attention is given to the prospects for further enhancement of EVA capabilities through the use of hard, shirtsleeve-condition crew enclosures that employ anthropomorphic arms and dextrous manipulators. The enclosure offering best overall performance and lowest total program costs is a high-pressure suit incorporating a fully regenerable life support system, whose high performance rating depends on the assumed future development of gloves furnishing levels of dexterity comparable to those of existing low pressure designs. O.C.

A87-38783#
THE NEXT STEP FOR THE MMU - CAPABILITIES AND ENHANCEMENTS
LESLIE J. A. ROGERS (Martin Marietta Corp., Denver, CO) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 883-889.
(SAE PAPER 861013)

The Manned Maneuvering Unit (MMU) for untethered astronaut EVAs is a self-contained vehicle incorporating all electrical power, propulsion control, and display components required for such operations as satellite rendezvous, docking and stabilization, as well as the rescuing of crew members, satellite refueling and inspection, and assistance for on-orbit construction of space platforms. Attention is given to prospective improvements of MMU hardware to facilitate its use in Space Shuttle and NASA Space Station-related activities. These enhancements encompass a digital electronics assembly, a navigation aid, and a propellant tank kit.
O.C.

A87-38784*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN IMPROVED WASTE COLLECTION SYSTEM FOR SPACE FLIGHT
WILLIAM E. THORNTON, WILLIAM W. LOFLAND, JR. (NASA, Johnson Space Center, Houston, TX), and HENRY WHITMORE (Whitmore Enterprises, San Antonio, TX) IN: Aerospace environmental systems; Proceedings of the Sixteenth Intersociety Conference on Environmental Systems, San Diego, CA, July 14-16, 1986 . Warrendale, PA, Society of Automotive Engineers, Inc., 1986, p. 891-895.
(SAE PAPER 861014)

Waste collection systems are a critical part of manned space flight. Systems to date have had a number of deficiencies. A new system, which uses a simple mechanical piston compactor and disposable pads allows a clean area for defecation and maximum efficiency of waste collection and storage. The concept has been extensively tested. Flight demonstration units are being built, tested, and scheduled for flight. A prototype operational unit is under construction. This system offers several advantages over existing or planned systems in the areas of crew interface and operation, cost, size, weight, and maintenance and power consumption.
Author

A87-39012#
A MODEL OF HUMAN ADAPTATION TO WEATHER [MODELIROVANIE MEKHANIZMA METEOADAPTATSII CHELOVEKA]
V. N. CHERNIAVSKII (Rostovskii-na-Donu Institut Narodnogo Khoziaistva, Rostov-on-Don, USSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no.70, 1986, p. 58-61. In Russian.

A model reflecting the hypothetical mechanisms of human adaptation to weather changes is formulated in the framework of the acoustic concept of weather adaptation proposed by Cherniavskii (1982). The concept is based on the discovery by the author of audible 'weather sounds' (WSs), i.e., noise generated in the free atmosphere by turbulently moving air, which can be modulated by the lower layers of the atmosphere (which in turn are subject to change by changing atmospheric conditions). Man constantly and subconsciously perceives and interprets these sounds, and his control centers use the information received to effect adaptive physiological changes. If, however, the prognostic WS information is inadequate or the WS image is forgotten, then negative emotional reactions can take place, leading to decrease in work capacity and physical discomfort. I.S.

A87-39013#
SOME ASPECTS OF RATIONAL WORK ORGANIZATION IN AUTOMATED SYSTEMS [NEKOTORYE ASPEKTY PROBLEMY RATSIONAL'NOI ORGANIZATSII TRUDA V AVTOMATIZIROVANNYKH SISTEMAKH]
N. I. MOISEEVA, S. V. PANIUSHKINA, A. N. PETROV, and R. F. PETROVA (Nauchno Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) *Kibernetika i Vychislitel'naia Tekhnika* (ISSN 0454-9910), no. 70, 1986, p. 69-72. In Russian.

The ability of an operator to make quick decisions under stress was assessed using questionnaires which made it possible to estimate the duration of the so-called 'individual minute' during operations which required quick decision making (thus evaluating the operator's emotional awareness of time), and of the individual minute's changes under stress. Subjects of three biorhythmic types were tested: people whose work capacity is highest in the first half of the day (the 'larks'); those who work best in the second half of the day (the 'owls'); and the arrhythmics, who have no definite rhythm. It was found that the arrhythmics differ from the 'larks' and the 'owls' by a more passive awareness of time, a shorter duration of the 'individual minute', and the shortening of the 'individual minute' in stress situations. These features make the arrhythmics less capable as operators of automated systems than are the 'larks' and the 'owls'. I.S.

A87-39014#
THE EFFECTS OF EXTERNAL RESTRAINTS ON THE PARAMETERS OF HUMAN-OPERATOR ACTIVITY [OSOBENNOSTI VLIIANIIA VNESHNIKH OGRANICHENII NA PARAMETRY DEIATEL'NOSTI CHELOVEKA-OPERATORA]
V. A. CHERNOMORETS (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) *Kibernetika i Vychislitel'naia Tekhnika* (ISSN 0454-9910), no. 70, 1986, p. 84-87. In Russian.

Consideration is given to the quantitative correlation between the time needed by a human operator to process a series of discrete messages (signals) and the time between the signals. The results of a mathematical study of operator rhythmic activity indicated that the times needed for the processing of signals delivered at the minimal, optimal, and natural tempos are correlated according to the Fibonacci sequence. I.S.

N87-22403*# Wisconsin Univ., Madison. Dept. of Horticulture.
CONTROLLED ENVIRONMENT LIFE SUPPORT SYSTEM: CALCIUM-RELATED LEAF INJURIES ON PLANTS
T. W. TIBBITTS Mar. 1986 38 p
(Contract NCC2-136)
(NASA-CR-177399; NAS 1.26:177399; T-5295) Avail: NTIS HC A03/MF A01 CSCL 05H

Calcium related injuries to plants grown in controlled environments under conditions which maximize plant growth rates are described. Procedures to encourage movement of calcium into developing leaves of lettuce plants were investigated. The time course and pattern of calcium accumulation was determined to develop effective control procedures for this injury, termed tipburn. Procedures investigated were: (1) increasing the relative humidity to saturation during the dark period and altering root temperatures, (2) maximizing water stress during light and minimizing water stress during dark periods, (3) shortening the light-dark cycle lengths in combination with elevated moisture levels during the dark cycles, (4) reducing nutrient concentrations and (5) vibrating the plants. Saturated humidities at night increased the rate of growth and the large fluctuation in plant water potential encouraged calcium movement to the young leaves and delayed tipburn. Root temperature regulation between 15 and 26 C was not effective in preventing tipburn. Attempts to modulate water stress produced little variation, but no difference in tipburn development. Variations in light-dark cycle lengths also had no effect on calcium concentrations within developing leaves and no variation in tipburn development. Low concentrations of nutrient solution delayed tipburn, presumably because of greater calcium transport in the low concentration plants. Shaking of the plants did not prevent tipburn, but did delay it slightly. Author

N87-22404*# San Francisco Univ., Calif. Coll. of Professional Studies.
ATMOSPHERE STABILIZATION AND ELEMENT RECYCLE IN AN EXPERIMENTAL MOUSE-ALGAL SYSTEM
DAVID T. SMERNOFF Mar. 1986 96 p
(Contract NCC2-210)
(NASA-CR-177402; NAS 1.26:177402; T-6632) Avail: NTIS HC A05/MF A01 CSCL 05H

Life support systems based on bioregeneration rely on the control and manipulation of organisms. Experiments conducted with a gas-closed mouse-algal system designed to investigate principles of photosynthetic gas exchange focus primarily on observing gas exchange phenomena under varying algal environmental conditions and secondarily on studying element cycling through compartments of the experimental system. Inherent instabilities exit between the uptake and release of carbon dioxide CO2 and oxygen O2 by the mouse and algae. Variations in light intensity and cell density alter the photosynthetic rate of the algae and enable maintenance of physiologic concentrations of CO2 and O2. Different nitrogen sources (urea and nitrate) result in different algal assimilatory quotients (AQ). Combinations of photosynthetic rate and AQ ratio manipulations have been examined for their potential in stabilizing atmospheric gas concentrations in the gas-closed algal-mouse system. Elemental mass balances through the experimental systems compartments are being studied with the concurrent development of a mathematical simulation model. Element cycling experiments include quantification of elemental flows through system compartments and wet oxidation of system waste materials for use as an algal nutrient source. Oxidized waste products demonstrate inhibitory properties although dilution has been shown to allow normal growth. Author

N87-22405*# California Univ., Berkeley. Dept. of Mechanical Engineering.
NONLINEAR SYSTEM CONTROLLER DESIGN BASED ON DOMAIN OF ATTACTION: AN APPLICATION TO CELSS ANALYSIS AND CONTROL
P. S. BABCOCK, IV Mar. 1986 121 p
(Contract NCC2-67)
(NASA-CR-177401; NAS 1.26:177401; T-4081) Avail: NTIS HC A06/MF A01 CSCL 12B

Nonlinear system controller design based on the domain of attraction is presented. This is particularly suited to investigating Closed Ecological Life Support Systems (CELSS) models. In particular, the dynamic consequences of changes in the waste storage capacity and system mass, and how information is used for control in CELSS models are examined. The models' high dimensionality and nonlinear state equations make them difficult to analyze by any other technique. The domain of attraction is the region in initial conditions that tend toward an attractor and it is delineated by randomly selecting initial conditions from the region of state space being investigated. Error analysis is done by repeating the domain simulations with independent samples. A refinement of this region is the domain of performance which is the region of initial conditions meeting a performance criteria. In nonlinear systems, local stability does not insure stability over a larger region. The domain of attraction marks out this stability region; hence, it can be considered a measure of a nonlinear system's ability to recovery from state perturbations. Considering random perturbations, the minimum radius of the domain is a measure of the magnitude of perturbations for which recovery is guaranteed. Design of both linear and nonlinear controllers are shown. Three CELSS models, with 9 to 30 state variable, are presented. Measures of the domain of attraction are used to show the global behavior of these models under a variety of design and controller scenarios. Author

N87-22406 Ohio State Univ., Columbus.
KINEMATIC AND PASSIVE RESISTIVE PROPERTIES OF HUMAN SHOULDER, HIP AND ELBOW COMPLEXES Ph.D. Thesis
SHUENN-MUH CHEN 1986 210 p
Avail: Univ. Microfilms Order No. DA8625193

In the last two decades, the computer-based multisegmented models of the total human body have gained increasing attention in their applications to simulate car crash victims and aerospace related applications. A computer-aided data acquisition system is described which was designed and developed to collect the three-dimensional kinematic data for the maximum voluntary ranges of motion and force data for the passive resistive properties beyond the voluntary ranges for the human shoulder, hip, and elbow complexes. A sonic digitizing technique using an overdeterminate number of sonic emitters is employed to continuously collect and check the accuracies of the kinematic data. A three-dimensional multiple-axis force and moment transducer is utilized to collect the resistive properties data. All data are expressed in functional expansion form for easy incorporation into the existing three-dimensional multisegmented models of the total human body. Finally, statistical data bases for the shoulder, hip, and elbow complexes are established based on a random sample of ten normal male subjects whose ages range from 18 thru 32. Estimates for the population mean and standard deviation as well as their confidence intervals are presented. The ultimate overall performance of the data acquisition system and efficacy of the associated data analysis technique are manifested by the good repeatability of sample means and sample standard deviations from different kinematic test runs made on the same sample.
Dissert. Abstr.

N87-22407# California Univ., Santa Barbara. Community and Organization Research Inst.
HAPTIC EXPLORATION IN HUMANS AND MACHINES: AN INITIAL OVERVIEW Technical Report, 1 May 1986 - 30 Apr. 1987
SUSAN J. LEDERMAN, ROBERTA L. KLATZKY, and R. BAJCSY 28 Jan. 1987 55 p Sponsored by ONR
(AD-A177315; TR-87-01) Avail: NTIS HC A04/MF A01 CSCL 05J

This technical report comprises two publications. The first provides an overview of our research program in haptic object processing. The second indicates in detail how the analysis of human exploratory procedures may be applied to the control of one- and two-fingered robot hands. GRA

N87-22408# Signal Research Center, Inc., Des Plaines, Ill.
DEVELOPMENT AND CHARACTERIZATION OF OXIDATION CATALYSTS FOR AIR PURIFICATION Contractor Report, Aug. 1984 - Sep. 1985
GEORGE R. LESTER and RICHARD E. MARINANGELI Feb. 1987 27 p
(Contract DAAK11-84-C-0053)
(AD-A177375; CRDEC-CR-87050) Avail: NTIS HC A03/MF A01 CSCL 06T

The objective of this project was the development and characterization of low temperature catalysts for removal of toxic chemical agents from air. Collective protection systems are being developed which depend on the catalytic destruction of chemical and biological agents. This method of air purification offers several potential advantages over conventional absorption systems, but successful development will require highly active catalysts which can function at temperatures as low as 250 C in order to minimize weight, volume and energy requirements. The objective of this research has been the identification of such catalysts by the determination of the important catalyst characteristics which affect the rate of destruction of a wide range of chemical agents and agent simulants, including cyanogen chloride (CK), hydrogen cyanide (AC), phosgene (CG), and dimethyl methylphosphonate (DMMP), by catalytic oxidation and/or hydrolysis. Catalytic destruction of CG was achieved at temperatures as low as 75 C and of CK as low as 150 °C. The best catalysts identified for conversion of AC and DMMP showed high initial activity at 250 C.
GRA

N87-22409# BioTechnology, Inc., Falls Church, Va.
LIFE SUPPORT AND PROTECTION REQUIREMENTS FOR THE HEAD/NECK REGION OF NAVY AIRCREWMEN Final Report
JAMES F. PARKER, JR., DIANE G. CHRISTENSEN, and GEORGE R. MUTIMER Dec. 1986 88 p
(Contract N00014-77-C-0253)
(AD-A177469) Avail: NTIS HC A05/MF A01 CSCL 06G

A Navy aircrewman is protected through use of an Aviation Life Support System (ALSS), the basic form of which has changed little through the years. This project examined primary life support and protection needs as a first step toward the development of an advanced ALSS to match the missions and flight regimes of future. Information covering: (1) reports of emergency escape from Navy aircraft under the combat conditions of Southeast Asia, (2) reports of peacetime operational and training emergency ejections, and (3) structured interviews with aircrewmen flying the F-14 fighter aircraft was gathered. Analyses of the information indicates that requirements include: (1) maintenance or enhancement of performance and sensory capabilities (vision, audition, and cognition) of critical importance for Navy missions, (2) protection against the unexpected, excessive, and sustained acceleration forces encountered in advanced aircraft, (3) provision of both fire protection and fire retardant systems and (4) use of automated systems as feasible to counter effects of periods of altered consciousness. GRA

N87-22410*# National Aeronautics and Space Administration, Washington, D.C.
NASA INFORMATION SCIENCES AND HUMAN FACTORS PROGRAM Annual Report, 1984
LEE B. HOLCOMB, DUNCAN E. MCIVER, JOHN D. DIBATTISTA, RONALD L. LARSEN, MELVIN D. MONTEMERLO, KEN WALLGREN, MARTY SOKOLOSKI, and DICK WASICKO May 1985 190 p
(NASA-TM-87569; NAS 1.15:87569) Avail: NTIS HC A09/MF A01 CSCL 05H

This report contains FY 1984/85 descriptions and accomplishments in six sections: Computer Science and Automation, Controls and Guidance, Data Systems, Human Factors, Sensor Technology, and Communications. Author

N87-22411*# George Washington Univ., Washington, D.C. Science Communication Studies.
PUBLICATIONS OF THE NASA CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) PROGRAM 1984-86
Washington NASA Jun. 1987 29 p
(Contract NASW-3165)
(NASA-CR-4070; NAS 1.26:4070) Avail: NTIS HC A03/MF A01 CSCL 06B

Publications of research sponsored by the NASA CELSS (Controlled Ecological Life Support Systems) Program are listed, along with publications of interest to the Program. The bibliography is divided into the three major divisions of CELSS research: (1) Food Production; (2) Waste Management; and (3) Systems Management and Control. This bibliography is an update of NASA CR-3911 and includes references from 1984 through 1986.
Author

N87-22636*# Harvard Univ., Cambridge, Mass.
GROUP-LEVEL ISSUES IN THE DESIGN AND TRAINING OF COCKPIT CREWS
J. RICHARD HACKMAN *In* NASA. Ames Research Center Cockpit Resource Management Training p 23-39 May 1987
(Contract NCC2-324)
Avail: NTIS HC A14/MF A01 CSCL 05H

Cockpit crews always operate in an organizational context, and the transactions between the crew and representatives of that context (e.g., organizational managers, air traffic controllers) are consequential for any crew's performance. For a complete understanding of crew performance a look beyond the traditional

focus on individual pilots is provided to see how team- and organization-level factors can enhance (or impede) the ability of even well-trained individuals to work together effectively. This way of thinking about cockpit crews (that is, viewing them as teams that operate in organizations) offers some potentially useful avenues for thinking about next steps in the development of CRM training programs. Those possibilities are explored, emphasizing how they can enrich (not replace) individually-focussed CRM training. Author

N87-23124# Joint Publications Research Service, Arlington, Va.
TOLERANCE TO FRUSTRATION AS A FACTOR IN OPERATOR PERFORMANCE
O. F. MAKAREVICH *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 29-32 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct 1986 p 24-26
Avail: NTIS HC A07/MF A01

Frustration tolerance is a personality trait that contributes to the reliable performance of an air traffic controller. The results of a psychological examination of air traffic controllers using the Rosenzweig frustration test are presented and a correlation between the predominant behavior type in frustrating circumstances and professional success is emphasized. Examples of realistic observations over air traffic controllers are given which confirm experimental data. Author

N87-23136# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF CAUSES OF HYDROGEN SULFIDE FORMATION IN RECLAIMED WATER
I. G. POPOV, V. V. VLODAVETS, S. V. CHIZHOV, YU. YE. SINYAK, M. I. SHIKINA, L. A. VINOGRADOVA, and N. B. KOLESINA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, September - October 1986 p 108-111 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 75-78
Avail: NTIS HC A07/MF A01

The factors responsible for the formation of hydrogen sulphide in the water reclaimed from the atmospheric condensate were investigated. It was found that hydrogen sulphide developed in reclaimed water due to microorganisms which in the presence of inorganic sulphur acquired the capacity to produce hydrogen sulphide, although normally they are not sulphur reducing. Among the microorganisms studied, E. coli showed the highest capacity (100%) and Streptococcus faecalis and Citrobacter freundii showed the lowest capacity (10 to 20%) to produce hydrogen sulphide. Author

N87-23137# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATION OF THE PROCESS OF CO2-CO-H2O-H2-N2 GAS MIXTURE BREAKDOWN IN ELECTROLYSIS CELL WITH SOLID ELECTROLYTE
B. G. GRISHAYENKOV and N. G. ZORINA *In its* USSR Report: Space Biology and Aerospace Medicine, Volume 20, No. 5, september - October 1986 p 112-116 16 Dec. 1986 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 5, Sep. - Oct. 1986 p 78-81
Avail: NTIS HC A07/MF A01

The experimental investigation was carried out in an electrolytic cell having the form of a short tube and containing a solid electrolyte of the following composition: 0.9 ZrO2-0.1Y2O3. The concentration of the gaseous mixtures investigated varied in range 0.22 to 18.0. The cathode polarization of the cell with platinum electrodes was measured as a function of the composition of the gaseous mixture and oxygen content at the temperatures 800, 900 and 1000 C. The measurements demonstrated that the cell cathode polarization decreased as the water concentration in the starting mixture decreased. The dependence of the cell cathode polarization on the oxygen content had minima in a specific range of the values. Simultaneously, the cell cathode polarization decreased as the water content in the starting gaseous mixture increased. Author

N87-23143# Illinois Univ., Champaign. Cognitive Psychophysiology Lab.
THE EVENT RELATED BRAIN POTENTIAL AS AN INDEX OF INFORMATION PROCESSING AND COGNITIVE ACTIVITY: A PROGRAM OF BASIC RESEARCH Annual Progress Report, 1 Jan. - 31 Dec. 1986
EMANUEL DONCHIN, MICHAEL COLES, and ARTHUR KRAMER 23 Feb. 1987 334 p
(Contract F49620-85-C-0041)
(AD-A179310; CPL-87-1; AFOSR-87-0322TR) Avail: NTIS HC A15/MF A01 CSCL 05J

Research designed to understand the event related potential (ERP) can be used as a tool in the study of human information processing and in the assessment of man machine systems. The present contract year has focussed on (1) the use of measures of the P300 and motor potentials in the chronometric analysis of human information processing, (2) the use of P300 in the study of memory, (3) the use of various ERP components in the study of the structure of human cognitive resources as a function of task difficulty, priority, and automaticity, and (4) the use of ERP components in lie detection and mental prosthesis. GRA

N87-23144# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN FACTORS ENGINEERING DATA MANAGEMENT HANDBOOK Final Report
R. B. MCCOMMONS Mar. 1987 75 p
(AD-A179691; HEL-TM-6-87) Avail: NTIS HC A04/MF A01 CSCL 05B

For some time, serious concerns have existed regarding how the Government acquires data. The questions most frequently asked include, how much data should we buy, when should we ask for it, how should we use it, and how do we acquire it so it is both timely and useful? This document was written with the above concerns and questions in mind. It is intended for use by HEL and other personnel who are engaged in HFE program management activities in support of materiel acqusitions. The document is presented as guidance for determining data requirements and specifying and scheduling their timely delivery. Accordingly, the objectives are to provide a basic understanding of data acquisition as part of the materiel development process. It should be considered a living document and, after evaluation and/or implementation by users, one which will be updated or modified, as required, to reflect field experience and changes in relevant policy. Last, while written from an HFE perspective, the author recognizes that HFE is most properly considered not as a discipline in and unto itself, but as a predominant element of the much larger initiative called MANPRINT (Manpower and Personnel Integration). GRA

N87-23145# Oak Ridge National Lab., Tenn.
ALTERNATIVE KNOWLEDGE ACQUISITION: DEVELOPING A PULSE CODED NEURAL NETWORK
W. B. DRESS Jan. 1987 12 p Presented at the Long Island University Computer Technology Symposium, Brookville, N.Y., 23 Jan. 1987
(Contract DE-AC05-84OR-21400)
(DE87-005192; CONF-870150-1) Avail: NTIS HC A02/MF A01

After a Rip-van-Winkle nap of more than 20 years, the ideas of biologically motivated computing are re-emerging. Instrumental to this awakening have been the highly publicized contributions of John Hopfield and major advances in the neurosciences. In 1982, Hopfield showed how a system of maximally coupled neutron-like elements described by a Hamiltonian formalism (a linear, conservative system) could behave in a manner startlingly suggestive of the way humans might go about solving problems and retrieving memories. Continuing advances in the neurosciences are providing a coherent basis in suggesting how nature's neurons might function. A particular model is described for an artificial neural system designed to interact with (learn from and manipulate)

a simulated (or real) environment. The model is based on early work by Iben Browning. The Browning model, designed to investigate computer-based intelligence, contains a particular simplification based on observations of frequency coding of information in the brain and information flow from receptors to the brain and back to effectors. The ability to act on and react to the environment was seen as an important principle, leading to self-organization of the system. DOE

N87-23146# Air Force Human Resources Lab., Brooks AFB, Tex.
AIRCREW TASK SURVEYS: SELECTION CRITERIA FOR LOW-COST TRAINING TECHNOLOGY APPLICATIONS Interim Technical Paper, Mar. 1983 - Feb. 1986
BERNELL J. EDWARDS Mar. 1987 39 p
(AD-A178473; AFHRL-TR-86-52) Avail: NTIS HC A03/MF A01 CSCL 05I

This paper documents the first phase of a research and development effort to obtain opinion data from Air Force operational aircrews to support the selection of training tasks as candidates for the development of several high technology, low cost, part task trainer demonstrations. The overall goal of the effort is to develop and combine scientifically derived, advanced part task training methods with state-of-the-art training technology. Several surveys of aircrews who fly tanker, transport, or bomber type aircraft were conducted to elicit their opinions regarding training issues which bear on the matching of task characteristics with low cost training technology. Survey results provide a general guide to the selection of appropriate tasks for further analysis. GRA

N87-23147# Naval Aerospace Medical Research Lab., Pensacola, Fla.
EFFECT OF THE NEUTRAL DENSITY HELMET VISOR ON THE VISUAL ACUITY OF NAVY FIGHTER PILOTS
P. V. HAMILTON and A. MORRIS Dec. 1986 27 p
(AD-A178486; NAMRL-1325) Avail: NTIS HC A03/MF A01 CSCL 06P

The visual acuity of 63 Navy fighter pilots was measured under four viewing conditions in an Automated Vision Test Battery housed in a Mobile Field Laboratory operated by the Naval Aerospace Medical Research Laboratory (NAMRL). These and other pilots were also interviewed concerning their visor usage habits. Use of the 12% neutral density visor resulted in an average acuity loss of about 0.51 minutes of visual angle (mva) for low contrast targets under high-luminance laboratory conditions. The visor may cause an operationally significant reduction in visual acuity in the presence of luminance levels encountered at typical flight altitudes. Pilots range widely in their sensitivities to reduced contrast and glare, so a single optical density visor would not be optimal for many pilots. Pilot attempts to identify individually-optimal strategies for using visors and sunglasses often have no objective or systematic basis. Recommendations are presented for improving the vision of aviators wearing visors. GRA

N87-23148# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 22ND ANNUAL CONFERENCE ON MANUAL CONTROL Annual Report, 15 - 16 Jul. 1986
FRANK L. GEORGE Dec. 1986 374 p Conference held in Dayton, Ohio, 15-16 Jul. 1986
(AD-A178627; AFWAL-TR-86-3093) Avail: NTIS HC A16/MF A01 CSCL 05H

The Twenty-Second Annual Conference on Manual Controls emphasized human-machine system design methodology and the impact of automation on the human-machine interface. GRA

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A87-35728
PREBIOLOGICAL EVOLUTION AND THE FACTORS DETERMINING IT [PREDBIOLOGICHESKAIA EVOLIUTSIIA I OPREDELIAIUSHCHIE EE FAKTORY]
K. L. GLADILIN IN: Problem of the search for life in the universe . Moscow, Izdatel'stvo Nauka, 1986, p. 85-91. In Russian. refs

The main possible stages and factors of prebiological evolution are considered along with possible approaches to evaluating the probability of the appearance of life on terrestrial-type planets. A scheme for the interrelationship between the main structural units of prebiological and biological evolution is presented. B.J.

A87-35739
DOES THE GENETIC CODE HAVE A DETERMINISTIC OR CHANCE CHARACTER? [DETERMINIROVAN ILI SLUCHAEN GENETICHESKII KOD?]
V. I. IVANOV IN: Problem of the search for life in the universe . Moscow, Izdatel'stvo Nauka, 1986, p. 91-98. In Russian. refs

It is argued that the present genetic code (GC) does not have a chance character, but this is not because there is a structural conformity between triplets of nucleotides and amino acids. Rather, the GC does not have a chance character for historical reasons: it derives from a more primitive code in which a conformity of the aforementioned type existed and which has been preserved as a relict in present protein-nuclein complexes. It is suggested that, insofar as the same stereochemical conformity lies at the basis of protein-nuclein life on other planets, the inheritors of this code, GCs, will have features in common but will not necessarily be identical. This hypothesis is argued on the basis of data concerning the formation of GC dialects found recently on the earth in cellular organelles, mitochondria. B.J.

A87-35740
THE ROLE OF LIQUID-DROP WATER IN THE ORIGIN OF LIFE ON EARTH [ROL' KAPEL'NO-ZHIDKOI VODY V PROISKHOZDENII ZHIZNI NA ZEMLE]
M. D. NUSINOV and K. B. SEREBROVSKAIA IN: Problem of the search for life in the universe . Moscow, Izdatel'stvo Nauka, 1986, p. 98-104. In Russian. refs

A qualitative model of the initial physical-chemical stage of biological evolution is proposed in which regolith grains of the primitive earth are taken as the platform of life-nucleation. It is proposed that the appearance of liquid-drop water in these grains served to initiate spontaneous catalytic processes leading to the self-organization of primordial evolving clay systems. This set the stage for the transition from chemical to biological evolution. B.J.

A87-38912*# California Inst. of Tech., Pasadena.
UNUSUAL STABLE ISOTOPE RATIOS IN AMINO ACID AND CARBOXYLIC ACID EXTRACTS FROM THE MURCHISON METEORITE
S. EPSTEIN, R. V. KRISHNAMURTHY (California Institute of Technology, Pasadena), J. R. CRONIN, S. PIZZARELLO, and G. U. YUEN (Arizona State University, Tempe) Nature (ISSN 0028-0836), vol. 326, April 2, 1987, p. 477-479.

The isotopic composition of hydrogen, nitrogen, and carbon in amino acid and monocarboxylic acid extracts from the Murchison meteorite has been determined. The unusually high D/H and

N-15/N-14 ratios in the amino acid fraction are uniquely characteristic of known interstellar organic materials. The delta D value of the monocarboxylic acid fraction is lower but still consistent with an interstellar origin. These results confirm the extraterrestrial origin of both classes of compound and provide the first evidence suggesting a direct relationship between the massive organosynthesis occurring in interstellar clouds and the presence of prebiotic compounds in primitive planetary bodies. C.D.

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 301) September 1987

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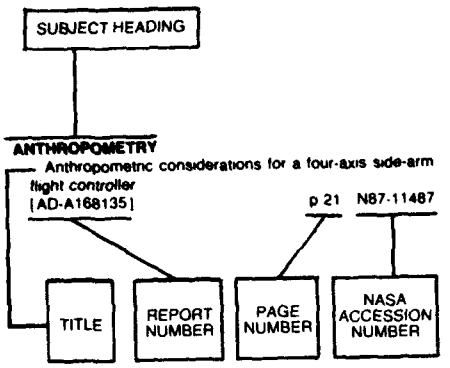

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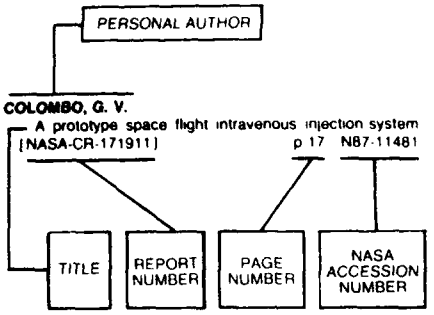
Typical Personal Author Index Listing



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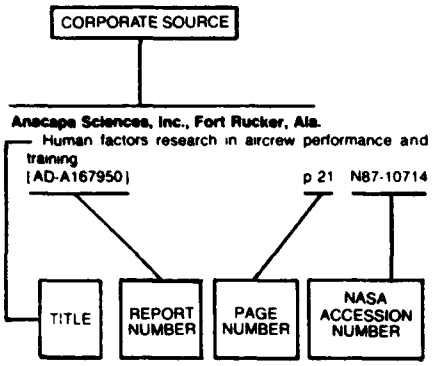

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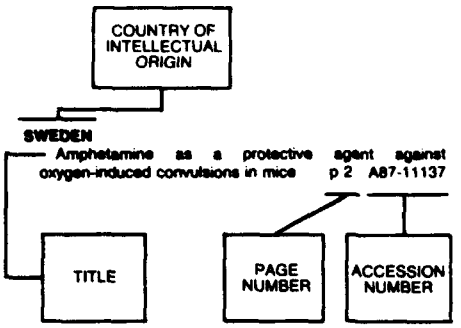

Listings in this index are arranged alphabetically by country of intellectual origin. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the citation in the abstract section.

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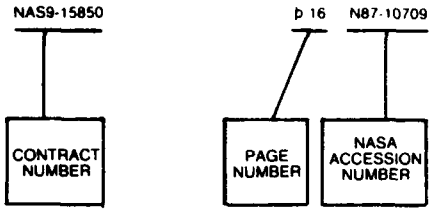

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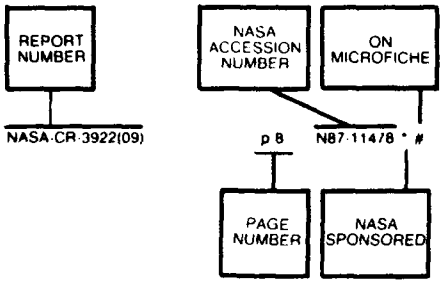

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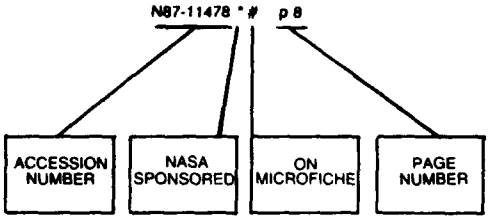

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