NASA SP-7011 (348)
April 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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National Aeronautics and Space Administration
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INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 154 reports, articles and other documents originally announced in March 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N91-13399 — N91-15122
IAA (A-10000 Series)	A91-16993 — A91-20488

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

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

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

A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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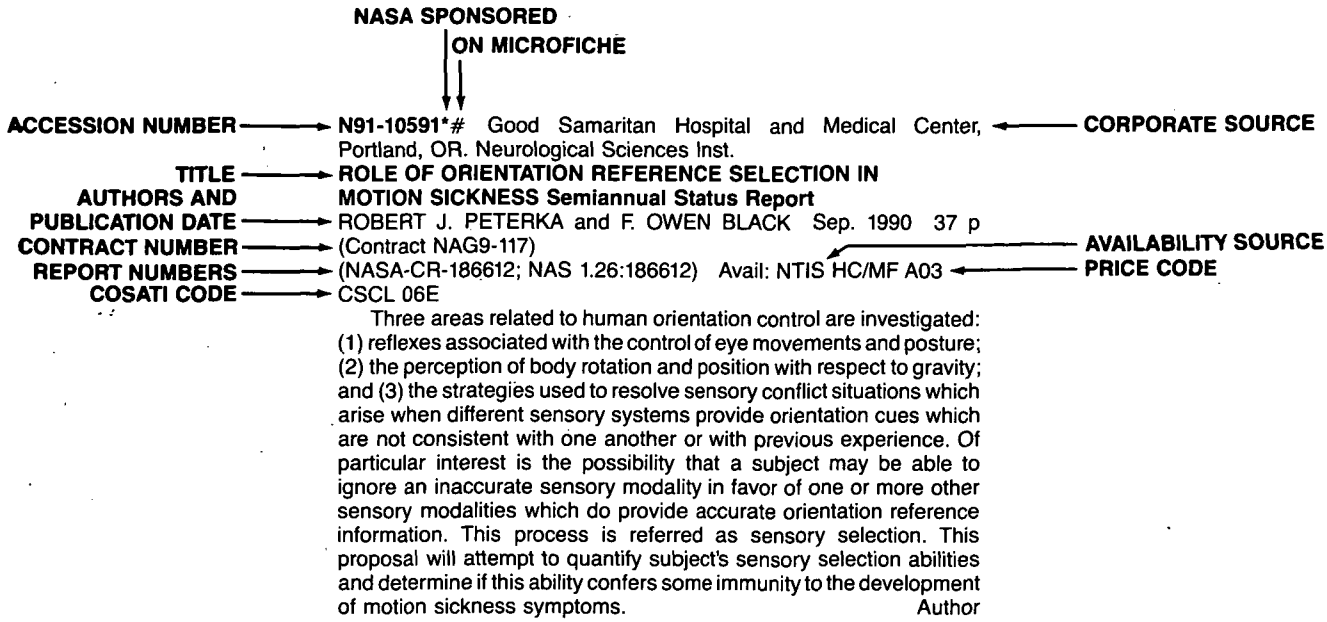
TYPICAL REPORT CITATION AND ABSTRACT



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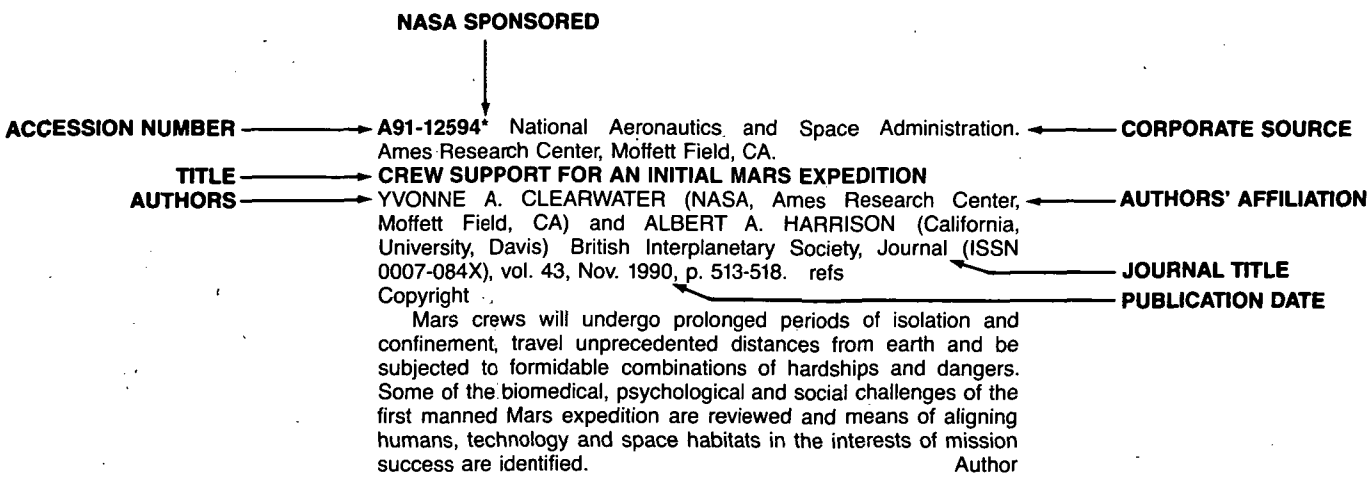

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 348)

APRIL 1991

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LIFE SCIENCES (GENERAL)

A91-17025
STRUCTURAL PREREQUISITES FOR THE TIME ORIENTATION OF NERVOUS ACTIVITY [STRUKTURNYE PREDPOSYLKI VREMENNOGO OBESPECHENIIA NERVNOI DEIATEL'NOSTI]
T. A. MERING (AMN SSSR, Institut Mozga, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 21, Oct.-Dec. 1990, p. 103-122. In Russian. refs
Copyright

Experimental and clinical data are presented demonstrating that there exist well-defined regions in the brain cortex which are part of the functional system responsible for three types of time-related nervous activity: biological clocks, the perception of different time intervals, and the perception of the sequence of events occurring in tandem. Particular attention is given to the role of the structures composing the hippocampal cycle (the septum, the mammilary bodies, and the entorhinal cortex) in metering time intervals. I.S.

A91-17688
EFFECTS OF HYPERGRAVITY ON LUNG CARCINOMA CELLS MAINTAINED IN CONTINUOUS ORGANOTYPIC CULTURE
F. CROUTE, Y. GAUBIN, B. PIANEZZI (Toulouse III, Universite, France), M. C. PREVOST (Institut National de la Sante et de la Recherche Medicale, Tolouse, France), R. BEAUPAIN (CNRS, Laboratoire d'Immunopharmacologie Experimentale, Paris, France) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1002-1006. refs
(Contract CNES-87-1245)
Copyright

The effects of hypergravity levels ranging from 1 to 15 g were studied on A549 lung adenocarcinoma cell line, cultivated as nodules. This organotypic culture model preserves as closely as possible the cellular structures and differentiation functions of the in vivo situation. Nodules submitted to hypergravity conditions for 27 d did not show any change of cell growth, protein and DNA contents, compared with controls. Also, cellular differentiation, as regards intracellular phospholipid composition and more particularly phosphatidylcholine content, appeared undisturbed. The only obvious effect of hypergravity was a modification of the structural organization, with a disappearance of the large alveoli present at the surrounding of control nodules and the development of a dense cellular mass instead. Author

A91-17689
IMPAIRMENT OF RAT POLYMORPHONUCLEAR NEUTROPHILIC GRANULOCYTE PHAGOCYTOSIS FOLLOWING REPEATED HYPOBARIC HYPOXIA
ROBERT BJERKNES, INGER-LISE NESLEIN, KJELL MYHRE, and HARALD T. ANDERSEN (Institute of Aviation Medicine, Blindern, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1007-1011. refs
Copyright

Exposure of rats to repeated hypobaric hypoxia (17 h at 0.5 atm for 0-7 d) induced significant reduction of the phagocytic capacity of peripheral blood polymorphonuclear neutrophilic granulocytes (PMNL). In addition, the hypoxia induced a significant increase of the hematocrit, hemoglobin, thrombocyte, and total leukocyte concentrations. Differential counting of peripheral blood revealed significant granulocytosis. An increase of the concentration of corticosterone was demonstrated following 2 d of hypobaric hypoxia, whereas 5 d later the corticosterone concentrations were similar to that of the controls. The reduced PMNL phagocytic capacity observed following repeated hypobaric hypoxia may have consequences for host defense in situations of hypoxia exposure. Author

A91-17690
ADVERSE EFFECTS OF DIETARY AND FUROSEMIDE-INDUCED SODIUM DEPLETION ON THERMOREGULATION
LAWRENCE DE GARAVILLA (Nova Pharmaceutical Corp., Baltimore, MD), MICHAEL J. DURKOT, THOMAS M. IHLEY, NATALIE LEVA, and RALPH P. FRANCESCONI (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1012-1017. refs
Copyright

The effect of sodium depletion on heat tolerance was investigated in rats subjected to one of the following treatments: (1) injections of a diuretic (furosemide, 10 mg/kg per day), (2) a sodium-free diet, or (3) a combination of furosemide treatment and dietary regimens. After four days of treatment, the control and the three experimental groups were acutely exposed to 42 C and the rectal temperature of the animals was monitored at 15-min intervals. It was found that the time required for rectal temperature to reach 42.6 C was significantly less in the experimental groups than in the control group (176, 181, and 111 min in groups 1, 2, and 3, as compared with 242 min in the contol group), indicating that dehydration and sodium deprivation can reduce heat tolerance by 25-50 percent. I.S.

A91-17691
CATECHOLAMINERGIC RESPONSES TO ROTATIONAL STRESS IN RAT BRAIN STEM - IMPLICATIONS FOR AMPHETAMINE THERAPY OF MOTION SICKNESS
NORIAKI TAKEDA, MASAHIRO MORITA, ATSUSHI YAMATODANI, HIROSHI WADA, and TORU MATSUNAGA (Osaka University, Japan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1018-1021. Research supported by MOESC. refs
Copyright

Experiments were carried out to verify the Wood-Graybiel (1970) theory according to which the noradrenergic neuron system in the brain stem inhibits the development of motion sickness. In the experiments, rats were rotated for 60 min about one axis (single rotation) or about two axes simultaneously (double rotation), and the concentrations of noradrenaline and dopamine, as well as of their metabolites, in the brain stem extracts were compared to those obtained from control animals. Measurements of kaolin intake (pica) were used to estimate the extent of motion sickness. It was found that double rotation produced motion sickness, while single rotation did not. However, no significant difference was found

between the catecholamine turnover induced by the two types of rotation. Moreover, pretreatment of rats with methamphetamine just before double rotation, while preventing the induction of motion sickness, did not affect the catecholamine turnover in the brain stem. I.S.

A91-17890
SOME CHARACTERISTICS OF POST-HYPOXIA-INDUCED DRINKING IN RATS
MELVIN J. FREGLY and SALLY A. MACARTHUR (Florida, University, Gainesville) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1116-1120. refs
(Contract N00014-88-J-1221)
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When rats are returned to a normoxic environment after chronic exposure to hypoxia, they manifest a striking drinking response. An objective of the present experiment was to measure the post-hypoxia drinking response at intervals during a 71-d exposure to an atmosphere containing 12 percent oxygen in nitrogen to assess whether the response could be observed throughout this entire period. The results suggest that the response continued unabated throughout the duration of exposure to hypoxia. The mechanism(s) accounting for the posthypoxic drinking response cannot be stated with certainty. However, the results of these studies indicate that administration of the betra-adrenoceptor antagonist, propranolol (6 mg/kg, i.p.), failed to affect the magnitude of the drink following return from hypoxia to normoxia. Hence, it is unlikely that the posthypoxic drinking response is mediated by an increase in beta-adrenergic activity. Author

A91-17891* Wayne State Univ., Detroit, MI.
ATRIAL NATRIURETIC FACTOR INCREASES VASCULAR PERMEABILITY
WARREN LOCKETTE and BRUCE BRENNAMAN (Wayne State University, Detroit; USVA, Medical Center, Allen Park; Henry Ford Hospital, Detroit; Michigan, University, Ann Arbor) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1121-1124. Research supported by NASA, American Heart Association, and Universities Space Research Association. refs
Copyright

An increase in central blood volume in microgravity may result in increased plasma levels of atrial natriuretic factor (ANF). In this study, it was determined whether ANF increases capillary permeability to plasma protein. Conscious, bilaterally nephrectomized male rats were infused with either saline, ANF + saline, or hexamethonium + saline over 2 h following bolus injections of (I-125)-albumin and (C-14)-dextran of similar molecular size. Blood pressure was monitored, and serial determinations of hematocrits were made. Animals infused with 1.0 microg/kg per min ANF had significantly higher hematocrits than animals infused with saline vehicle. Infusion of ANF increased the extravasation of (I-125)-albumin, but not (C-14)-dextran from the intravascular compartment. ANF also induced a depressor response in rats, but the change in blood pressure did not account for changes in capillary permeability to albumin; similar depressor responses induced by hexamethonium were not accompanied by increased extravasation of albumin from the intravascular compartment. ANF may decrease plasma volume by increasing permeability to albumin, and this effect of ANF may account for some of the signs and symptoms of space motion sickness. Author

A91-17892
FIELD ORIENTATION EFFECTS DURING 5.6-GHZ RADIOFREQUENCY IRRADIATION OF RATS
MELVIN R. FREI (USAF, School of Aerospace Medicine, Brooks AFB; Trinity University, San Antonio, TX), JAMES R. JAUCHEM, JIMMY M. PADILLA (USAF, School of Aerospace Medicine, Brooks AFB, TX), and DANNY L. PRICE (Trinity University, San Antonio, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1125-1129. refs
Copyright

The effects of the exposure orientation during RF irradiation of rats on different physiological characteristics of iradiated animals were investigated in rats exposed in E and H orientations (i.e. long axis parallel to electric or magnetic field, respectively) to far-field 5.6-GHz continuous-wave RF radiation. Patterns of localized heating disclosed significant differences between the E- and H-orientations: increases in the tail- and left-subcutaneous temperature values due to RF irradiation were significantly greater during the E-orientation exposure, while the right-subcutaneous temperature increase was significantly greater during H-orientation exposure. The tympanic site showed no difference. No significant differences were observed in the heart rate and the mean arterial blood pressure values, in contrast to earlier observed results of irradiation at 2.45 GHz (Frei et al., 1989). I.S.

A91-18475
MODERN CYANOBACTERIAL ANALOGS OF PALEOZOIC STROMATOPOROIDS
JOZEF KAZMIERCZAK (Polish Academy of Sciences, Institute of Paleobiology, Warsaw, Poland) and STEPHAN KEMPE (Hamburg, Universitaet, Federal Republic of Germany) Science (ISSN 0036-8075), vol. 250, Nov. 30, 1990, p. 1244-1248. Research supported by BMFT and Polska Akademia Nauk. refs
Copyright

A sea-linked, stratified alkaline crater lake on Satonda Island, Indonesia, is the site of both recent and subfossil calcareous structures, reminiscent of cystose and subclathrate Paleozoic stromatoporoids, which were produced by mats of coccoid cyanobacteria. These internally complex structures are generated by two different calcification processes, namely periodic, in vivo calcification of the surficial cyanobacterial layers by low-Mg calcite, and early postmortem calcification of the cyanobacterial aggregates beneath the mat surface by a microbially-precipitated aragonite. These findings support the hypothesized identification of Paleozoic stromatoporoids with fossilized cyanobacteria. O.C.

A91-18646
BACTERIAL ORIGIN OF A CHLOROPLAST INTRON - CONSERVED SELF-SPLICING GROUP I INTRONS IN CYANOBACTERIA
MING-QUN XU, HEIDI GOODRICH-BLAIR, DAVID A. SHUB (New York, State University, Albany), SCOTT D. KATHE, and SANDRA A. NIERZWICKI-BAUER (Rensselaer Polytechnic Institute, Troy, NY) Science (ISSN 0036-8075), vol. 250, Dec. 14, 1990, p. 1566-1570. refs
(Contract NIH-GM-37746; NSF DMB-90-11698)
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A self-splicing group I intron has been found in the gene for a leucine transfer RNA in two species of Anabaena, a filamentous nitrogen-fixing cyanobacterium. The intron is similar to one that is found at the identical position in the same transfer RNA gene of chloroplasts of land plants. Because cyanobacteria were the progenitors of chloroplasts, it is likely that group I introns predated the endosymbiotic association of these eubacteria with eukaryotic cells. Author

A91-18647
AN ANCIENT GROUP I INTRON SHARED BY EUBACTERIA AND CHLOROPLASTS
MARIA G. KUHSEL, RODERICK STRICKLAND, and JEFFREY D. PALMER (Indiana University, Bloomington) Science (ISSN 0036-8075), vol. 250, Dec. 14, 1990, p. 1570-1573. Research supported by NIH. refs
(Contract DFG-KU-721/1-1)
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Introns have been found in the genomes of all major groups of organisms except eubacteria. The presence of introns in chloroplasts and mitochondria, both of which are of eubacterial origin, has been interpreted as evidence either for the recent acquisition of introns by organelles or for the loss of introns from their eubacterial progenitors. The gene for the leucine transfer RNA with a UAA anticodon from five diverse cyanobacteria and several major groups of chloroplasts contains a single group I intron. The intron is conserved in secondary structure and primary

sequence, and occupies the same position, within the UAA anticodon. The homology of the intron across chloroplasts and cyanobacteria implies that it was present in their common ancestor and that it has been maintained in their genomes for at least 1 billion years. Author

A91-18734
SUSPENSIONS OF PLANT CELLS IN MICROGRAVITY
R. HAMPP (Tuebingen, Universitaet, Federal Republic of Germany), B. NATON, E. HOFFMANN, and W. MEHRLE (ZARM, MBB-ERNO, OHB-System, et al., International Microgravity Congress, 1st, Bremen, Federal Republic of Germany, Sept. 24-26, 1990) Microgravity Science and Technology (ISSN 0938-0108), vol. 3, Dec. 1990, p. 168-172. Research supported by BMFT. refs
Copyright

Electrofusion of evacuolated with vacuolated mesophyll protoplasts of Nicotiana spec. was performed as part of the German Sounding Rocket Program (TEXUS). The results indicate a significant increase not only in the yield of 1:1 fusion products, but also in homo- and multifusion products. Heterokaryons obtained under microgravity have been shown to be viable to a higher degree with respect to their ability for light-dependent oxygen evolution (independent of other substrates than bicarbonate). Furthermore hybrid plants from suspensions of vacuolated and evacuolated protoplasts which were pulse-treated under microgravity were regenerated. These expressed characteristics intermediate to those of the parental plants (Nicotiana tabacum (cv. Samsun), evacuolated; N. rustica, vacuolated). Author

A91-18735
LIFE SCIENCES ISSUES AFFECTING SPACE EXPLORATION
JOEL I. LEONARD (Lockheed Engineering and Sciences Co., Washington, DC), R. J. WHITE, L. LEVETON, K. GAISER, and R. TEETER (ZARM, MBB-ERNO, OHB-System, et al., International Microgravity Congress, 1st, Bremen, Federal Republic of Germany, Sept. 24-26, 1990) Microgravity Science and Technology (ISSN 0938-0108), vol. 3, Dec. 1990, p. 173-179. refs
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Critical factors in the support of manned space exploration which are under study by the NASA Life Sciences programs encompass protection from space radiation, reduced-gravity countermeasures and artificial gravity, medical care, life-support systems, and human behavior in an extraterrestrial environment. Sites for research facilities analogous to planetary outposts are being considered in Antarctica and comparably remote settings, and closed ecological life support systems are to be tested both in terrestrial laboratories and the projected Space Station. Both the Space Shuttle and Spacelab will be used for short-duration life-support simulations. It is anticipated that lunar facilities will be essential for preparations for Mars missions. O.C.

A91-18828
A NEW GROUP OF ANAEROBIC THERMOPHILIC HYDROGEN-PRODUCING CARBOXYDOBACTERIA [NOVAIA GRUPPA ANAEROBNYKH TERMOFIL'NYKH KARBOKSIDOBAKTERII, VYDELIAIUSHCHIKH VODOROD]
V. A. SVETLICHNYI, T. G. SOKOLOVA, G. A. ZAVARZIN (AN SSSR, Institut Mikrobiologii, Moscow, USSR), and M. GERHARDT (Institut fuer Biotechnologie, Berlin, Federal Republic of Germany) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 314, no. 3, 1990, p. 742-744. In Russian. refs
Copyright

A new type of chemolithotrophy among extremely thermophilic anaerobic eubacteria has been discovered. It is based on the utilization of CO as the sole energy source as well as carbon, leading to the production of H2. It is found that organisms characterized by this type of metabolism are diverse and widespread in fresh-water and marine hydrothermal habitats. B.J.

A91-18835
PHYSIOLOGICAL MECHANISMS INVOLVED IN THE ANTIHYPOXIC EFFECT OF LIPOSOMES [NEKOTORYE FIZIOLOGICHESKIE MEKHANIZMY ANTIGIPOKSICHESKOGO DEISTVIIA LIPOSOM]
V. P. POZHAROV, T. D. MINIAILENKO, A. V. STEFANOV, S. A. BRYGINSKII, M. M. SEREDENKO (AN USSR, Institut Fiziologii and Institut Boikhimii, Kiev, Ukrainian SSR) et al. Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, July 1990, p. 897-902. In Russian. refs
Copyright

The alleviating effect of phospholipids introduced into the vascular system in the form of liposomes on the development of the hypoxia-specific syndrome was investigated in rats kept for 90 min in a 7-percent oxygen-nitrogen atmosphere. It is shown that an injection of liposomes (2.5 mg lipid/100 g body weight) 30 min after the onset of the experiment improved the blood-to-tissue and air-to-blood oxygen diffusion rates, compared with those of noninjected controls. As the result of this protection, the degree of tissue hypoxia (estimated on the basis of measurements of the lactic acid content and the lactate/pyruvate ratio) was considerably reduced, the peroxidation of lipids was inhibited, and the efficiency of external respiration and gas exchange was increased. I.S.

A91-18836
REGULATION OF PROTEIN PHOSPHORYLATION IN THE HYPOTHALAMUS, HYPOPHYSIS, AND ADRENALS DURING DEEP HYPOTHERMIA [REGULIATSIIA FOSFORILIROVANIIA BELKOV GIPOTALAMUSA, GIPOFIZA I NADPOCHECHNIKOV PRI GLUBOKOI GIPOTERMII]
V. D. SVIRID (AN BSSR, Institut Fiziologii, Minsk, Belorussian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, July 1990, p. 919-923. In Russian. refs
Copyright

The effect of deep hypothermia on factors regulating protein phosphorylation in tissues of the hypothalamus, hypophysis, and adrenals was investigated in mice subjected to a 0 C environment for 5 min, 15 min, 30 min, 1 hr, 2 hr, or 3 hrs (until, after 3 hrs, the values of rectal temperature were lowered by about 6.8 C). The protein phosphorylation activity was assessed by assaying tissue extracts for the contents of ATP and c-AMP and activities of adenyl cyclase and c-AMP-dependent proteokinases. Results showed that, in all the structures under investigation, protein phosphorylation is regulated via the adenyl cyclase system. In the hypothalamus and adrenals, the calcium-calmodulin system also participates in activating phosphorylation. I.S.

A91-18837
THE FREQUENCY AND THE SUCCESSION OF BIOPOTENTIALS OF THE COLD-SPECIFIC THERMORECEPTORS AT VARYING SKIN TEMPERATURE [CHASTOTA I POSLEDOVATEL'NOST' BIOPOTENTSIALOV KHOLODOVYKH TERMORETSEPTOROV PRI RAZLICHNOI TEMPERATURE KOZHI]
N. K. DANILOVA, K. P. IVANOV, V. A. KONSTANTINOV, and G. B. MOROZOV (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, July 1990, p. 924-931. In Russian. refs
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The electrical responses of cold-specific thermoreceptors in the rabbit nasolabial area were monitored in anesthetized animals, while the skin temperature was lowered to 20 C, raised to 39 C, and lowered again to 4.5-7 C by means of perfusion. For every individual thermoreceptor, the range of firing rate, the temperature of maximal discharge, and the character of the discharge sequence were measured at regular temperature intervals. It was found that, at certain skin temperatures, the majority of the thermoreceptors reacted by bursts of 2 to 10 or more discharges. A wide variety of responses of the receptors to a continuous drop of the skin temperature was observed. I.S.

A91-18838
NEURONS IN HYPOTHALAMUS SLICES RESPONDING TO TEMPERATURE CHANGES [NEIRONY V SREZAKH GIPOTALAMUSA, REAGIRUIUSHCHIE NA IZMENENIE TEMPERATURY]
V. IU. VASILENKO (AN BSSR, Institut Fiziologii, Minsk, Belorussian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, July 1990, p. 937-941. In Russian. refs
Copyright

The responses of individual neurons in tissue slices of the guinea-pig hypothalamus to changes of temperature were investigated by monitoring the responses of individual cold-specific, heat-specific, and temperature-insensitive neurons during heating the tissue from 32 to 40 C and cooling it back to 32 C. Out of 38 neurons observed, 18 displayed static sensitivity to the temperature level. Four of these displayed bursts of 2-10 or more discharges, with 20-200 millisec pulse intervals, and responses that were similar to those observed earlier for hippocampal tissue slices (i.e., stimulation upon heating and inhibition upon cooling). I.S.

A91-18936
1989 ISSOL MEETING, 6TH, PRAGUE, CZECHOSLOVAKIA, JULY 3-8, 1989, PROCEEDINGS. PART 2
JAMES P. FERRIS, ED. (Rensselaer Polytechnic Institute, Troy, NY) Meeting sponsored by the International Society for the Study of the Origin of Life. Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, 173 p. For individual items see A91-18937 to A91-18947.
Copyright

Recent studies on the origins and early development of life on earth are discussed in reviews and reports. Topics addressed include bolide impacts and the oxidation state of carbon in the early atmosphere, the synthesis of amino acids and sugars on an inorganic template from constituents of the prebiotic atmosphere, the role of transition-metal ferrocyanides (II) in evolution, and proteinoids as complexes of polyamino acids with melanoidins. Consideration is given to oligomerization reactions of deoxyribonucleotides on montmorillonite clay, the photochemical origins of life and the photoreaction of ferrous ions in the archaean oceans, protoporphyrin IX as a possible ancient photosensitizer, and geochemical constraints on the origin of organic compounds in hydrothermal systems. T.K.

A91-18938
THE SYNTHESIS OF AMINO ACIDS AND SUGARS ON AN INORGANIC TEMPLATE FROM CONSTITUENTS OF THE PREBIOTIC ATMOSPHERE
B. O. FIELD and J. E. D. SPENCER (City University, London, England) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 233-248. refs
Copyright

Inelastic electron tunneling spectroscopy has been used to identify the reaction products present on an alumina surface when it is exposed to likely components of the earth's prebiotic atmosphere. The alumina barrier of Al-Al-O(x)-Pb tunneling junctions have been exposed to water; aqueous ammonia; wet carbon monoxide gas; and to aqueous formaldehyde vapor under normal atmospheric conditions at room temperature. It is proposed that atmospheric CO2 is involved in this surface catalyzed reaction. The wet carbon monoxide spectrum and the aqueous formaldehyde spectrum have been produced by an infusion doping process. These spectra of CO and aqueous formaldehyde are assigned as a sugar-like polymer or a sugar formed on the alumina surface. A tunnelling spectrum of D(-) fructose has been produced to aid this assignment. The role of an inorganic template such as alumina in the original prebiotic synthesis of amino acids and sugars is considered. Author

A91-18939
DIKETOPIPERAZINE-MEDIATED PEPTIDE FORMATION IN AQUEOUS SOLUTION
M. NAGAYAMA, O. TAKAOKA, K. INOMATA, and Y. YAMAGATA (Kanazawa University, Japan) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 249-257. refs
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Though diketopiperazines (DKP) are formed in most experiments concerning the prebiotic peptide formation, the molecules have not been paid attention in the studies of chemical evolution. It is found that triglycine, tetraglycine, or pentaglycine are formed in aqueous solution of glycine anhydride (DKP) and glycine, diglycine, or triglycine, respectively. A reaction of alanine with DKP resulted in the formation of glycylglycylalanine under the same conditions. These results indicate that the formation of the peptide bonds proceeds through the nucleophilic attack of an amino group of the amino acids or the oligoglycines on the DKP accompanied by the ring-opening. The formation of the glycine anhydride, di-, tri-, and tetraglycine was also observed in a mixed aqueous solution of urea and glycine in an open system to allow the evaporation of ammonia. A probable pathway is proposed for prebiotic peptide formation through diketopiperazine on the primitive earth. Author

A91-18940
ROLE OF TRANSITION METAL FERROCYANIDES (II) IN CHEMICAL EVOLUTION
MR. KAMALUDDIN, MALA NATH, SUSHAMA W. DEOPUJARI, and ARCHANA SHARMA (Roorkee, University, India) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 259-268. Research supported by the Department of Science and Technology of India. refs
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Due to ease of formation of cyanide under prebiotic conditions, cyanide ion might have formed stable complexes with transition metal ions on the primitive earth. In the course of chemical evolution insoluble metal cyano complexes, which settled at the bottom of primeval sea could have formed peptide and metal amino acid complexes through adsorption processes of amino acids onto these metal cyano complexes. Adsorption of amino acids such as glycine, aspartic acid, and histidine on copper ferrocyanide and zinc ferrocyanide have been studied over a wide pH range of 3.6 - 8.5. Amino acids were adsorbed on the metal ferrocyanide complexes for different time periods. The progress of the adsorption was followed spectro-photometrically using ninhydrin reagent. Histidine was found to show maximum adsorption on both the adsorbents at neutral pH. Zinc ferrocyanide exhibits good sorption behavior for all the three amino acids used in these investigations. Author

A91-18941
PROTEINOIDS AS COMPLEXES OF POLYAMINO ACIDS WITH MELANOIDINS
T. A. TELEGINA, T. E. PAVLOVSKAIA (AN SSSR, Institut Biokhimii, Moscow, USSR), Z. MASINOVSKY, V. LIEBL (Ceskoslovenska Akademie Ved, Mikrobiologicky Ustav, Prague, Czechoslovakia), A. A. SIVASH (AN USSR, Institut Botaniki, Kiev, Ukrainian SSR) et al. (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 269-277. refs
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Proteinoids have been demonstrated as complexes of amino acid polymers with melanoidin pigments. Some physico-chemical properties of proteinoid pigments were studied in comparison with the standard melanoidins. Proteinoid pigments were able to enhance oxidoreduction and hydrolysis reactions, and their activity was comparable with the activity of the corresponding polyamino acid components or even of the entire proteinoids. The pigmented proteinoids had relatively strong ESR signal indicating the presence of free radicals into melanoidin components. Hypothetical participation of proteinoid melanoidin pigments in prebiotic evolution is discussed. Author

A91-18942* Rensselaer Polytechnic Inst., Troy, NY.
OLIGOMERIZATION REACTIONS OF DEOXYRIBONUCLEOTIDES ON MONTMORILLONITE CLAY - THE EFFECT OF MONONUCLEOTIDE STRUCTURE, PHOSPHATE ACTIVATION AND MONTMORILLONITE COMPOSITION ON PHOSPHODIESTER BOND FORMATION
JAMES P. FERRIS, MR. KAMALUDDIN, and GOZEN ERTEM (Rensselaer Polytechnic Institute, Troy, NY) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 279-291. refs
(Contract NSF CHE-85-06377; NGR-33-018-148)
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The 2(prime)-d-5(prime)-GMP and 2(prime)-d-5(prime)-AMP bind 2 times more strongly to montmorillonite 22A than do 2(prime)-d-5(prime)-CMP and 5(prime)-TMP. The dinucleotide d(pG)2 forms in 9.2 percent yield and the cyclic dinucleotide c(dpG)2 in 5.4 percent yield in the reaction of 2(prime)-d-5(prime)-GMP with EDAC in the presence of montmorillonite 22A. The yield of dimers which contain the phosphodiester bond decreases as the reaction medium is changed from 0.2 M NaCl to a mixture of 0.2 M NaCl and 0.075 M $MgCl_2$. A low yield of d(pA)2 was observed in the condensation reaction of 5(prime)-ImdpA on montmorillonite 22A. The yield of d(pA)2 obtained when EDAC is used as the condensing agent increases with increasing iron content of the Na(+)-montmorillonite used as catalyst. Evidence is presented which shows that the acidity of the Na(+)-montmorillonite is a necessary but not sufficient factor for the montmorillonite catalysis of phosphodiester bond formation. Author

A91-18943* Rockefeller Univ., New York, NY.
THE PHOTOCHEMICAL ORIGINS OF LIFE AND PHOTOREACTION OF FERROUS ION IN THE ARCHAEAN OCEANS
DAVID C. MAUZERALL (Rockefeller University, New York) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 293-302. Research supported by Rockefeller University. refs
(Contract NAGW-321)
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A general argument is made for the photochemical origins of life. A constant flux of free energy is required to maintain the organized state of matter called life. Solar photons are the unique source of the large amounts of energy probably required to initiate this organization and certainly required for the evolution of life to occur. The completion of this argument will require the experimental determination of suitable photochemical reactions. It is shown that biogenetic porphyrins readily photooxidize substrates and emit hydrogen in the presence of a catalyst. These results are consistent with the Granick hypothesis, which relates a biosynthetic pathway to its evolutionary origin. It has been shown that photoexcitation of ferrous ion at neutral pH with near ultraviolet light produces hydrogen with high quantum yield. This same simple system may reduce carbon dioxide to formaldehyde and further products. These reactions offer a solution to the dilemma confronting the Oparin-Urey-Miller model of the chemical origin of life. If carbon dioxide is the main form of carbon on the primitive earth, the ferrous photoreaction may provide the reduced carbon necessary for the formation of amino acids and other biogenic molecules. These results suggest that this progenitor of modern photosynthesis may have contributed to the chemical origins of life. Author

A91-18944* Alabama Univ., Birmingham.
WAS THERE A UNIVERSAL TRNA BEFORE SPECIALIZED TRNAS CAME INTO EXISTENCE?
JAMES C. LACEY, JR. and MARK P. STAVES (Alabama, University, Birmingham) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 303-308. refs
(Contract NAGW-1512)
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It is generally true that evolving systems begin simply and become more complex in the evolutionary process. For those who try to understand the origin of a biochemical system, what is required is the development of an idea as to what simpler system preceded the present one. A hypothesis is presented that a universal tRNA molecule, capable of reading many codons, may have preceded the appearance of individual tRNAs. Evidence seems to suggest that this molecule may have been derived from a common ancestor of the contemporary 5S rRNAs and tRNAs. Author

A91-18945
MAGNESIUM PORPHYRINS AS POSSIBLE PHOTOSENSITIZERS OF MACROERGIC PHOSPHATE BONDS FORMATION DURING PREBIOTIC EVOLUTION
N. V. GONCHAROVA (AN SSSR, Institut Biokhimii, Moscow, USSR) and M. G. GOLDFELD (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 309-319. refs
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The paper presents experimental data on the light-induced ATP synthesis in the model systems containing chlorophyll adsorbates on aluminum or silicon oxides. The mechanism of phosphorylation observed in this system is based on the photosensitized electron transfer, where phosphate ion plays the role of an electron donor. Chlorophyll is a representative of magnesium porphyrins, which are known as photosensitizers. The formation of magnesium porphyrins in the prebiotic conditions seems to be quite probable, e.g., as a result of volcanic activity. During arising of life, magnesium porphyrins could participate in the formation of macroergic phosphate bonds of the dehydrating agents, which are necessary for the synthesis of biologically significant compounds. Author

A91-18946
PROTOPORPHYRIN IX AS A POSSIBLE ANCIENT PHOTOSENSITIZER - SPECTRAL AND PHOTOCHEMICAL STUDIES
G. I. LOZOVAIA, A. A. SIVASH (AN USSR, Institut Botaniki, Kiev, Ukrainian SSR), and Z. MASINOVSKY (Ceskoslovenska Akademie Ved, Mikrobiologicky Ustav, Prague, Czechoslovakia) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 321-330. refs
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The absorption and fluorescence characteristics of PP IX and its complexes with human serum albumin (HSA) and basic proteinoid have been studied in parallel with their photochemical activity. The most significant change in the absorption spectrum of PP IX was the appearance of a new maximum at 455 (or 461) nm in the presence of HSA or proteinoid, respectively. Some changes in the physicochemical properties of PP IX in different microenvironments have been detected by changes in fluorescence emission and excitation spectra. The increase of fluorescence quantum yield resulting from the formation of PP IX complexes with HSA or proteinoid correlates with the increase of their photochemical activity. The results are discussed from the point of view of the early evolution of the photosynthetic apparatus. Author

A91-18947
GEOCHEMICAL CONSTRAINTS ON THE ORIGIN OF ORGANIC COMPOUNDS IN HYDROTHERMAL SYSTEMS
EVERETT L. SHOCK (Washington University, Saint Louis, MO) (International Society for the Study of the Origin of Life, Meeting, 6th, Prague, Czechoslovakia, July 3-8, 1989) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 3-4, 1990, p. 331-367. Research supported by the Petroleum Research

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It is proposed that abiotic synthesis of organic compounds occurs in metastable states. These states are permitted by kinetic barriers which inhibit the approach to stable equilibrium in the C-H-O-N system. Evidence for metastable equilibrium among organic compounds in sedimentary basins is reviewed, and further evidence is elucidated from hydrous pyrolysis experiments reported in the literature. This analysis shows that at hydrothermal conditions, organic compounds are formed or destroyed primarily through the oxidation/reduction reactions, and that the role of temperature is to lower the kinetic barriers to these reactions. These lines of evidence allow the development of a scenario in which abiotic synthesis can occur at hydrothermal conditions through the reduction of CO2 and N2. This scenario can be tested quantitatively with distribution of species calculations as functions of temperature, pressure, hydrogen fugacity, and initial composition. Author

A91-19817* Wistar Inst. of Anatomy and Biology, Philadelphia, PA.
NUCLEAR LAMINS DURING GAMETOGENESIS, FERTILIZATION AND EARLY DEVELOPMENT
G. G. MAUL (Wistar Institute of Anatomy and Biology, Philadelphia, PA) and G. SCHATTEN (Florida State University, Tallahassee) IN: Nucleocytoplasmic transport. Berlin, Springer-Verlag, 1986, p. 123-134. refs
(Contract NAG2-340; NIH-GM-21615; NIH-CA-10815; NIH-HD-12913; NIH-HD-363; NSF PCM-83-15900)
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The distribution of lamins (described by Gerace, 1978, as major proteins of nuclear envelope) during gametogenesis, fertilization, and early development was investigated in germ cells of a mouse (Mus musculus), an echinoderm (Lytechinus variegatus), and the surf clam (Spisula solidissima) was investigated in order to determine whether the differences detected could be correlated with differences in the function of cells in these stages of the germ cells. In order to monitor the behavior of lamins, the gametes and embryos were labeled with antibodies to lamins A, C, and B extracted from autoimmune sera of patients with scleroderma and Lupus erythematosus. Results indicated that lamin B could be identified in nuclear envelopes on only those nuclei where chromatin is attached and where RNA synthesis takes place. I.S.

A91-19949* Brown Univ., Providence, RI.
STRETCH-INDUCED PROSTAGLANDINS AND PROTEIN TURNOVER IN CULTURED SKELETAL MUSCLE
HERMAN H. VANDENBURGH, SOPHIA HATFALUDY, ISTVAN SOHAR, and JANET SHANSKY (Brown University; Miriam Hospital, Providence, RI; Szent-Gyorgyi Albert Orvostudomanyi Egyetem, Szeged, Hungary) American Journal of Physiology: Cell Physiology (ISSN 0363-6143), vol. 25, 1990, p. C232-C240. refs
(Contract NIH-AR-36266; NIH-RR-05818; NIH-AR-39998; NAG2-414)
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The purpose of the study is to determine whether mechanical stimulation of cultured muscle cells influences prostaglandin efflux rates and whether they are related to stretch-induced alterations in protein turnover rates. The materials and methods of the experiment, including cell cultures, mechanical stimulation, protein synthesis, and degradation assays are outlined, and emphasis is placed on the effect of short-term mechanical stimulation in basal medium prostaglandin efflux from cultured skeletal muscle and stretch-induced alterations in prostaglandins efflux in complete medium. The major finding of the study is that mechanical stimulation of tissue-cultured skeletal-muscle cells under conditions inducing skeletal-muscle hypertropy increases the efflux of PGE(2) and PGE(2-alpha) but not 6-keto-PGF(1-alpha), the prostacyclin product. V.T.

A91-19950* Brown Univ., Providence, RI.
METABOLIC ALTERATIONS INDUCED IN CULTURED SKELETAL MUSCLE BY STRETCH-RELAXATION ACTIVITY
SOPHIA HATFALUDY, JANET SHANSKY, and HERMAN H. VANDENBURGH (Brown University; Miriam Hospital, Providence, RI) American Journal of Physiology: Cell Physiology (ISSN 0363-6143), vol. 25, 1989, p. C175-C181. refs
(Contract NIH-AR-36266; NAG2-414)
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Muscle cells differentiated in vitro are repetitively stretched and relaxed in order to determine the presence of short- and long-term alterations occurring in glucose uptake and lactate efflux that are similar to the metabolic alterations occurring in stimulated organ-cultured muscle and in vivo skeletal muscle during the active state. It is observed that whereas mechanical stimulation increases these metabolic parameters within 4-6 h of starting activity, unstimulated basal rates in control cultures also increase during this period of time, and by 8 h, their rates have reached or exceeded the rates in continuously stimulated cells. Measurements of these parameters in media of different compositions show that activity-induced long-term alterations in the parameters occur independently of growth factors in serium and embryo extracts. V.T.

A91-20194* Miriam Hospital, Providence, RI.
LONGITUDINAL GROWTH OF SKELETAL MYOTUBES IN VITRO IN A NEW HORIZONTAL MECHANICAL CELL STIMULATOR
HERMAN H. VANDENBURGH and PATRICIA KARLISCH (Miriam Hospital; Brown University, Providence, RI) In Vitro Cellular and Developmental Biology (ISSN 0883-8364), vol. 25, July 1989, p. 607-616. refs
(Contract NIH-AR-36266; NAG2-414)
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A tissue-culture model system for growing skeletal-muscle cells under more dynamic conditions than found in normal tissue-culture environments is described. A computerized device presented allows mechanical stimulation of the cell's substratum by 300 to 400 pct in length in the horizontal plane. Cell growth rates and skeletal-muscle organogenesis are stimulated in this in vitro system. It is noted that longitudinal myotube growth observed is accompanied by increased rates of cell proliferation and myoblast fusion. Prestretching the collagen-coated substratum before cell plating is shown to lead to increased cell proliferation, myotube orientation, and longitudinal myotube growth. The effects of substratum stretching on myogenesis in the model system are also assessed and attributed to alterations in the cell's extracellular matrix. V.T.

A91-20198* Florida State Univ., Tallahassee.
LATRUNCULIN INHIBITS THE MICROFILAMENT-MEDIATED PROCESSES DURING FERTILIZATION, CLEAVAGE AND EARLY DEVELOPMENT IN SEA URCHINS AND MICE
GERALD SCHATTEN, HEIDE SCHATTEN, CHRISTI CLINE (Florida State University, Tallahassee), ILAN SPECTOR (New York, State University, Stony Brook), NEIDHARD PAWELETZ (Deutsches Krebsforschungszentrum, Heidelberg, Federal Republic of Germany) et al. Experimental Cell Research (ISSN 0014-4827), vol. 166, 1986, p. 191-208. Research supported by NIH, NSF, DFG, et al. refs
(Contract NAG2-340)
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A91-20199* Georgia State Univ., Atlanta.
PROCESSING OF FORM STIMULI PRESENTED UNILATERALLY IN HUMANS, CHIMPANZEES (PAN TROGLODYTES), AND MONKEYS (MACACA MULATTA)
WILLIAM D. HOPKINS, DAVID A. WASHBURN, and DUANE M. RUMBAUGH (Georgia State University; Emory University, Atlanta) Behavioral Neuroscience (ISSN 0735-7044), vol. 104, Aug. 1990, p. 577-582. refs
(Contract NAG2-438; NIH-RR-00165)
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Visual forms were unilaterally presented using a video-task paradigm to ten humans, chimpanzees, and two rhesus monkeys to determine whether hemispheric advantages existed in the processing of these stimuli. Both accuracy and reaction time served as dependent measures. For the chimpanzees, a significant right hemisphere advantage was found within the first three test sessions. The humans and monkeys failed to show a hemispheric advantage as determined by accuracy scores. Analysis of reaction time data revealed a significant left hemisphere advantage for the monkeys. A visual half-field x block interaction was found for the chimpanzees, with a significant left visual field advantage in block two, whereas a right visual field advantage was found in block four. In the human subjects, a left visual field advantage was found in block three when they used their right hands to respond. The results are discussed in relation to recent reports of hemispheric advantages for nonhuman primates. Author

A91-20218* Florida State Univ., Tallahassee.
BEHAVIOR OF CENTROSOMES DURING FERTILIZATION AND CELL DIVISION IN MOUSE OOCYTES AND IN SEA URCHIN EGGS
HEIDE SCHATTEN, GERALD SCHATTEN, RON BALCZON, CALVIN SIMERLY (Florida State University, Tallahassee), and DANIEL MAZIA (Stanford University, Pacific Grove, CA) National Academy of Sciences, Proceedings (ISSN 0027-8424), vol. 83, Jan. 1986, p. 105-109. refs
(Contract NAG2-340; NIH-HD-12913; NIH-HD-363; NIH-HD-7098; NSF PCM-81-04467; NSF PCM-83-15900)
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The behavior of centrosomes during the stages of fertilization and cell division in mouse oocytes and in sea urchin eggs was monitored in an immunofluorescence microscope, using autoimmune centrosomal antiserum derived from a patient with scleroderma to label the centrosomal material. These observations showed that centrosomes reproduce during the interphase and aggregate and separate during cell mitosis. Results supported the hypothesis of Mazia (1984), who proposed that centrosomes are 'flexible bodies'. It was also found that, while the sea urchin centrosomes are paternally inherited as was initially proposed by Bovery (1904), the mouse centrosomes are of maternal origin. I.S.

N91-13841*# Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
LOCALIZE AND IDENTIFY THE GRAVITY SENSING MECHANISM OF PLANTS Final Technical Report, Aug. 1980 - Oct. 1989
ROBERT S. BANDURSKI 19 Nov. 1990 18 p
(Contract NAGW-0097)
(NASA-CR-187411; NAS 1.26:187411) Avail: NTIS HC/MF A03 CSCL 06C

The machinery by which a plant transduces the gravity stimulus into a growth response is localized and identified at the cellular level. The fact that a plant grows unequally on the lower side of a horizontally placed stem implies that there must be an asymmetric distribution of some of the chemical substances involved in the growth response. The three most likely chemicals to cause this growth were determined to be potassium, calcium, or the growth hormone, indole-3-acetic acid (IAA). IAA was chosen for this study and the results present a fairly complete understanding of the transduction of the gravity stimulus. Author

N91-13842*# National Aeronautics and Space Administration, Washington, DC.
BIOLOGICAL LIFE SUPPORT TECHNOLOGIES: COMMERCIAL OPPORTUNITIES
MARK NELSON, ed. and GERALD SOFFEN, ed. (Space Biospheres Ventures, Oracle, AZ.) Nov. 1990 117 p Workshop held in Tucson, AZ, 30 Oct. - 1 Nov. 1989
(NASA-CP-3094; NAS 1.55:3094) Avail: NTIS HC/MF A06 CSCL 06C

The papers from the workshop on Biological Life Support Technologies: Commercial Opportunities are presented. The meeting attracted researchers in environmental and bioregenerative systems. The role of biological support technologies was evaluated in the context of the global environmental challenge on Earth and the space exploration initiative, with its goal of a permanent space station, lunar base, and Mars exploration.

N91-13843*# Paine (Thomas) Associates, Los Angeles, CA.
BIOSPHERES AND SOLAR SYSTEM EXPLORATION
THOMAS O. PAINE *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 1-11 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The implications of biosphere technology is briefly examined. The exploration status and prospects of each world in the solar system is briefly reviewed, including the asteroid belt, the moon. and comets. Five program elements are listed as particularly critical for future interplanetary operations during the coming extra-terrestrial century. They include the following: (1) a highway to Space (earth orbits); (2) Orbital Spaceports to support spacecraft assembly, storage, repair, maintenance, refueling, launch, and recovery; (3) a Bridge Between Worlds to transport cargo and crews to the moon and beyond to Mars; (4) Prospecting and Resource Utilization Systems to map and characterize the resources of planets, moons, and asteroids; and (5) Closed Ecology Biospheres. The progress in these five field is reviewed. E.R.

N91-13844*# Space Biospheres Ventures, Oracle, AZ. Dept. of Research and Development.
HISTORICAL OVERVIEW OF THE BIOSPHERE 2 PROJECT
JOHN P. ALLEN *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 12-22 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

An extensive historical overview is given of the Biosphere 2 project. The overview begins in late 1969, as the moon landings commenced, when work began on ecological projects which laid the conceptual foundation for the current Biosphere 2 project. Continuing through to taking a complete functional suite of microbes together with their associated aquatic elements and an air volume and putting them inside a closed lab flask in which to measure the oxygen and CO2 levels, study energy flows and visually observe the changes therein. The laws of biospherics formulated by the author which can be tested in the Biosphere 2 project are listed. E.R.

N91-13845*# Space Biospheres Ventures, Oracle, AZ.
BIOSPHERE 2 TEST MODULE EXPERIMENTATION PROGRAM
ABIGAIL ALLING, LINDA S. LEIGH, TABER MACCALLUM, and NORBERTO ALVAREZ-ROMO *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 23-32 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The Biosphere 2 Test Module is a facility which has the capability to do either short or long term closures: five month closures with plants were conducted. Also conducted were investigations of specific problems, such as trace gas purification by bioregenerative systems by in-putting a fixed concentration of a gas and observing its uptake over time. In other Test Module experiments, the concentration of one gas was changed to observe what effects this has on other gases present or on the system. The science of biospherics which encompasses the study of closed biological systems provides an opening into the future in space as well as in the Earth's biosphere. E.R.

N91-13846*# Arizona Univ., Tucson. Environmental Research Lab.
SOIL BED REACTOR WORK OF THE ENVIRONMENTAL RESEARCH LAB. OF THE UNIVERSITY OF ARIZONA IN SUPPORT OF THE RESEARCH AND DEVELOPMENT OF BIOSPHERE 2
ROBERT FRYE *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 33-40 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

Research at the Environmental Research Lab in support of Biosphere 2 was both basic and applied in nature. One aspect of

the applied research involved the use of biological reactors for the scrubbing of trace atmospheric organic contaminants. The research involved a quantitative study of the efficiency of operation of Soil Bed Reactors (SBR) and the optimal operating conditions for contaminant removal. The basic configuration of a SBR is that air is moved through a living soil that supports a population of plants. Upon exposure to the soil, contaminants are either passively adsorbed onto the surface of soil particles, chemically transformed in the soil to usable compounds that are taken up by the plants or microbes as a metabolic energy source and converted to CO2 and water. Author

N91-13847*# Space Biospheres Ventures, Oracle, AZ. Dept. of Medical Operations.
BIOMEDICAL PROGRAM AT SPACE BIOSPHERES VENTURES
ROY WALFORD *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 41-44 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

There are many similarities and some important differences between potential health problems of Biosphere 2 and those of which might be anticipated for a space station or a major outpost on Mars. The demands of time, expense, and equipment would not readily allow medical evacuation from deep space for a serious illness or major trauma, whereas personnel can easily be evacuated from Biosphere 2 if necessary. Treatment facilities can be somewhat less inclusive, since distance would not compel the undertaking of heroic measures or highly complicated surgical procedures on site, and with personnel not fully trained for these procedures. The similarities are given between medical requirements of Biosphere 2 and the complex closed ecological systems of biospheres in space or on Mars. The major problems common to all these would seem to be trauma, infection, and toxicity. It is planned that minor and moderate degrees of trauma, including debridement and suturing of wounds, x ray study of fractures, will be done within Biosphere 2. Bacteriologic and fungal infections, and possibly allergies to pollen or spores are expected to be the commonest medical problem within Biosphere 2. E.R.

N91-13848*# National Aeronautics and Space Administration, Washington, DC.
THE NASA CELSS PROGRAM
MAURICE M. AVERNER *In its* Biological Life Support Technologies: Commercial Opportunities p 45-46 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The NASA Controlled Ecological Life Support System (CELSS) program was initiated with the premise that NASA's goal would eventually include extended duration missions with sizable crews requiring capabilities beyond the ability of conventional life support technology. Currently, as mission duration and crew size increase, the mass and volume required for consumable life support supplies also increase linearly. Under these circumstances the logistics arrangements and associated costs for life support resupply will adversely affect the ability of NASA to conduct long duration missions. A solution to the problem is to develop technology for the recycling of life support supplies from wastes. The CELSS concept is based upon the integration of biological and physico-chemical processes to construct a system which will produce food, potable water, and a breathable atmosphere from metabolic and other wastes, in a stable and reliable manner. A central feature of a CELSS is the use of green plant photosynthesis to produce food, with the resulting production of oxygen and potable water, and the removal of carbon dioxide. Author

N91-13849*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
THE CELSS BREADBOARD PROJECT: PLANT PRODUCTION
WILLIAM M. KNOTT *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 47-52 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

NASA's Breadboard Project for the Controlled Ecological Life Support System (CELSS) program is described. The simplified schematic of a CELSS is given. A modular approach is taken to building the CELSS Breadboard. Each module is researched in order to develop a data set for each one prior to its integration into the complete system. The data being obtained from the Biomass Production Module or the Biomass Production Chamber is examined. The other primary modules, food processing and resource recovery or waste management, are discussed briefly. The crew habitat module is not discussed. The primary goal of the Breadboard Project is to scale-up research data to an integrated system capable of supporting one person in order to establish feasibility for the development and operation of a CELSS. Breadboard is NASA's first attempt at developing a large scale CELSS. E.R.

N91-13850*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CELSS RESEARCH AND DEVELOPMENT PROGRAM
DAVID BUBENHEIM *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 53-59 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

Research in Controlled Ecological Life Support Systems (CELSS) conducted by NASA indicate that plant based systems are feasible candidates for human support in space. Ames has responsibility for research and development, systems integration and control, and space flight experiment portions of the CELSS program. Important areas for development of new methods and technologies are biomass production, waste processing, water purification, air revitalization, and food processing. For the plant system, the approach was to identify the flexibility and response time for the food, water, and oxygen production, and carbon dioxide consumption processes. Tremendous increases in productivity, compared with terrestrial agriculture, were realized. Waste processing research emphasizes recycle (transformation) of human wastes, trash, and inedible biomass to forms usable as inputs to the plant production system. Efforts to improve efficiency of the plant system, select new CELSS crops for a balanced diet, and initiate closed system research with the Crop Growth Research Chambers continue. The System Control and Integration program goal is to insure orchestrated system operation of the biological, physical, and chemical operation of the biological, physical, and chemical component processors of the CELSS. Space flight studies are planned to verify adequate operation of the system in reduced gravity or microgravity environments. Author

N91-13851*# Wolverton Environmental Services, Picayune, MS.
PLANTS AND THEIR MICROBIAL ASSISTANTS: NATURE'S ANSWER TO EARTH'S ENVIRONMENTAL POLLUTION PROBLEMS
B. C. WOLVERTON *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 60-65 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The utilization of higher plants and their associated microorganisms to solve environmental pollution problems on Earth and in future space applications is briefly reviewed. If man is sealed inside closed facilities, he becomes a polluter of the environment. It is also common knowledge to most people that man cannot survive on Earth without green photosynthesizing plants and microorganisms. Therefore, it is vitally important to have a better understanding of the interactions of man with plants and microorganisms. Biosphere 2 and other related studies presently being conducted or planned, hopefully, will supply data that will help save planet Earth from impending environmental disaster. The development of means to utilize both air and water pollution as a nutrient source for growing green plants is examined. Author

N91-13852*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, MS.
THE BIOHOME: A SPINOFF OF SPACE TECHNOLOGY
ANNE JOHNSON *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 66-71 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The discussion of the BioHome is prefaced with some information about the work done at the environmental lab over the past 15 years concerning environmental issues related to

biological life support such as the use of water hyacinths for wastewater purification, artificial marshes, indoor polluted air revitalization, and the reduction of organic contaminants using a biological system comprised of plants and microorganisms. One of the main concerns, especially with respect to a closed environment, is whether or not these systems are expelling microorganisms into the air. Analyses are being conducted to determine the numbers and types of microbes that are emitted. The BioHome is a 650 sq ft habitat that will enable the evaluation of the efficiency of bioregenerative technology in a closed system. This BioHome system is described and its functions discussed. E.R.

N91-13853*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
EARTH OBSERVING SATELLITE: UNDERSTANDING THE EARTH AS A SYSTEM
GERALD SOFFEN *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 72-87 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

There is now a plan for global studies which include two very large efforts. One is the International Geosphere/Biosphere Program (IGBP) sponsored by the International Council of Scientific Unions. The other initiative is Mission to Planet Earth, an unbrella program for doing three kinds of space missions. The major one is the Earth Observation Satellite (EOS). EOS is large polar orbiting satellites with heavy payloads. Two will be placed in orbit by NASA, one by the Japanese and one or two by ESA. The overall mission measurement objectives of EOS are summarized: (1) the global distribution of energy input to and energy output from the Earth; (2) the structure, state variables, composition, and dynamics of the atmosphere from the ground to the mesopause; (3) the physical and biological structure, state, composition, and dynamics of the land surface, including terrestrial and inland water ecosystems; (4) the rates, important sources and sinks, and key components and processes of the Earth's biogeochemical cycles; (5) the circulation, surface temperature, wind stress, sea state, and the biological activity of the oceans; (6) the extent, type, state, elevation, roughness, and dynamics of glaciers, ice sheets, snow and sea ice, and the liquid equivalent of snow in the global cryosphere; (7) the global rates, amounts, and distribution of precipitation; and (8) the dynamic motions of the Earth (geophysics) as a whole, including both rotational dynamics and the kinematic motions of the tectonic plates. E.R.

N91-13854*# Space Industries, Inc., Houston, TX.
BUSINESS AND LIFE IN SPACE
JOSEPH ALLEN *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 88-95 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The life support systems in the machine called the Space Shuttle is discussed and later about life support systems in a little cocoon that is far smaller than the shuttle; the more common term is a space suit. E.R.

N91-13855*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
A PERSONAL HISTORY OF THE HUMAN EXPLORATION INITIATIVE WITH COMMENTARY ON THE PIVOTAL ROLE FOR LIFE SUPPORT RESEARCH
WENDELL MENDELL *In* NASA, Washington, Biological Life Support Technologies: Commercial Opportunities p 96-104 Nov. 1990
Avail: NTIS HC/MF A06 CSCL 06C

The author relates the history of the human exploration initiative from a personal perspective from the 1961 J. F. Kennedy initiative to land a man on the moon up to 1986 when a memo was circulated from NASA Headquarters to its employees which stated as a major goal the expansion of the human presence beyond Earth into the solar system. The pivotal role of life support research is woven into this personalized history. E.R.

N91-13856*# Sverdrup Technology, Inc., Huntsville, AL. Materials and Processing Dept.
MICROBIAL ECOLOGY LABORATORY PROCEDURES MANUAL NASA/MSFC Final Report
TIMOTHY L. HUFF Sep. 1990 77 p
(Contract NAS8-37814)
(NASA-CR-184033; NAS 1.26:184033) Avail: NTIS HC/MF A05 CSCL 06C

An essential part of the efficient operation of any microbiology laboratory involved in sample analysis is a standard procedures manual. The purpose of this manual is to provide concise and well defined instructions on routine technical procedures involving sample analysis and methods for monitoring and maintaining quality control within the laboratory. Of equal importance is the safe operation of the laboratory. This manual outlines detailed procedures to be followed in the microbial ecology laboratory to assure safety, analytical control, and validity of results. Author

N91-13857*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
BIOFILM MONITORING COUPON SYSTEM Patent Application
RICHARD L. SAUER, inventor (to NASA) and DAVID T. FLANAGAN, inventor (to NASA) (Krug International, Houston, TX.) 14 Mar. 1990 15 p
(NASA-CASE-MSC-21585-1; NAS 1.71:MSC-21585-1; US-PATENT-APPL-SN-493529) Avail: NTIS HC/MF A03 CSCL 06C

An apparatus and method is disclosed for biofilm monitoring of a water distribution system which includes the mounting of at least one fitting in a wall port of a manifold in the water distribution system with a passage through the fitting in communication. The insertion of a biofilm sampling member is through the fitting with planar sampling surfaces of different surface treatment provided on linearly arrayed sample coupons of the sampling member disposed in the flow stream in edge-on parallel relation to the direction of the flow stream of the manifold under fluid-tight sealed conditions. The sampling member is adapted to be aseptically removed from or inserted in the fitting and manifold under a positive pressure condition and the fitting passage sealed immediately thereafter by appropriate closure means so as to preclude contamination of the water distribution system through the fitting. The apparatus includes means for clamping the sampling member and for establishing electrical continuity between the sampling surfaces and the system for minimizing electropotential effects. The apparatus may also include a plurality of fittings and sampling members mounted on the manifold to permit extraction of the sampling members in a timed sequence throughout the monitoring period. NASA

N91-13858# Oak Ridge National Lab., TN. Health and Safety Research Div.
INORGANIC CONCEPTS RELEVANT TO METAL BINDING, ACTIVITY, AND TOXICITY IN A BIOLOGICAL SYSTEM
JAMES D. HOESCHELE (Parke-Davis Pharmaceutical Co., Ann Arbor, MI.), JAMES E. TURNER, and M. WENDY ENGLAND 1990 27 p Presented at the 4th International Workshop on QSAR in Environmental Toxicology, Veldhoven, Netherlands, 16-20 Sep. 1990
(Contract DE-AC05-84OR-21400)
(DE91-001489; CONF-9009278-1) Avail: NTIS HC/MF A03

The purpose of this paper is to review selected physical and inorganic concepts and factors which might be important in assessing and/or understanding the fact and disposition of a metal system in a biological environment. Hopefully, such inquiries will ultimately permit us to understand, rationalize, and predict differences and trends in biological effects as a function of the basic nature of a metal system and, in optimal cases, serve as input to a system of guidelines for the notion of 'Chemical Dosimetry'. The plan of this paper is to first review, in general terms, the basic principles of the Crystal Field Theory (CFT), a unifying theory of bonding in metal complexes. This will provide the necessary theoretical background for the subsequent discussion of selected concepts and factors. DOE

N91-13859# Brookhaven National Lab., Upton, NY.
CALCIFIED-TISSUE INVESTIGATIONS USING SYNCHROTRON X RAY MICROSCOPY
K. W. JONES, P. SPANNE, G. SCHIDLOVSKY, XUE DEJUN, R. S. BOCKMAN, M. B. RABINOWITZ, P. B. HAMMOND, R. L. BORNSCHEIN, and D. A. HOELTZEL (Columbia Univ., New York, NY.) Oct. 1990 8 p Presented at the X Ray Microscopy Conference, London, England, 3-7 Sep. 1990 Sponsored in part by Jaffin Foundation
(Contract DE-AC02-76CH-00016; NIEHS-ES0156611; NIH-RR-01838; NIH-CA-38645; NIH-H-08945; NIH-HD-17047; NIH-HD-20381; NIH-ES-00138; NIH-HD-18655)
(DE91-001729; BNL-44730; CONF-9009235-2) Avail: NTIS HC/MF A02

Synchrotron x ray microscopy (SXRM) in both emission and absorption modes has been used to examine elemental distributions in specimens of rat tibia, human deciduous teeth, and an orthopedic implant phantom. The work was performed with a spatial resolution of 8 microns for the emission work and 25 microns for the absorption work. The results illustrate the usefulness of SXRM for measurements of different types of calcified tissue. DOE

N91-13860*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THREE-DIMENSIONAL CELL TO TISSUE ASSEMBLY PROCESS Patent Application
DAVID A. WOLF, inventor (to NASA), RAY P. SCHWARZ, inventor (to NASA), MARIAN L. LEWIS, inventor (to NASA), JOHN H. CROSS, inventor (to NASA), and MARY H. HULS, inventor (to NASA) (Krug International, Houston, TX.) 2 Mar. 1989 55 p
(NASA-CASE-MSC-21559-1; NAS 1.71:MSC-21559-1; US-PATENT-APPL-SN-317776) Avail: NTIS HC/MF A04 CSCL 06C

The present invention relates a 3-dimensional cell to tissue and maintenance process, more particularly to methods of culturing cells in a culture environment, either in space or in a gravity field, with minimum fluid shear stress, freedom for 3-dimensional spatial orientation of the suspended particles and localization of particles with differing or similar sedimentation properties in a similar spatial region. NASA

N91-14700*# Center for Blood Research, Boston, MA.
INITIAL BLOOD STORAGE EXPERIMENT
DOUGLAS MACN. SURGENOR 1 Apr. 1988 445 p Prepared in cooperation with Little (Arthur D.), Inc., Boston, MA; Childrens Hospital Medical Center, Boston, MA; Lahey Clinic Medical Center, Boston, MA and Massachusetts Univ., Boston
(Contract NAS9-17222)
(NASA-CR-185513-PT-1; NAS 1.26:185513-PT-1) Avail: NTIS HC/MF A19 CSCL 06/3

The design of the Initial Blood Storage Experiment (IBSE) was based upon a carefully controlled comparison between identical sets of human blood cell suspensions - red cells, white cell, and platelets - one set of which was transported aboard the Columbia on a 6 day 11 hour mission, and the other held on the ground. Both sets were carried inside stainless steel dewars within specially fabricated flight hardware. Individual bags of cell suspensions were randomly assigned with respect to ground vs orbit status, dewar chamber, and specific location within the dewar. To foster optimal preservation, each cell type was held under specific optimal conditions of pH, ionic strength, solute concentration, gas tension, and temperature. An added variable in this initial experiment was provided by the use of three different polymer/plasticizer formulations for the sealed bags which held the blood cells. At termination of the experiment, aliquots of the suspensions, identified only by code, were distributed to be assayed. Assays were selected to constitute a broad survey of cellular properties and thereby maximize the chances of detection of gravitational effects. A total of 74 different outcome measurements were reported for statistical analysis. When the measurements were completed, the results were entered into the IBSE data base, at which time the data were matched with the original blood bag numbers to determine their status with respect to polymer/plasticizer type, orbit status (orbit or ground), and storage position within the experimental hardware. The data were studied by analysis of variance. Initially, type of bag and orbital status were main factors; later more detailed analyses were made on specific issues such as position in the hardware and specific plastic. If the analysis of variance indicated a statistical significance at the 5 percent level the corresponding p-value was reported. Author

N91-14701*# Center for Blood Research, Boston, MA.
INITIAL BLOOD STORAGE EXPERIMENT
DOUGLAS MACN. SURGENOR 1 Apr. 1988 301 p Prepared in cooperation with Little (Arthur D.), Inc., Boston, MA; Childrens Hospital Medical Center, Boston, MA; Lahey Clinic Medical Center, Boston, MA and Massachusetts Univ., Boston
(Contract NAS9-17222)
(NASA-CR-185513-PT-2; NAS 1.26:185513-PT-2) Avail: NTIS HC/MF A14 CSCL 06/3

The possibility of conducting experiments with the formed elements of the blood under conditions of microgravity opens up important opportunities to improve the understanding of basic formed element physiology, as well as, contribution to improved preservation of the formed elements for use in transfusion. The physiological, biochemical, and physical changes of the membrane of the erythrocyte, platelet, and leukocyte was studied during storage under two specific conditions: standard blood bank conditions and microgravity, utilizing three FDA approved plastic bags. Storage lesions; red cell storage on Earth; platelet storage on Earth; and leukocyte storage Earth were examined. The interaction of biomaterials and blood cells was studied during storage. B.G.

N91-14702*# Washington Univ., Saint Louis, MO. Dept. of Pharmacology.
COSMOS 2044 Final Report
OLIVER H. LOWRY, IGOR KRASNOV, E. ILYINA KAKUEVA, PATTI M. NEMETH, DAVID B. MCDOUGAL, JR., RATI CHOKSI, JOYCE G. CARTER, MAGGIE M. Y. CHI, JILL K. MANCHESTER, and MARY ELLEN PUSATERI 14 Sep. 1990 51 p
(Contract NAG2-615)
(NASA-CR-187003; NAS 1.26:187003) Avail: NTIS HC/MF A04 CSCL 06/3

The effects of microgravity and hind limb suspension on the enzyme patterns are assessed within a slow twitch muscle (soleus) and a fast twitch muscle (tibialis anterior). Studies were made on 95 soleus fibers and about 300 tibialis anterior (TA) fibers. Over 2200 individual enzyme measurements were made. Six key metabolic enzymes (hexokinase, pyruvate kinease, citrate kinase, beta-hydroxyacyl CoA dehydrogenase, glucose-6-P dehydrogenase, and aspartate aminotransferase) plus glutaminase and glutamate decarboxylase, as well as glutamate, aspartate, and GABA, were measured in 11 regions of the hippocampal formation of synchronous, flight, and tail suspension rats. Major differences were observed in the normal distribution of each enzyme and amine acid, but no substantive effects of either microgravity or tail suspension on these patterns were clearly demonstrated. B.G.

N91-14703* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
BIO-REACTOR CHAMBER Patent
JOSEPH A. CHANDLER, inventor (to NASA) 13 Jun. 1989 8 p Filed 20 Aug. 1987
(NASA-CASE-MSC-20929-1; US-PATENT-4,839,046; US-PATENT-APPL-SN-087358; US-PATENT-CLASS-210-355; US-PATENT-CLASS-210-414; US-PATENT-CLASS-435-311; US-PATENT-CLASS-435-316; INT-PATENT-CLASS-B01D-29/04; INT-PATENT-CLASS-B01D-29/42) Avail: US Patent and Trademark Office CSCL 06/2

A bioreactor for cell culture is disclosed which provides for the introduction of fresh medium without excessive turbulent action. The fresh medium enters the bioreactor through a filter with a backwash action which prevents the cells from settling on the

filter. The bioreactor is sealed and depleted medium is forced out of the container as fresh medium is added.
Official Gazette of the U.S. Patent and Trademark Office

N91-14704# Princeton Univ., NJ.
BIOREACTIVITY: STUDIES ON A SIMPLE BRAIN STEM REFLEX IN BEHAVING ANIMALS Final Report, 1 Jun. 1987 - 31 May 1990
BARRY L. JACOBS 10 Aug. 1990 7 p
(Contract AF-AFOSR-0301-87; AF PROJ. 2312)
(AD-A226823; AFOSR-90-0967TR) Avail: NTIS HC/MF A02 CSCL 06/5

A major problem in attempting to understand complex physiological processes, such as brain neuromodulation, or complex behavioral processes, such as arousal, is finding a simple system that will permit such analyses. The brain stem masseteric (jaw closure) reflex in cats is such a system. It is simple, containing only one synapse in the brain, and receives dense inputs from two neurochemical systems important in neuromodulation and arousal. Initial pharmacologic studies showed that locally applied norepinephrine facilitated the reflex response. More importantly, physiologic conditions, known to activate the brain norepinephrine system, also facilitated the response. This latter finding was shown to be causal, rather than correlative, by a study which found that the facilitation could be blocked by prior destruction of the norepinephrine input specifically to the reflex circuitry. These data represent the first definitive example of an activational effect in an intact and behaving organism being attributable to a particular central neurotransmitter acting at a specific brain site. GRA

N91-14705# Naval Medical Research Inst., Bethesda, MD.
DEVELOPMENT OF AN ANIMAL MODEL OF HUMAN NON-FREEZING COLD INJURY: CHANGES IN THERMAL SENSITIVITY FOLLOWING COLD EXPOSURE Technical Report, Oct. 1988 - Sep. 1989
STEPHEN T. AHLERS, JOHN R. THOMAS, KARL F. VANORDEN, JOHN SCHROT, and MARK P. MCANDREW 17 Aug. 1990 17 p
(AD-A227174; NMRI-90-63) Avail: NTIS HC/MF A03 CSCL 06/10

Non-freezing cold injury (NFCI) is a debilitating injury that results from damage to peripheral tissues exposed to cold temperatures for a prolonged period of time. NFCI continues to be a major operational hazard for personnel who must perform in cold environments. Despite considerable research, the mechanisms underlying NFCI have remained elusive. The objective of the research described represents the initial efforts to develop an animal model that adequately reflects the symptomatology observed in human NFCI. A salient feature in the post cold exposure manifestation of NFCI in humans is that, following an initial period of sensation loss in the affected limb, an increased, often permanent, thermal sensitivity develops. This is one of the more debilitating aspects of NFCI since personnel are unable to tolerate even minor alterations in temperature of the hands or feet and are thus greatly restricted from performing in inclement weather conditions. Thermal sensitivity was measured in the tail of adult rats before and after the tail and a portion of the hind flank were exposed to cold (1 to 4 C) or warm (28 C) water for one to nine hours. GRA

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AEROSPACE MEDICINE

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

A91-17028
SUPPRESSION OF OPTOKINETIC VELOCITY STORAGE IN HUMANS BY STATIC TILT IN PITCH
S. H. LAFORTUNE, D. J. IRELAND, and R. M. JELL (Manitoba, University, Winnipeg, Canada) Journal of Vestibular Research (ISSN 0957-4271), vol. 1, 1990, p. 3-12. Research supported by the Medical Research Council of Canada and Winnipeg Health Sciences Centre. refs
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The effects of static tilts about the pitch axis on human horizontal optokinetic afternystagmus OKAN (HOKAN) were examined. Static tilts in pitch produced tilt-dependent HOKAN suppression. The slow decay (indirect pathway) component (coefficient C and long time constant 1/D) of the two-component model for OKAN was significantly reduced, while the short decay (direct pathway) component (coefficient A and short time constant 1/B) remained invariant as angle of tilt was increased. These results provide further evidence that otolith organ activity can couple to horizontal velocity storage in humans, in accordance with models proposed in the literature. Author

A91-17686* Kansas State Univ., Manhattan.
EMG ANALYSIS OF HUMAN POSTURAL RESPONSES DURING PARABOLIC FLIGHT MICROGRAVITY EPISODES
CHARLES S. LAYNE and BRIAN S. SPOONER (Kansas State University, Manhattan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 994-998. refs
(Contract NAGW-1197)
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Anticipatory postural activity in the trunk and legs precedes rapid shoulder flexion in unit gravity. The hypothesis that anticipatory activity is a component of a single neural command for arm movement was tested by monitoring the surface electromyographic activity of the biceps femoris, paraspinals, and deltoid muscles of three subjects during the microgravity phase of parabolic flight. If part of a single command, anticipatory postural activity would be expected to remain intact despite the absence of the body's center of gravity in a reduced gravity environment. However, in at least 75 percent of the microgravity trials anticipatory biceps femoris activity was absent, indicating a separation of postural and agonist muscle activity. Such a finding suggests that anticipatory postural biceps femoris activity may be initiated independently of agonist (deltoid) activity. Author

A91-17687
FLIGHT INFLUENCE ON THE PLASMA LEVEL OF RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM AND ATRIAL NATRIURETIC PEPTIDE
YU-MIN WANG and DONG-YUN SHENG (Lanzhou Air Force Hospital, People's Republic of China) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 999-1001. refs
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Plasma levels of the renin-angiotensin-aldosterone system (RAAS) and atrial natriuretic peptide (ANP) were studied in healthy male pilots, and in a ground crew control group. Plasma concentrations of angiotensin I (A I), angiotensin II (A II) and aldosterone (Aldo) were measured in the pilots before and after flight by radioimmunoassay. Results showed that the plasma concentrations of A I, A II, and Aldo were much higher after flight than before flight, and were different from samples taken from the control group. On the other hand, the ANP levels in the pilot group did not differ significantly from the control group, before or after flight. There was no significant difference of the four hormones within the control group over the course of the study. This suggests that the development of hypertension in pilots may relate to the reaction of the RAAS. Author

A91-17692
USE OF PHENYTOIN IN THE PREVENTION OF MOTION SICKNESS
WILLIAM CHELEN, MATTHEW KABRISKY, CHARLES HATSELL, ROGELIO MORALES, EDWARD FIX (USAF, Institute of Technology and Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) et al. Aviation, Space,

and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1022-1025. refs
Copyright

In a placebo-controlled double-blind crossover pilot study of acute Coriolis-induced motion sickness treatment/prevention in humans employing an anticonvulsant dose of phenytoin, a mean increase in tolerance to motion stress from 4.87 min (S.D. = 5.55) to 46.87 min (S.D. = 32.6) was obtained. This represents a greater than fourfold improvement in efficacy over any currently available single agent and is more than twice as effective as the scopolamine/dexadrine combination. There were none of the usual side effects of blurred vision, dizziness, dry mouth, or sedation. Author

A91-17693
A CASE OF DECOMPRESSION SICKNESS AT 2,437 METERS (8,000 FEET)
FREDERICK W. RUDGE (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1026, 1027. refs
Copyright

Among aviators, decompression sickness is a condition that occurs almost exclusively at altitudes above 6,098 m (20,000 ft). Several reports have been published describing the development of decompression sickness after altitude exposures of 3,049 to 4,878 m (10,000-16,000 ft). In most of these cases, the affected individual had a previous history of pain in the involved area due to prior trauma or surgery, or had other risk factors for decompression sickness, such as obesity. Few of these reports have confirmed the presence of decompression sickness by a test of pressure. A case is reported here of multiple joint pains developing after a rapid decompression at 2,439 m (8,000 ft), which improved during descent and rapidly resolved with recompression therapy. There was no prior history of joint pain, trauma, or diving. A brief discussion of decompression sickness is included. Author

A91-17694
THE RISK OF DEVELOPMENT DECOMPRESSION SICKNESS DURING AIR TRAVEL FOLLOWING ALTITUDE CHAMBER FLIGHT
WALTER L. RUSH and SALIMI A. WIRJOSEMITO (USAF, Medical Center, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1028-1031. refs
Copyright

Approximately 35,000 students are trained anually in United States Air Force (USAF) altitude chambers. Students who depart the training site via aircraft on the same day as their altitude chamber exposure may place themselves at increased risk for decompression sickness (DCS). Air travel as a passanger in the immediate postchamber flight period is unrestricted by current USAF regulations. A retrospective study was conducted to assess the potential risk involved in such postchamber flight travel. During the years 1982-87, there were 292 cases of DCS involving altitude chamber students which were subsequently treated with hyperbaric oxygen therapy. Only seven cases were found wherein the student was asymptomatic prior to air travel and subsequently developed DCS. Because the percentage of students who postpone travel is unknown, a precise relative risk could not be determined. Although the number of cases where sequential chamber and aircraft hypobaric exposure has initiated DCS is small, the potential for such occurrences remains a health concern. Author

A91-17695
EXPOSURE TO SOLAR ULTRAVIOLET RADIATION IN FLIGHT
B. L. DIFFEY (Dryburn Hospital, Durham, England) and A. H. ROSCOE (Britannia Airways, Ltd., Luton, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1032-1035. refs
Copyright

The ultraviolet radiation (UVR) exposure of airline pilots during flight was measured with ultraviolet-sensitive film badges. The badges were worn by flight crew on the epaulette nearest to the window of either a Boeing 737 or 767 during 18 different flights in 1989. The results showed in every case that the UVR exposure was negligible; a flight lasting several hours resulted in an exposure equivalent to no more than a minute or two outdoors. There is anecdotal evidence that pilots may be at increased risk of developing skin cancer compared with many other occupational groups. The suggestion that this is due to significant exposure to UVR, the main aetiological factor in skin cancer, on the flight deck cannot be sustained. Author

A91-17696
THE AEROMEDICAL IMPLICATIONS OF ATRIAL FIBRILLATION
JOEL M. NEUTEL, DAVID H. G. SMITH, DAVID JANKELOW, JOHANNES J. L. PRETORIUS, and DIRK P. MYBURGH (Institute of Aviation Medicine, Pretoria, Republic of South Africa) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1036-1038. refs
Copyright

A retrospective study was undertaken to determine the incidence of spontaneous atrial fibrillation (AF) in a group of asymptomatic pilots. The electrocardiograms of 13,037 aircrew members accumulated between 1964 and 1986 were reviewed and those coded for AF were extracted. In each case an attempt was made to investigate factors relating to the onset, course, and prognosis of the AF. Eight subjects (mean age 50.1 years) were found to have AF. Of this group, two had a single isolated episode of AF for which a specific precipitating factor was implicated, three had recurrent paroxysmal AF of which one progressed to chronic persistent AF, and three had chronic persistent AF from the outset. The mean follow-up period for the eight subjects was 13.6 years. The two pilots who had isolated attacks of AF have thus far had no subsequent episodes of AF. Five of the remaining six have been completely well, while one required treatment for an embolus to his left leg. Concerning the aeromedical implications, it is recommended that pilots demonstrating single isolated episodes of AF in the presence of a normal heart, and in whom recovery is complete, should be allowed to return to full aviation duties on a wavier clause. Patients with chronic AF, lone AF, or paroxysmal AF should be excluded from all flying duties. Author

A91-17697
RETROSPECTIVE COHORT STUDY OF DUODENAL ULCER DISEASE IN U.S. AIR FORCE PILOTS
TERENCE J. LYONS (USAF, School of Aerospace Medicine, Brooks AFB, TX) and KATHLEEN WILSON (USAF, Medical Center, Lackland AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1039-1045. refs
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Current waiver policy for duodenal ulcer (DU) disease in pilots is based on data from civilian populations since little information is available on the course and prognosis of this disease in pilots. The USAF waiver file and the Office of Medical Support database were used to identify 100 pilots with onset of DU between 1981 and 1987. A written questionnaire was returned by 86 of these pilots. The incidence of DU in USAF active-duty pilots was estimated to be 5.0 per 10,000 pilot-years. DU was significantly associated with cigarette smoking. Bleeding ulcers were significantly associated with aspirin use. After 587 person-years of follow-up there were no fatalities; serious sequelae were reported in only 6 pilots, and moderate sequelae in only 12 others. The risk of recurrence of DU in this population was not appreciably higher among those initially presenting with hemorrhage. Author

A91-17698
THE ELECTROCARDIOGRAPHIC RESPONSE OF FEMALES TO CENTRIFUGE +GZ STRESS
ANGELA M. WHINNERY (USAF, McGuire AFB, NJ) and JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 1046-1051. refs
Copyright

The influence of sex on the cardiovascular tolerance of humans to acceleration (+Gz) stress was investigated by comparing ECG responses to centrifuge +Gz stress observed in 94 to those of 685 men, using data existing within a centrifuge data repository. It was found that female subjects had less atrial ectopy. There was less frequent occurrence of ventricular and supraventricular tachycardia; essentiallly equivalent premature ventricular contractions (PVCs), multiformed PVCs, and paired PVCs; and more frequent PVCs in a bigeminal pattern as well as more frequent occurrence of a PVC falling on any part of the T-wave of the preceding sinus beat. Male subjects exhibited more frequent sinus arrhythmia, sinus bradycardia, and increased T-wave post +Gz stress. Ectopic atrial rhythm and atrioventricular dissociation were similar in males and females. Women who participated in either simulated aerial combat maneuver-type centrifuge or in centrifuge high-G training showed ECG changes similar to those of men.
I.S.

A91-17885
THE TRANSFER OF ADAPTATION BETWEEN ACTUAL AND SIMULATED ROTARY STIMULATION
THOMAS G. DOBIE (U.S. Navy, Naval Biodynamics Laboratory, New Orleans; New Orleans, University, LA), JAMES G. MAY, CAROLINA GUTIERREZ, and SHERRYL SCOTT HELLER (New Orleans, University, LA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1085-1091. refs
(Contract N00205-89-M-B449)

The cross-protective effects of rotary-motion-specific adaptation acquired during exposures to either actual bodily motion or visually-induced apparent motion were investigated together with the effect of the direction of motion. Subjects were pretested and posttested on measures of disorientation after active bodily rotation in either clockwise or counterclockwise direction or after visually-induced self-vection in either directions. It was found that repeated exposures to bodily rotation resulted in increased tolerance to visually-induced rotation, while exposures to visually-induced self-vection did not produce greater tolerance to bodily rotation. No evidence was found of directional specificity.
I.S.

A91-17888
DISTRIBUTION OF COMMON CAROTID BLOOD FLOW, MEASURED BY DOPPLER, IN MAN AT HIGH ALTITUDE
O. BAILLIART (Paris V, Universite, France), P. BONNIN, H. NORMAND, H. MAROTTE, and E. VARGAS Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1102-1106. Research sponsored by Ministere des Affaires Etrangeres and CNRS. refs

The aim of the work was to estimate the possible changes induced by high altitude in the distribution of the common carotid arterial blood flow toward the internal and external carotid arteries. Common carotid blood flow and internal and external blood velocities were measured in 20 lowlanders at sea level, in five of them over a 3-week period at 3800 m, and in 20 permanent residents of this high altitude. Internal and external blood velocities were recorded with a continuous Doppler, and blood flow was recorded by range-gated Doppler velocimeter. Common carotid blood flow was 15 percent higher in all subjects exposed to high altitude due to a lowering in downstream vascular resistance, since systemic blood pressure did not change at high altitude. The increase of blood flow in the common carotid was the result of a rise mainly in the external carotid blood flow. Author

A91-17889
PULMONARY BLOOD FLOW DISTRIBUTION IN ERECT MAN IN AIR AND DURING BREATHHOLD DIVING
V. LOPEZ-MAJANO (Cook County Hospital, Chicago, IL), P. G. DATA, B. LOSSREDO (Chieti, Universita, Italy), R. MARTIGNONI (Ospedale S. S. Liberatore, Atri, Italy), and M. ARBORELIUS, JR. (Lund, Universitet, Malmo, Sweden) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1107-1115. refs

Intravenously administered 99m Tc-labelled macroaggregates and a gamma camera attached to a computer were used for measuring distribution of pulmonary blood flow per unit lung volume in eight healthy subjects sitting erect in air and also during breathhold diving to 1 or 10 m of depth. Distribution of perfusion was measured in the supine position, and substituted regional lung volume was measured with regional perfusion in the supine for calculating regional perfusion per lung volume erect in air and during diving. The perfusion per unit lung increased rectilinearly down the lung in subjects below 30 years of age but decreased in the lowermost regions in older subjects. This decrease showed a strong correlation to closing capacity. An age-related decrease in transpulmonary pressure may influence both basal perfusion and closing capacity. During submersion, perfusion became equal in all regions with the exception of the lung apex which became hyperperfused. Redistribution was the same at surface (1 m of depth) with the lung volume being close to total lung capacity and at 10 m of depth when lung volume was compressed to functional residual capacity. During breathhold diving, high intrapulmonary blood volume and pressure became more important for blood flow distribution than gravity or lung volume, while differences in regional hypoxic vasoconstriction and in transpulmonary pressure seem to explain interindividual variation.
Author

A91-17893
FLYING AFTER DIVING GUIDELINES - A REVIEW
PAUL J. SHEFFIELD (USAF, Office of Surgeon General, Bolling AFB, DC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1130-1138. refs

Recreational divers face a difficult choice when trying to select the appropriate surface interval between diving and flying. A literature review revealed that proposed surface intervals ranged from zero to 24 h, but few were human-tested. On February 24, 1989, the Undersea and Hyperbaric Medical Society Workshop formalized guidelines for recreational divers. Do not go to the maximum exposures allowed by the tables. For no-decompression dives: (1) with less than 2 h total dive time (surface to surface) during the previous 48 h, divers should wait 12 h before flying; (2) with multiday, unlimited diving, wait 24 h before flying. Recreational divers should not make dives that require decompression stops, but if such dives should occur, delay flying for at least 24 h and, if possible, for 48 h. Divers with decompression symptoms should not fly, unless it is required to obtain hyperbaric treatment. Author

A91-17894
DECOMPRESSION SICKNESS AFFECTING THE TEMPOROMANDIBULAR JOINT
FREDERICK W. RUDGE (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1139, 1140.

Two cases of pain-only decompression sickness of the temporomandibular joint following altitude chamber exposure are presented. A detailed interview of both individuals revealed no other joint involvement or other complaints. A careful neurologic examination failed to disclose abnormalities. In both cases, the pain resolved completely with compression therapy, supporting the diagnosis of decompression sickness. Decompression sickness limited to this small joint is extremely rare, and may be easily confused with other causes of joint pain. Author

A91-17895
NAVY HELICOPTER PILOT WITH A JUXTASELLAR MASS - CASE REPORT WITH AEROMEDICAL CONSIDERATIONS
JONATHAN B. CLARK, BRUCE K. BOHNKER, GERARD B. HAYES (Naval Aerospace Medical Institute, Pensacola, FL), and WILLIAM A. MOREY (U.S. Navy, Aerospace Medical Research Laboratory,

Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1141-1144. refs
Copyright

A Navy helicopter pilot was found to have a suprasellar mass during evaluation for primary infertility and mildly elevated prolactin level. Extensive evaluation revealed no other abnormalities. After 1 year of folloup without radiographic tumor enlargement, he was returned to flying duties with continuing medical monitoring. Aeromedical considerations for tumors in the juxtasellar region are reviewed, including neuroendocrine disorders, neuro-ophthalmologic defects, and neurological impairment. The impact of improved diagnostic capabilities on aeromedical disposition is discussed. Author

A91-17897
MILITARY PARACHUTE MISHAP FATALITIES - A RETROSPECTIVE STUDY
PAUL F. MELLEN (U.S. Army, Walter Reed Medical Center, Washington, DC) and STEVEN S. SOHN (Armed Forces Institute of Pathology, Washington, DC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1149-1152. refs
Copyright

Forty-nine military parachute accident fatalities occurring during 1964-1989 were studied. Causes of the accidents included accidental deployment of reserve parachute in aircraft, static line failures and entanglements, equipment (canopy) failures, in-air collisions, landing injuries, drowning, and dragging. Rarely, preexisting illness such as coronary artery disease caused or contributed to an accident. Pathologic findings revealed a high proportion of deceleration and blunt force injuries: cardiac, aortic, and liver laceration and skull, pelvic, and extremity fractures. Isolated head injury, strangulation, and posttraumatic pulmonary embolus were occasionally noted. Toxicologic examination demonstrated contributing factors such as alcohol intoxication or antihistamine use in a small number of cases. Background investigations, scene inspections, autopsy, and toxicology studies all yielded important data or pertinent negatives during investigations. An investigation protocol is proposed. Author

A91-17898
ENHANCING AIRCREW CENTRIFUGE HIGH-G TRAINING USING ON-LINE VIDEOTAPE DOCUMENTATION
JOSEPH P. CAMMAROTA and JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1153-1155.
Copyright

Many air forces are training fighter aircrew to improve their tolerance to the high-G environment by using human centrifuges. At the Navar Air Development Center, several techniques have been developed to consolidate as much of the information as possible on the videotape recording of the centrifuge training. This includes a continuous electrocardiographic display, anti-G suit pressure tracing, heart rate parameters, +Gz parameters, and, if +Gz-induced loss of consciousness (G-LOC) occurs, the duration of incapacitation resulting from G-LOC. Author

A91-18801
SPATIAL AND FREQUENCY STRUCTURE OF ELECTRICAL CORTICAL PROCESSES DURING VARIOUS TYPES OF HUMAN INTELLECTUAL ACTIVITY [PROSTRANSTVENNO-CHASTOTNAIA STRUKTURA ELEKTRICHESKIKH KORKOVYKH PROTSESSOV PRI RAZLICHNYKH INTELLEKTUAL'NYKH DEISTVIIAKH CHELOVEKA]
N. E. SVIDERSKAIA, T. A. KOROL'KOVA, and N. O. NIKOLAEVA (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 5-12. In Russian. refs
Copyright

The space-frequency structure of electrical cortical processes invoked by three basic types of human mental activity (such as mental activity involved in the course of using simple and complicated code algorithms, automatic movements, and an analysis of numbers and their similarities according to several criteria) was investigated by mapping the patterns of cortical areas with increased electrical activity in subjects performing these tasks. It is shown that the patterns were specific for each type of activity. The characteristic spatial and frequency characteristics of these patterns depended on various subranges of slow EEG waves. I.S.

A91-18802
THE STRUCTURE OF ENERGY EXPENDITURES ON PHYSICAL WORK AND THE OPTIMAL AMBIENT TEMPERATURE [STRUKTURA RABOCHIKH ENERGOTRAT I OPTIMAL'NAIA TEMPERATURA VNESHNEI SREDY]
E. IA. TKACHENKO, V. E. DIVERT, and S. V. KUZ'MINOV (AMN SSSR, Institut Fiziologii and Institut Klinicheskoi i Eksperimental'noi Meditsiny, Novosibirsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 127-131. In Russian. refs
Copyright

The effects of ambient temperature on the vegetative reactions and the energy balance of a human performing physical work were investigated. The parameters of energy consumption and the activity of the cardiorespiratory and thermoregulatory systems in human subjects performing physical exercises were investigated at temperatures 13 and 19 C. Using these data, a mathematical relationship was developed that makes it possible to determine optimal temperatures for tasks of known energy expenditure. I.S.

A91-18804
EFFECTS OF CONTINUOUS MAGNETOPUNCTURE IN COMPUTER OPERATORS WORKING IN SHIFTS [EFFEKTY PRODOLZHITEL'NOI MAGNITOPUNKTURY U OPERATOROV INFORMATSIONNYKH SISTEM PRI SMENNOI RABOTE]
A. P. SHUL'GA, S. V. GUS'KOV (AMN SSSR, Nauchno-Issledovatel'skii Institut Normal'noi Fiziologii, Moscow, USSR), and A. N. MEDELIANOVSKII Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 142-146. In Russian. refs
Copyright

Effects of a continuous (3-5 day) application of magnets (applied with either S or N pole toward the skin) on the functioning of the cardiovascular system, respiration, and gas exchange in computer operators working in day and night shifts were investigated by measuring the physiological parameters of subjects fitted with magnets applied to four biologically active (i.e., acupuncture-active) spots. Nonmagnet applicators were used for the control group. It is shown that both the daytime and the nighttime operators fitted with the S pole of the magnets placed toward the skin exhibited an optimization of physiological parameters, although the effect was less obvious in operators working at night. I.S.

A91-18805
SOME RESULTS OF CLINICAL AND EXPERIMENTAL STUDIES OF THE HUMAN TEMPERATURE ANALYZER [NEKOTORYE ITOGI KLINIKO-EKSPERIMENTAL'NYKH ISSLEDOVANII TEMPERATURNOGO ANALIZATORA CHELOVEKA]
V. A. LIKHTENSHTEIN Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 158-161. In Russian. refs
Copyright

Results of experimental studies have shown that one of the major zones of thermoregulation in animals, the nasolabial area, functions in correlation with the respiration rhythm, with the skin temperature in this zone decreasing during inhalation phase and increasing during exhalation. It was also found that it is possible to induce a number of physiological reactions, such as drowsiness and sleep, by increasing the temperature of the nasolabial area in pulses correlated with the inhalation phases ('thermopulsation'). The use of thermopulsation to treat various pathological conditions, including neurosis, vascular cerebral insufficiency, and bronchial asthma, is described. I.S.

A91-18806
CHARACTERISTICS OF HEMODYNAMICS AND THE CIRCADIAN REGULATION OF CARDIAC RHYTHM IN WORKERS TRANSPORTED DAILY FOR DAY SHIFTS IN MOUNTAINS OF MEDIUM HEIGHT [OSOBENNOSTI GEMODINAMIKI I SUTOCHNOI REGULIATSII RITMA SERDTSA U LIUDEI, RABOTAIUSHCHIKH V REZHIME EZHEDNEVNOI SREDNEGORNOI VAKHTY]
A. L. MAKSIMOV, T. B. CHERNOOK, P. P. PADIUKOV, M. IU. TOCHILKINA, and I. I. GODUNOVA (AN KSSR, Institut Fiziologii i Eksperimental'noi Patologii Vysokogor'ia, Frunze, Kirgiz SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 167, 168. In Russian. refs

A91-19806*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SILENT BUBBLES - THEIR EFFECTS AND DETECTION
MICHAEL R. POWELL (NASA, Johnson Space Center, Houston, TX) Workshop on Hypobaric Decompression, Brooks AFB, TX, Oct. 16-18, 1990, Paper. 44 p. refs

This paper discusses the concept of the 'silent bubble' (a phenomenon due to gas phase formation in tissues, which does not lead to frank decompression sickness). Special attention is given to the conditions for silent bubbles formation, the methods of their detecton, and to their pathophysiology. Data relating the gas formation in blood and the symptoms of decompression sickness indicate that the distinction between the silent bubbles and clinical ones is often vague and that a bubble-free decompression never existed. I.S.

N91-13861# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
P. S. GARAYEV and I. D. ALIYEV 12 Oct. 1989 64 p
(JPRS-ULS-89-011) Avail: NTIS HC/MF A04

Numerous topics related to U.S.S.R. life science research are discussed. Topics covered include agricultural science, biochemistry, biotechnology, epidemiology, immunology, laser bioeffects, military medicine, pharmacology, physiology, and public health. Author

N91-13862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
PHYSIOLOGICAL RESPONSES TO PROLONGED BED REST IN HUMANS: A COMPENDIUM OF RESEARCH, 1981-1988
PHUONG B. LUU, VANESSA ORTIZ, PAUL R. BARNES (San Francisco State Univ., CA.), and JOHN E. GREENLEAF Jul. 1990 140 p
(NASA-TM-102249; A-90003; NAS 1.15:102249) Avail: NTIS HC/MF A07 CSCL 06S

Clinical observations and results form more basic studies that help to elucidate the physiological mechanisms of the adaptation of humans to prolonged bed rest. If the authors' abstract or summary was appropriate, it was included. In some cases a more detailed synopsis was provided under the subheadings of purpose, methods, results, and conclusions. Author

N91-13863# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.
ECHOCARDIOGRAPHY IN NATO AIRCREW
Oct. 1990 104 p
(AGARD-AR-297; AGARD-WG-13; ISBN-92-835-0593-X)
 Avail: NTIS HC/MF A06; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The protocol is considered for a planned cross-sectional and a longitudinal study on echocardiography in NATO aircrew. It gives an overview of the procedures manual, technical manual, the echo data sheet, the software program, and the quality control manual. Included is the multinational protocol for the performance and reporting of echocardiograms. Author

N91-13864# John B. Pierce Foundation of Connecticut, New Haven.
THERMOREGULATORY CONSEQUENCES OF RESONANT MICROWAVE EXPOSURE Final Report, Aug. 1987 - Dec. 1989
ELEANOR R. ADAIR Jun. 1990 89 p
(Contract F33615-87-C-0607; AF PROJ. 7757)
(AD-A226540; USAFSAM-TR-90-7) Avail: NTIS HC/MF A05 CSCL 06/7

Four experiments were conducted in which it was shown that behavioral and autonomic thermo-regulatory responses are mobilized in an orderly fashion when squirrel monkeys undergo whole-body exposure at the resonant frequency, 450 MHz. The threshold for alteration of thermo-regulatory behavior is about 3 mW/sq cm, equivalent to an Specific Absorption Rate (SAR) of nearly 2 W/kg. Behavioral responses serve to regulate the skin temperature at the normally preferred level. Because of the deep penetration of the radiation at resonance, this regulation results in a stable hyperthermic offset or bias in the deep body temperature. This situation is identical to that which occurs during exercise. Although not yet studied, we presume that the magnitude of this offset will be a direct function of the energy deposited in the body or SAR. Autonomic response of peripheral vasodilation and sweating, manifested on the skin surface, are stimulated at SARs similar to the behavioral threshold, indicating the possibility that such responses could serve as auxiliary sensory cues to behavior. GRA

N91-13865*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
PORTABLE DYNAMIC FUNDUS INSTRUMENT Patent Application
GERALD TAYLOR, inventor (to NASA), RICHARD MEEHAN, inventor (to NASA), NORWOOD HUNTER, inventor (to NASA), MICHAEL CAPUTO, inventor (to NASA) (Krug International, Houston, TX.), and C. ROBERT GIBSON, inventor (to NASA) 29 Jun. 1990 21 p
(NASA-CASE-MSC-21675-1; NAS 1.71:MSC-21675-1; US-PATENT-APPL-SN-562095) Avail: NTIS HC/MF A03 CSCL 06/3

A portable diagnostic image analysis instrument is disclosed for retinal funduscopy in which an eye fundus image is optically processed by a lens system to a CCD device which produces recordable and viewable output data and is simultaneously viewable on an electronic view finder. The fundus image is processed to develop a representation of the vessel or vessels from the output data. NASA

N91-13866# Brookhaven National Lab., Upton, NY.
A COMPUTER MODEL TO DETERMINE THE PRIMARY CONTRIBUTORS TO RELATIVE RADIATION DOSE RECEIVED BY ASTRONAUTS
O. W. LAZARETH, M. DIVADEENAM, H. LUDEWIG, and J. R. POWELL 1990 11 p Presented at the 8th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 6-10 Jan. 1991
(Contract DE-AC02-76CH-00016)
(DE90-015681; BNL-44858; CONF-910116-2) Avail: NTIS HC/MF A03

This paper describes a computer model which was used to determine the relative radiation dose of protons of different energies. In the future, the model will be extended to calculate the dosage received by an astronaut during a specific mission to Mars, and within a spacecraft with specific materials and with a specific geometry. The framework for the calculations centered on the computer program HETC, a Monte Carlo transport code for computing the properties of high energy nucleon-meson cascades in matter. It is valid up to several hundred GeV. DOE

N91-13867# Wisconsin Univ., Madison. Dept. of Medical Physics.
DEVELOPMENT AND INITIAL CHARACTERIZATION OF A NUCLEAR MAGNETIC RESONANCE DOSIMETRY SYSTEM Ph.D. Thesis
DAVID MICHAEL THOMASSON 1990 91 p Sponsored by

National Cancer Inst., Bethesda, MD
(Contract DE-FG02-86ER-60417)
(DE91-001775; DOE/ER-60417/5) Avail: NTIS HC/MF A05

A high dose radiation dosimeter was developed employing NMR spectroscopic quantitation of the radiolytic products of methanol. Chemical shifts of product resonances relative to the solvent allow quantification using NMR techniques. Due to expected dynamic range limitations of NMR instrumentation, deuterated methanol is used with a presaturation suppression sequence to reduce the solvent proton signals. Methanol's (13)C-coupled proton resonances is used as an internal reference to normalize product signals otherwise subject to spectrometer variability. Data on reproducibility, dose response, and temporal stability were acquired. System reproducibility for a sample at 1 kGy is approximately 10 percent. The dose response is linear in the range between 200 Gy and 50 kGy. No significant signal degradation was observed during a six month period. Advantages of this type dosimeter system include ease of use, large dynamic range, and temporal stability. An additional characteristic of a methanol based system is the LET dependent response in the chemical yields of formaldehyde and ethylene glycol. DOE

N91-13868 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
REVIEW OF UNCERTAINTIES IN THE USE OF NPL PRIMARY STANDARDS OF X-RAY EXPOSURE FOR THE CALIBRATION OF SECONDARY STANDARDS IN TERMS OF EXPOSURE AND AIR KERMA
A. R. S. MARSH and C. CROSS Dec. 1988 72 p
(NPL-RS(EXT)-109; ISSN-0143-7135; ETN-91-98373) Copyright Avail: National Physical Laboratory, Teddington, TW11 0LW, England

A review of the present values of accuracy or uncertainty was made. The numbers quoted should be considered as the base line from which future modifications are to be made. The systematic uncertainties associated with corrections to primary standards were re-examined, as well as those uncertainties associated with physical data and the intercomparison procedures. For random uncertainties in therapy level secondary standard calibration, the results from the last few calibration periods were analyzed, in order to obtain a more recent estimate of random uncertainty. For protection levels, random uncertainties were calculated on an accumulative basis. ESA

N91-14706# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
B. A. ATCHABAROV and B. A. ABEUOV 18 Apr. 1990 45 p
(JPRS-ULS-89-003) Avail: NTIS HC/MF A03

Life sciences research in the U.S.S.R. is discussed. Topics covered include aerospace medicine, biochemistry, genetics, laser bioeffects, physiology, public health, psychology, radiation biology, virology, and veternary medicine. Author

N91-14707# Ohio State Univ., Columbus. Dept. of Speech and Hearing Science.
DEMODULATION PROCESSES IN AUDITORY PERCEPTION Annual Report, 1 Dec. 1988 - 30 Nov. 1989
LAWRENCE L. FETH 1 Mar. 1990 6 p
(Contract AF-AFOSR-0227-89; AF PROJ. 2313)
(AD-A226824; AFOSR-90-0966TR) Avail: NTIS HC/MF A02 CSCL 06/4

The overall goal of this project is to understand the ability of the human listener to extract information from complex, time-varying sounds such as speech, music or other environmentally important signals. Specifically, we are interested in the listener's ability to process modulations of frequency and amplitude which are thought to carry the information of such signals. This report represents the continuation and extension of work begun at the University of Kansas in 1987. Preliminary work to determine the temporal acuity of normal hearing listeners for spectrally-dynamic signals is complete. Pilot work on processing of frequency transitions in a proving frequency paradigm has been started; and work on listeners with cochlear hearing impairments has been added to the scope of work undertaken on the project. GRA

N91-14708# Army Research Inst. of Environmental Medicine, Natick, MA.
THE EFFECTS OF SLEEP LOSS ON INDIVIDUAL AND GROUP PERFORMANCE
ROBERT H. STRETCH and DAVID W. JAMIESON (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) May 1990 46 p
(Contract DA PROJ. 3M1-61102-BS-15)
(AD-A226963; USARIEM-T16-90) Avail: NTIS HC/MF A03 CSCL 06/10

This experiment was part of a study designed to assess the effects of two-hour naps on cognitive performance during sustained operation conditions. It was conducted using 12 young, military subjects who performed operations officer duties in a simulated brigade-level command post. They worked continuously processing military messages over a 4.5 day period and were tested on several recurring cognitive tasks. This paper reports the results of tasks and questionnaires assessing the effects of sleep loss on both individual and group performance. Across subjects, the results indicate significant sleep loss effects on perceived physical health, sleep quality, sleep value, and attributions of performance on mental tasks and individual and group cognitive performance. Significant individual differences in the effects of sleep loss are also noted. A discussion of the results is presented and is asserted that there is a need to individualize the placement of naps in future studies to maximize performance. GRA

N91-14709* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
DUAL PHYSIOLOGICAL RATE MEASUREMENT INSTRUMENT Patent
TOMMY G. COOPER, inventor (to NASA) 26 Jun. 1990 6 p Filed 15 Apr. 1988 Continuation of abandoned US-Patent-Appl-SN-585627, filed 7 Mar. 1984 which is a continuation of US-Patent-Appl-SN-394343, filed 1 Jul. 1982
(NASA-CASE-MSC-20078-3; US-PATENT-4,936,309; US-PATENT-APPL-SN-183475; US-PATENT-APPL-SN-585627; US-PATENT-APPL-SN-394343; US-PATENT-CLASS-128-671; US-PATENT-CLASS-128-689; US-PATENT-CLASS-128-706; US-PATENT-CLASS-128-716; US-PATENT-CLASS-331-1) Avail: US Patent and Trademark Office CSCL 06/5

The object of the invention is to provide an instrument for converting a physiological pulse rate into a corresponding linear output voltage. The instrument which accurately measures the rate of an unknown rectangular pulse wave over an extended range of values comprises a phase-locked loop including a phase comparator, a filtering network, and a voltage-controlled oscillator, arranged in cascade. The phase comparator has a first input responsive to the pulse wave and a second input responsive to the output signal of the voltage-controlled oscillator. The comparator provides a signal dependent on the difference in phase and frequency between the signals appearing on the first and second inputs. A high-input impedance amplifier accepts an output from the filtering network and provides an amplified output DC signal to a utilization device for providing a measurement of the rate of the pulse wave.
Official Gazette of the U.S. Patent and Trademark Office

N91-14710# Oak Ridge National Lab., TN.
PREDICTION OF HELICOPTER SIMULATOR SICKNESS
ROGER D. HORN, J. DOUGLAS BIRDWELL (Tennessee Univ., Knoxville.), and GLENN O. ALLGOOD 1990 11 p Presented at the 29th IEEE Conference on Decision and Control, Honolulu, HI, 5-7 Dec. 1990
(Contract DE-AC05-84OR-21400)
(DE90-016530; CONF-901209-2) Avail: NTIS HC/MF A03

Machine learning methods from artificial intelligence are used to identify information in sampled accelerometer signals and associative behavioral patterns which correlates pilot simulator

sickness with helicopter simulator dynamics. These simulators are used to train pilots in fundamental procedures, tactics, and response to emergency conditions. Simulator sickness induced by these systems represents a risk factor to both the pilot and manufacturer. Simulator sickness symptoms are closely aligned with those of motion sickness. Previous studies have been performed by behavioral psychologists using information gathered with surveys and motor skills performance measures; however, the results are constrained by the limited information which is accessible in this manner. In this work, accelerometers were installed in the simulator cab, enabling a complete record of flight dynamics and the pilot's control response as a function of time. Given the results of performance measures administered to detect simulator sickness symptoms, the problem was then to find functions of the recorded data which could be used to help predict the simulator sickness level and susceptibility. Methods based upon inductive inference were used, which yield decision trees whose leaves indicate the degree of simulator-induced sickness. The long-term goal is to develop a gauge which can provide an on-line prediction of simulator sickness level, given a pilot's associative behavioral patterns (learned expectations). This will allow informed decisions to be made on when to terminate a hop and provide an effective basis for determining training and flight restrictions placed upon the pilot after simulator use. DOE

N91-14711* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 343)
Dec. 1990 82 p
(NASA-SP-7011(343); NAS 1.21:7011(343)) Avail: NTIS HC A05; NTIS standing order as PB90-912300, $11.50 domestic, $23.00 foreign CSCL 06/5

This bibliography lists 125 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during January, 1989. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

N91-14712* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 344)
Jan. 1991 92 p
(NASA-SP-7011(344); NAS 1.21:7011(344)) Avail: NTIS HC A05; NTIS standing order as PB91-912300, $15.00 domestic, $30.00 foreign CSCL 06/5

This bibliography lists 125 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during January, 1989. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

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BEHAVIORAL SCIENCES

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

A91-17448
A MODEL FOR INSTRUCTOR TRAINING ANALYSIS IN SIMULATION-BASED FLIGHT TRAINING
R. RAMESH (New York, State University, Buffalo) and CHEICKNA SYLLA (New Jersey Institute of Technology, Newark) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 20, Sept.-Oct. 1990, p. 1070-1080. refs
Copyright

In this research, the instructor training process is modeled and a methodology for determining instructor training plans is developed. A framework for instructor training analysis is described that covers the identification of instructor skill requirements, methods of training instructors, and the development of instructor training plans. The framework was developed from a study of training-system characteristics conducted using a group of experts in flight simulation. The system developed in this research has been integrated with a framework for instructor operator station design developed earlier. The instructor training model's implications for the design of this station are presented, and directions for future research are provided. I.E.

A91-17683
CORPORATE INSTABILITY IS RELATED TO AIRLINE PILOTS' STRESS SYMPTOMS
LINDA F. LITTLE, IRENE C. CAFFNEY, KAREN H. ROSEN (Virginia Polytechnic Institute and State University, Falls Church, VA), and MARY M. BENDER (Federal Food and Drug Administration, Div. of Consumer Studies, Rockville, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 977-982. refs
Copyright

The Symptoms of Stress questionnaire was administered to three random samples of commercial airline pilots. Respondents included one group of 212 pilots who were emplyed by an airline company with a history of corporate instability and two groups, totalling 220 pilots, who were employed by two airline carriers with histories of corporate stability. The pilot group employed by the airline with a history of corporate instability reported significantly more stress and depression symptoms and a greater accumulation of symptoms than did the pilot groups employed by the stable airlines. With the advent of airline deregulation and its concomitant changes in the airline industry, including corporate instability, it is concluded that the relationship between corporate instability within the aviation environment and the subjective distress reported by pilots suggests the need for further investigation into implications for health and safety. Author

A91-17684
STRESS INOCULATION TRAINING FOR SMOKE DIVERS AND FREE FALL LIFEBOAT PASSENGERS
KARSTEN HYTTEN, ARVID JENSEN (Oslo, Universitetet, Norway), and GEIR SKAULI (Bergen, Universitetet, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 983-988. Research supported by NTNF. refs
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The effects of 1 h stress inoculation training on subjective experience, performance, and physiological activation were studied in two fear-provoking situations. In the freefall lifeboat situation, the experimental group reported higher acceptance of the free fall lifeboat concept after the training course than the control group. In the smoke diving situation, the experimental group reported less need of success and reported learning self confidence instead of skills more often than the control group and received less help from the instructor during diving. However, the experimental group reported higher anxiety than the control group during training. There were no differences between groups in saliva cortisol values in either of the two experiments. Effects of stress inoculation training are explained in terms of expectancy theory. Author

A91-17886
EFFECTS OF WHOLE-BODY VIBRATION ON SHORT-TERM MEMORY
NEIL SHERWOOD (Surrey, University, Guildford, England) and MICHAEL J. GRIFFIN (Southampton, University, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1092-1097. Research supported by the Ministry of Defence. refs
Copyright

An experiment has been conducted to investigate the effects of whole-body vibration on cognitive performance independent of the direct mechanical action of vibration on vision and manual control. Sixteen subjects completed a short-term memory task (memory scanning) during exposure to 16 Hz sinusoidal whole-body vibration at four magnitudes: 0, 1.0, 1.6, and 2.5 m/sec sq rms. The results show a detrimental effect of vibration on performance when measured by mean reaction time (p less than 0.001) and number of attentional lapses (p less than 0.01). Response errors rose significantly during the 1.0 m/sec sq rms condition alone. The data suggest that vibration disrupts central cognitive mechanisms utilized during the processing of information in short-term memory, although compensatory cognitive procedures may exist to minimize these effects. Author

A91-17887
PERCEPTION OF NEAR EARTH ALTITUDES BY PILOTS - ASCENDING VS. DESCENDING OVER BOTH A LAND AND WATER SURFACE
TIMOTHY J. UNGS (USCG, Support Center, Kodiak, AL) and SATYA P. SANGAL (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1098-1101. refs
Copyright

Thirteen experienced HH-3 pilots were tested on their ability to obtain four target altitudes between 25 and 200 ft. The target altitudes were attempted by both ascending from 0 ft and descending from 500 ft. Subjects were tested both over a land and water surface for a total of 16 recorded achieved altitudes per pilot. The pilots had full aircraft control but were without use of altimeters. Subjects showed wide variation for each test situation with some achieved altitudes exceeding the target altitude by 100 percent while others were below the target altitude. The predominant error was an achieved altitude greater than the target altitude. The mean achieved altitude when descending to a given target altitude exceeded the mean achieved altitude when ascending to the same target altitude. There was no statistically significant difference in mean achieved altitude between land and water surfaces. Author

A91-17896
A RETROSPECTIVE STUDY OF MARITAL DISCORD IN PILOTS - THE USAFSAM EXPERIENCE
JURGEN K. RASCHMANN, JOHN C. PATTERSON, and GARY SCHOFIELD (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1145-1148. refs
Copyright

This exploratory retrospective multicase study investigates marital discord in USAF pilots as part of an overall concern with mission safety. Seventeen USAF School of Aerospace Medicine (USAFSAM) cases involving marital distress were reviewed, using a standardized format. Duration of marital discord ranged from 1-10 years with an average of 2.25 years. The most frequent problem noted was one of communication, with authoritarian or controlling styles predominating. The second most frequent conflict concerned occupational demands; both pilots and spouses complained about frequent work-related separations. Nine of ten distressed outcomes (i.e., separated or divorced) were initiated by the wife. It is speculated that a pilot with an inflexible communication style who is not cognizant of his or her spouse's emotional needs is likely to exacerbate marital problems. The notion that marital distress may adversely affect a pilot's attention, generating performance decrements, underscores the importance of investigating elements of marital harmony in the pilot population. It is suggested the USAF employ programs that recognize the spouse's contribution to mission safety, increase spouse's awareness of mission requirements, enhance couple's communication, and improve stress management skills. Author

A91-18803
INFORMATION CONTENT OF PSYCHOPHYSIOLOGICAL INDICES OF A HUMAN OPERATOR WORKING IN HIGH-TEMPERATURE ENVIRONMENT [INFORMATIVNOST' PSIKHOFIZIOLOGICHESKIKH POKAZATELEI CHELOVEKA-OPERATORA V USLOVIIAKH VYSOKIKH TEMPERATUR]
A. S. GABRIEL'IAN and A. N. AZHAEV Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Sept.-Oct. 1990, p. 137-141. In Russian. refs
Copyright

The information content of various psychophysiological indices used to measure the effect of temperature on the physiological condition and the work capacity of an operator was determined in eight subjects performing physical activity at ambient temperatures of 29, 35, 37, 39, or 41 C and at relative humidity between 20 and 40 percent. It was found that the most informative indices at high temperatures were the critical flicker fusion, the time required for a simple sensorimotor reaction, the time required to react to a moving object, muscular endurance to static loads, and occurrence of tremor. The character of the index and the degree of its change depended on the ambient temperature and the duration of thermal stress. I.S.

N91-13869# New York Univ., New York. Neuromagnetism Lab.
COGNITIVE AND NEURAL BASES OF SKILLED PERFORMANCE Final Technical Report, 5 Sep. 1986 - 30 Nov. 1989
LLOYD KAUFMAN and SAMUEL J. WILLIAMSON 9 Aug. 1990 48 p
(Contract F49620-86-C-0131; AF PROJ. 3484)
(AD-A226668; AFOSR-90-0918TR) Avail: NTIS HC/MF A03 CSCL 05/8

Major improvements were introduced for neuromagnetic studies by the installation of a magnetically shielded room and versatile gantry to hold our 5-sensor neuromagnetometer. Studies with this system verify that the strength of the 100-ms component of the cortical response to a tone is unaffected by tone frequency and intensity at suprathreshold levels, but we have shown that both the 100-ms and 180-ms components are affected by attention. Moreover, we have obtained evidence that auditory cortex in left and right hemispheres may have differing responses to a tone depending on the inter-stimulus interval. Neuronal sources of certain components of auditory-evoked responses are found to be displaced across cortex from the others, with a tonotopic representation for the 50-ms transient component apparently differing from the representation for the steady-state component, which has a similar apparent latency. Studies of spatial attention have revealed robust effects for latencies exceeding 200 ms, unlike for the auditory system, but some subjects show effects commencing as early as 100 ms. An investigation of the classic P300 response for both visual and auditory stimulation has been initiated with a more efficient paradigm, and early results provide evidence that the neuronal source is independent of sensory modality. To address the question of how much cortex is involved in producing an evoked field or potential, we have analyzed published data on intracortical voltage measurements in cat and monkey and found that the current dipole moment per square millimeter of cortical area is very much the same at moments of peak activity for long-latency response. For this we deduce that the area in human cortex typically ranges from 40 to 400 sq mm, based on the current dipole moments deduced from neuromagnetic data. Several technical developments were made during this period. GRA

N91-13870# Human Engineering Labs., Aberdeen Proving Ground, MD.
AN INDEXED BIBLIOGRAPHY ON TRACKING
SALVATORE P. SCHIPANI Jul. 1990 153 p
(AD-A226682; HEL-TN-6-90) Avail: NTIS HC/MF A08 CSCL 05/8

A bibliography about tracking and related literature, with corresponding documentation in the form of indexed author and

subject listings is presented. Indexing was performed to enhance its utility as a reference. Topical subjects were distinguished after a review of citations revealed repeated mention. Generally, tracking is divided into compensatory tracking (such as driving a car while keeping the vehicle within the boundaries of the road) or pursuit tracking (such as aiming a gun at a moving target while keeping the gun sight directly on the target). This search was partly performed through computer inquiries using the National Technical Information Service's DIALOG Information Retrieval Service, and the PSYCINFO service of the American Psychological Association. Sources were also manually extracted, including journal articles, Government and private sector reports, conference proceedings, and books. In some instances, direct contact was made with author(s). GRA

N91-13871 Physics and Electronics Lab. TNO, The Hague (Netherlands).
STUDY SYSTEM CONCEPT FOR A PELOTONS PROCEDURE TRAINER (PEP-TRAINER) FOR THE WEAPON SYSTEMS YPR-PRAT, YPR-25 MM (EWS) AND LEOPARD 1-5 Final Report
J. C. P. BOL and G. SWIEP Jul. 1990 50 p In DUTCH; ENGLISH summary
(Contract A89/KL/606)
(FEL-90-A084; TD-90-1224; ETN-91-98298) Copyright Avail: Physics and Electronics Laboratory TNO, P.O. Box 96864, 2506 JG The Hague, Netherlands

A system for procedure training for the guided weapon system YPR-PRAT, the 25 mm weapon system YPR-EWS and the tank system Leopard 1-5 is described. The starting points for the systems concept are the 'pelotons fire control trainer' developed by the Netherlands Army as well as the results of feasibility study. The systems concept of the novel PEP trainer is based on the use of a laser light source in combination with a CCD (Charged Coupled Device) sensor for the registration of a hit. The training system is based on a scaled target field containing stationary and moving targets. The concept of the PEP trainer has a generalized structure that can be used for different weapon systems. ESA

N91-13872 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
TIME-SHARING PERFORMANCE AS A FACTOR FOR SUCCESS IN FLIGHT TRAINING: TEST DEVELOPMENT AND VALIDATION Final Report
P. G. A. M. JORNA 21 Dec. 1989 33 p
(Contract A81/KM/126)
(IZF-1989-58; TD-89-4556; ETN-91-98307) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

A test based on dual-task performance developed to investigate the trainability of aspirant pilots to perform under demanding conditions is described. The dual-task is a combination of a pursuit tracking task with preview and a Continuous Memory Task (CMT). Aspirant pilots practice the tracking task and are tested under single and dual task conditions. Dual-task performance is expected to be related to pilot aptitude as assessed by other criteria. Predictive validity is evaluated in a stepwise validation with increasing levels of pilot aptitude as assessed by traditional selection procedures. A flight simulator test and advanced flight training for the Lockheed Orion and Westland Lynx helicopter are used. Successful aspirants, now operational pilots, are characterized by their excellent performance under dual-task conditions as well as under single-task conditions, depending on how soon they failed in the selection and training process. Prior flying experience did not influence tracking performance and was not found to be a critical factor in predicting success in advanced or operational flight training. ESA

N91-13873 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
VESTIBULO-OCULAR RESPONSES IN MAN TO +G SUB Z HYPERGRAVITY Final Report
J. T. MARCUS and C. R. VANHOLTEN 21 Dec. 1989 19 p In DUTCH; ENGLISH summary Presented at AsMA Meeting, Washington, DC 8 May 1989 Previously announced in IAA as A90-39645
(Contract A88/M/318)
(IZF-1989-59; TD-89-4557; ETN-91-98308) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

The influence of high G(sub z) gravito-inertial force on the vestibular system in man is investigated in a centrifuge (radius 4 m) with a freely swinging gondola. The subject is exposed to an acceleration of plus 2 G(sub z)/s, plus 3 G(sub z) for three minutes and a deceleration of minus 2 G(sub z)/s. The tests are carried out in two conditions in randomized order: facing forward and facing backward. Under these conditions the effective angular velocity in the plane on the vertical semicircular canals is opposed. Adding the slow phase velocity responses from these conditions yields the G(sub z) effect only; subtracting yields the angular velocity effect only. Vertical vestibular nystagmus is analyzed with five subjects. Results indicate that plus 3 G(sub z) induces a subject-dependent vertical nystagmus with slow phase downwards. The vestibular stimulation by G(sub z) could result in a false subjective perception of attitude, and could play a major role in spatial disorientation in flight. ESA

N91-13874 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
ADAPTABLE DRIVER-CAR INTERFACING AND MENTAL WORKLOAD: A REVIEW OF THE LITERATURE Final Report
W. B. VERWEY 26 Jan. 1990 41 p
(IZF-1990-B-3; TD-90-0018; ETN-91-98315) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

The design of an adaptive interface or dialog controller in a car equipped with a GIDS (Generic Intelligent Driver Support) system is discussed. A short review of human performance in multitask situations is given. Practice is assumed to be a major significance for mental workload reduction especially in tasks that are executed concurrently with similar tasks. Issues concerning the concept, prediction and assessment of mental workload are discussed. Distinction is made between mental workload assessment for the evaluation of GIDS systems and for the adaptation of the interface to the driver workload. Recommendations are given for workload assessment in evaluation studies. Literature on adaptive interfaces is reviewed. Distinctions are made between human and system initiated interface adaptation and between short-term and long-term adaptation. Recommendations regarding when and how to adapt the interface characteristics to driver workload are presented. ESA

N91-14713# PERI, Inc., Princeton, NJ.
AIR TRAFFIC CONTROLLER MEMORY ENHANCEMENT Technical Report, Oct. 1989 - Sep. 1990
P. J. VINGELIS, E. SCHAEFFER, P. STRINGER, S. GROMELSKI, and B. AHMED Dec. 1990 85 p Prepared in cooperation with Essex Corp., Alexandria, VA
(Contract DTFA08-89-0050)
(DOT/FAA/CT-TN90/38) Avail: NTIS HC/MF A05

The Federal Aviation Administration is engaged in an ongoing research effort to help air traffic controllers reduce the frequency of operational errors. The results of the first year's efforts in a three-year project to develop practical, effective memory aids to improve controller performance of tasks where memory is a critical element are given. Literature on controller memory and performance is reviewed and operational errors are analyzed to determine the nature and frequency of controller memory lapses. Several potential memory aids are identified and evaluated for effectiveness, feasibility, usability, acceptability, cost, and testability. The highest ranking memory aids are recommended for further evaluation in controlled experiments. Author

N91-14714# Rutgers - The State Univ., New Brunswick, NJ. Dept. of Psychology.
EYE MOVEMENTS AND VISUAL INFORMATION PROCESSING Interim Progress Report, Apr. 1989 - Apr. 1990
EILEEN KOWLER 22 Aug. 1990 4 p
(Contract AF-AFOSR-0171-88; AF PROJ. 2313)
(AD-A226782; AFOSR-90-0978TR) Avail: NTIS HC/MF A01 CSCL 06/4

This research extended our understanding of the visual and cognitive process controlling saccadic and smooth eye movements, and the role of these eye movements in visual information acquisition. Experiments showed that: (1) saccades are biased toward likely locations of targets, suggesting that previous reports of center-of-gravity reflexes are actually due to search of attentional strategies; (2) saccades can be directed to spatially-extended targets with an accuracy and precision as good as those found for single point targets; (3) predictive smooth eye movements are caused by cognitive expectations about future path of target motion, not by learned oculomotor habits; (4) slow control is not sensitive to position error; (5) smooth eye movements are sensitive to the expected direction of future target motion; (6) strategies of scanning the boundaries of difficult texture patterns are more effective than strategies of scanning the symmetric axis; (7) normal reading is carried out by a coordinated pattern of eye movements and head movements. GRA

N91-14715# Oregon Univ., Eugene. Dept. of Psychology.
INVESTIGATING INDIVIDUAL DIFFERENCES IN GENERAL COMPREHENSION SKILL: THE ROLE OF SUPPRESSION AND ENHANCEMENT Final Technical Report, 1 Apr. 1989 - 1 Apr. 1990
MORTON A. GERNSBACHER 1 Aug. 1990 69 p
(Contract AF-AFOSR-0305-89; AF PROJ. 2313)
(AD-A226788; AFOSR-90-0945TR) Avail: NTIS HC/MF A04 CSCL 05/8

Investigation into whether the cognitive mechanism of suppression underlies differences in adult comprehension skills are reported. Less-skilled comprehenders less-efficiently reject the inappropriate meaning of ambiguous words (e.g., the playing card vs garden tool meaning of spade), the incorrect forms of homophones (e.g., patients vs patience), the highly-typical-but-absent members of scenes (e.g., tractor in a farm scene), and words superimposed on pictures of pictures surrounding words. However, less-skilled comprehenders are not less cognizant of what is contexually appropriate; in fact, they benefit from a biasing context just as much (and perhaps more) as more-skilled comprehenders do. So, comprehenders do no have difficulty enhancing contexually appropriate information. Instead, it is suggested that less-skilled comprehenders suffer from less-efficient suppression mechanism, which we conclude is an important component of general comprehension skill. GRA

N91-14716# Harvard Univ., Cambridge, MA. Dept. of Psychology.
PERCEPTION AND TEMPORAL PROPERTIES OF SPEECH Annual Technical Report, Jul. 1989 - Jul. 1990
PETER C. GORDON 26 Jul. 1990 67 p
(Contract AF-AFOSR-0461-89; AF PROJ. 2313)
(AD-A226958; AFOSR-90-0943TR) Avail: NTIS HC/MF A04 CSCL 05/7

Two series of experiments are reported on the role of prosody in human speech comprehension. One series looked at the role of prosodic information in listeners' ability to recognize adjacent vowels and consonants cued by the common temporal feature of vowel duration. The stimuli consisted of syllables from a large sample of natural speech which listeners heard with prosodic context or without. Prosodic context was found to aid listeners in correctly attributing the phonological source of vowel duration. The second series of experiments examines the role of stress in syllable accessibility during the on-line comprehension of language and from short-term memory. During on-line comprehension stress is found to interact with lexical processing, while the effect of stress on syllable accessibility from short-term memory is not dependent on lexical effects. Partial contents: Disambiguation of segmental dependencies by extended phonetic context; and coming to terms with stress -- Effects of stress location in sentence processing. GRA

N91-14717# Naval Aerospace Medical Research Lab., Pensacola, FL.
VALIDATION OF DICHOTIC LISTENING AND PSYCHOMOTOR TASK PERFORMANCE AS PREDICTORS OF PRIMARY FLIGHT TRAINING CRITERIA: HIGHLIGHTING RELEVANT STATISTICAL ISSUES Interim Report, Jun. - Aug. 1989
HAROLD D. DELANEY Jul. 1990 26 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD
(AD-A227010; NAMRL-1357) Avail: NTIS HC/MF A03 CSCL 05/8

A statistical evaluation of the automated dichotic listening (DLT) and psychomotor tasks (PMT) indicated that both contributed to the prediction of primary flight training criteria. Prior to the main analyses, the extreme skewness-squadron differences in flight grades were removed by tranformations based on z-scores. Primary flight grades were highly correlated with the psychomotor scores (r's between -.26 and -.41) and moderately related with the dichotic listening scores (r's between -.22 and -.28). These r's were significant at an experiment wise alpha of .05. Multiple regression analysis indicated an even stronger validity coefficient when a combination of the performance measures was used (R = .442). Furthermore, the 19.5 percent of flight grade variance accounted for by the performance based tests was largely independent of the 16.6 percent variance accounted for by a combination of current selection tests and demographic variables. For the pass/fail criterion, a statistically optimal combination of DLT/PMT variables, selection tests scores, and demographic variables was specified that could be used to identify individuals who are relatively more likely to attrite. Classification matrices illustrate how such predictions could reduce attrition. GRA

N91-14718# EEG Systems Lab., San Francisco, CA.
EMPIRICAL NETWORK MODEL OF HUMAN HIGHER COGNITIVE BRAIN FUNCTIONS Final Technical Report, 1 Apr. 1987 - 31 Mar. 1990
ALAN S. GEVINS, BRIAN A. CUTILLO, JUDY ILLES, STEVEN L. BRESSLER, and PAUL A. BRICKETT 31 Mar. 1990 207 p
(Contract F49620-87-C-0047; AF PROJ. 2313)
(AD-A227193; EEG-88001; AFOSR-90-1028TR) Avail: NTIS HC/MF A10 CSCL 05/8

EEG Systems Laboratory (EEGSL) develops and applies advanced technologies for measuring neurocognitive signals in the human brain. Results included: (1) measurement of leading indicator neuroelectric patterns preceding performance decrements in five Air Force fighter test pilots who performed difficult cognitive tasks for 10 to 14 hours; (2) measurement of split-second neurocognitive patterns of basic linguistic operations which distinguished letter from non-letter, word from non-word, and syntactic from non-syntactic processing; and (3) functional anatomical localization based on 124-channel evoked potential recordings and three dimensional finite element brain models constructed from magnetic resonance images. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A91-17152
SIMULATION OF THE OPERATOR-BEHAVIOR PROCESS IN MAN-MACHINE SYSTEMS [MODELIROVANIE PROTSESSA POVEDENIIA OPERATORA V SISTEMAKH 'CHELOVEK-MASHINA']
V. IU. ANISIMOV and E. V. BORISOV Radioelektronika (ISSN 0021-3470), vol. 33, June 1990, p. 95-97. In Russian.
Copyright

An approach based on fuzzy-set theory is developed for the simulation of one of the aspects of the behavior of a human operator, i.e., the result of his actions. The proposed simulation method is applied to the case when the operator has to make a decision concerning the state of a system according to the information presented to him. It is concluded that the proposed approach is suitable for the simulation of fuzzy variables in man-machine systems. B.J.

A91-17246
A SYNTHESIS OF MICROSAINT COMPUTER SIMULATION AND MCCRACKEN-ALDRICH WORKLOAD ESTIMATES TO PREDICT THE IMPACT OF AUTOMATIC TARGET HANDOFF SYSTEM AVIONICS INTEGRATION ON AH-64A OPERATOR PERFORMANCE
DEBORAH L. HARDIN, THOMAS W. OLSSON (Rockwell International Corp., Collins Government Avionics Div., Cedar Rapids, IA), and SANDRA M. SZABO (CAE-Link Corp., Link Flight Simulation Div., Binghamton, NY) IN: AHS, Annual Forum, 46th, Washington, DC, May 21-23, 1990, Proceedings. Volume 1. Alexandria, VA, American Helicopter Society, 1990, p. 631-644. refs
Copyright

A91-17444
COMPOSITE PSEUDOLINK END-POINT CONTROL OF FLEXIBLE MANIPULATORS
JOEL O. KING, V. G. GOURISHANKAR, and RAYMOND E. RINK (Alberta, University, Edmonton, Canada) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 20, Sept.-Oct. 1990, p. 969-977. refs
Copyright

A novel method of decomposing the dynamical equations of a three-link, flexible manipulator is described. The concept of a 'pseudolink' is used to separate the full manipulator-system model into a pseudolink subsystem model and a flexible subsystem model. A composite controller is designed for achieving accurate end-point positioning and trajectory tracking of a predetermined trajectory described in terms of pseudolinks, and for stabilizing the flexible subsystem. Simulation results are presented to demonstrate the effectiveness of the control method. Practical steps for implementing this strategy in an actual system are also discussed. I.E.

A91-17455
ADAPTIVE IMAGE FEATURE PREDICTION AND CONTROL FOR VISUAL TRACKING WITH A HAND-EYE COORDINATED CAMERA
JOHN T. FEDDEMA (Sandia National Laboratories, Albuquerque, NM) and C. S. GEORGE LEE (Purdue University, West Lafayette, IN) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 20, Sept.-Oct. 1990, p. 1172-1183. refs
(Contract NSF CDR-88-03017)
Copyright

An adaptive method for visually tracking a known moving object with a single mobile camera is described. The goal is to predict the location of features of the object on the image plane based on past observations and past control inputs and then to determine an optimal control input that will move the camera so that the image features align with their desired positions. A resolved motion rate control structure is used to control the relative position and orientation between the camera and the object. A geometric model of the camera is used to determine the linear differential transformation from image features to camera position and orientation. To adjust for modeling errors and system nonlinearities, a self-tuning adaptive controller is used to update the transformation and compute the optimal control. Computer simulations were conducted to verify the performance of the adaptive feature prediction and control. I.E.

A91-17685
EFFECT OF WHOLE-BODY VIBRATION ON ACOUSTIC MEASURES OF SPEECH
ZINNY S. BOND (Oslo, Universitetet, Norway) and THOMAS J. MOORE (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Nov. 1990, p. 989-993. Research supported by USAF. refs
Copyright

If Automatic Speech Recognition technology is to be applied in the cockpit, it must deal with speech produced under environmental conditions that may alter the acoustic characteristics of the speech to be recognized. The present study examines the acoustic-phonetic detail of selected words produced under vibration, with the talker wearing an oxygen mask. The duration of words and syllables showed small effects that were inconsistent and statistically non-significant. Statistically significant increases were found in fundamental frequency and in the proportion of energy in the higher frequencies (decreased spectral tilt). The vibration conditions examined had no consistent effect on the center frequencies of the vowel formants measured. Author

A91-17884
FLIGHT DECK DESIGN AND PILOT SELECTION - ANTHROPOMETRIC CONSIDERATIONS
PETER W. BUCKLE, GEOFF C. DAVID, and ALAN C. KIMBER (Surrey, University, Guildford, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Dec. 1990, p. 1079-1084. refs
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Safe and successful operation of flight displays and controls is, in part, dependent on the anthropometric characteristics of the pilots with respect to the design of a particular aircraft. This paper describes the approach required to optimize this fit and provides guidelines for both those responsible for design and those who select pilot recruits. The major results reported are those for a British population, although the aircraft considered (Boeing 737-200, 747, 757, and Lockheed TriStar) are used by airlines throughout the world. The study shows that limitations in design considerably reduce the pool of potential recruits with the appropriate anthropometric characteristics. The selection criteria, based on functional seated eye height, might exclude 73 percent of the British 19-65-year-old female population, and 13 percent of the male population. Author

A91-18386
CRASH VICTIM MODELING OF A NEW HEAD AND NECK SUPPORT - HANS
ROBERT P. HUBBARD (Michigan State University, East Lansing) and PAUL C. BEGEMAN (Wayne State University, Detroit, MI) SAFE Journal, vol. 20, Winter 1990, p. 12-16. Research supported by the Michigan Department of Commerce.
Copyright

The Head And Neck Support (HANS) device, which is to be worn in association with a helmet in order to reduce the extreme head motions, neck loads, and neck injuries experienced by fighter and helicopter pilots, is presently subjected to a series of computer simulations to generate crash dynamics and injury-potential

predictions for cases with and without HANS. Model predictions can be verified via crash dummy results from impact-sled tests. Model results show marked reductions in neck loading and head motions with HANS; the latter reduce the likelihood of neck injury through impact with surrounding structures. O.C.

A91-18387
DEVELOPMENT AND EVOLUTION OF THE U.S. ARMY SPH-SERIES AIRCREW HELMET
RONALD W. PALMER (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, AL) SAFE Journal, vol. 20, Winter 1990, p. 18-23. refs
Copyright

A development history is presented for the U.S. Army's Sound Protective Helmet-4 (SPH-4) and its recent derivatives, the Improved SPH-4 and Head Gear Unit-56/Personal (HGU-56/P). Excessive helmet rotation and helmet loss are noted to have always been problems associated with the SPH-4. The HGU-56/P, which will replace the SPH-4 over the course of the 1990s, will furnish greater protection due to the incorporation of a low-density and thicker foam core, crushable earcups, and the Modified Yoke Retention Assembly, which differs from the SPH-4 retention assembly in that its chinstrap is a continuous extension of the helmet shell attachment tabs. O.C.

A91-18736
THE STRATEGIC ROLE OF EXERCISE DEVICES IN MANNED SPACEFLIGHT
D. ESSFELD (Koeln, Deutsche Sporthochschule, Cologne, Federal Republic of Germany) (ZARM, MBB-ERNO, OHB-System, et al., International Microgravity Congress, 1st, Bremen, Federal Republic of Germany, Sept. 24-26, 1990) Microgravity Science and Technology (ISSN 0938-0108), vol. 3, Dec. 1990, p. 180-183. refs
Copyright

Crew exercise during spaceflight is both a primary countermeasure against adverse physiological adaptations to microgravity and a basis for health monitoring; it is also essential in training for emergency egress and EVA. Attention is presently given to the emerging conflict between observation of, and prevention of adaptation to, weightlessness in long-term space missions. Key elements of a reconcilliation of scientific and practical requirements encompass improved simulation of terrestrial locomotion aboard spacecraft and a careful combination of work and physical exercise. An account is given of the 'Grasim' gravitation-simulator concept, which is essentially a modified treadmill. O.C.

A91-19510
KINEMATIC AND DYNAMIC PROPERTIES OF AN ELBOW MANIPULATOR MOUNTED ON A SATELLITE
ROBERT E. LINDBERG (Orbital Sciences Corp., Fairfax, VA), RICHARD W. LONGMAN (Columbia University, New York), and MICHAEL F. ZEDD (U.S. Navy, Naval Research Laboratory, Washington, DC) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 397-421. refs
Copyright

The discussion in this paper is intended as an introduction to several topics treated in various forms or extensions in the other papers in this issue. Many applications of robots in space require the robot to manipulate a load mass that is not negligible compared to the satellite on which the robot is mounted. In such cases, the robot motion disturbs the position and attitude of the satellite, and this in turn disturbs the robot end-effector position. This implies that the robot joint angles that would normally be commanded to produce a prescribed robot end-effector position and orientation will result in missing the target. In this paper an overview is given of certain engineering problems arising from this phenomenon. The robot end-effector positioning problem is discussed for the two cases of the satellite attitude control system either off or on, and computation of the robot motion disturbances to the satellite is discussed. Shuttle Remote Manipulator System based examples are given. Author

A91-19511
THE KINETICS AND WORKSPACE OF A SATELLITE-MOUNTED ROBOT
RICHARD W. LONGMAN (Columbia University, New York) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 423-440. Research supported by the U.S. Navy. refs
Copyright

Satellite-mounted robots are considered that manipulate loads whose masses are not negligible compared to the satellite mass. In this paper the satellite attitude control system is considered to be turned off, as is often done on the Space Shuttle during Remote Manipulator System operation. Thus the satellite is considered to be free to not only translate, but to rotate in reaction to robot motions. Three basic topics in robotics, the forward kinematics, the inverse kinematics, and the robot work space, are all generalized here for satellite-mounted robots. One complete solution to the very complex inverse kinetics problem for 6-DOF satellite-mounted robot manipulators is presented. The robot workspace is also generated and found to be a perfect sphere whose radius is a function of the load mass. Comparison of the free-flying satellite robot workspace to that of a robot mounted on an attitude fixed satellite, and to an inertially mounted robot, shows that it is usually larger than either one. Author

A91-19512* General Electric Co., Schenectady, NY.
ON THE DYNAMICS OF SPACE MANIPULATORS USING THE VIRTUAL MANIPULATOR, WITH APPLICATIONS TO PATH PLANNING
Z. VAFA (General Electric Co., Schenectady, NY) and S. DUBOWSKY (MIT, Cambridge, MA) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 441-472. refs
(Contract NAG1-801)
Copyright

Robotic manipulators carried by future spacecraft are expected to perform important tasks in space, such as the servicing of satellites. However, the performance of these systems could be severely degraded by dynamic disturbances to the spacecraft caused by manipulator motions. This paper presents a method for representing the dynamics of space manipulator systems using the recently developed Virtual Manipulator (VM) concept. This representation is then applied to develop algorithms which can be used to plan manipulator motions that minimize disturbances of the spacecraft. Author

A91-19513* Massachusetts Inst. of Tech., Cambridge.
AN EXTENDED OPERATIONAL-SPACE CONTROL ALGORITHM FOR SATELLITE MANIPULATORS
HAROLD L. ALEXANDER (MIT, Cambridge, MA) and ROBERT H. CANNON, JR. (Stanford University, CA) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 473-486. refs
(Contract NCC2-333)
Copyright

A new control algorithm, called the extended operational-space method, is presented for control of free-floating space robots. Experimental and simulation results are presented, for two-dimensional (laboratory) and three-dimensional (simulation) robot configurations. The method's significance is discussed for robot design, and for teleoperator and autonomous control of free-floating robots. Author

A91-19514
ATTITUDE TUMBLING DUE TO FLEXIBILITY IN SATELLITE-MOUNTED ROBOTS
RICHARD W. LONGMAN (Columbia University, New York) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 487-509. Research supported by the U.S. Navy. refs
Copyright

Future satellite-mounted robots will often be required to manipulate load masses that are not insignificant compared to the satellite mass. These robots will also exhibit structural flexibility because of their size and the need for a light weight design. Here

it is shown by simple example, that the structural vibrations induced by robot manipulations will generally try to tumble the spacecraft. The satellite attitude control system will have to compensate for such attitude disturbances. A general formalism is developed to determine the satellite attitude control torque required to counteract robot motion disturbances including the effects of robot flexibility. The results are useful for analysis and evaluation of attitude control, and with proper instrumentation might serve as the control law in a feedforward control signal. Author

A91-19517
DYNAMICS DURING SLEWING AND TRANSLATIONAL MANEUVERS OF THE SPACE STATION BASED MRMS
H. W. MAH, V. J. MODI (British Columbia, University, Vancouver, Canada), Y. MORITA, and H. YOKOTA (Institute of Space and Astronautical Science, Tokyo, Japan) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 38, Oct.-Dec. 1990, p. 557-579. Research supported by the Network of Centers of Excellence. refs
(Contract NSERC-G-1547)
Copyright

The paper presents a relatively general formulation for studying librational dynamics of a flexible platform supporting a mobile base connected to a series of slewing, flexible appendages. It is applicable to missions requiring slew maneuvers of antennas, telescopes, scientific instruments, and in particular, the U.S. proposed Space Station's Mobile Remote Manipulator System (MRMS). Application of the formulation is illustrated through two simple examples: (1) a satellite consisting of a rigid platform with a slewing, rigid appendage; (2) a flexible beam-type platform representing the Space Station with a mobile, flexible, slewing arm. The analysis provides a useful insight into interactions between inertia parameters, orbit geometry, translational and slewing time histories, flexibility and initial conditions. Results suggest that under critical combinations of the parameters the system may become unstable. Application of the infinite time linear regulator is demonstrated to regain stability. Author

A91-19600
METHODS AND PROCESSES OF THERMAL DISTILLATION OF WATER SOLUTIONS FOR CLOSED WATER SUPPLY SYSTEMS
V. G. RIFERT, P. A. BARABASH, and N. N. GOLIIAD (Kievskii Politekhnicheskii Institut, Kiev, Ukrainian SSR) SAE, Intersociety Conference on Environmental Systems, 20th, Williamsburg, VA, July 9-12, 1990. 10 p. refs
(SAE PAPER 901249) Copyright

It is noted that an ideal thermal distillation system should possess compactness, low specific power consumption, and be able to operate under extreme conditions. This report deals with the type of processes which can take place under implementation of autonomous systems of water supply such as liquid film evaporation and steam condensation on the supercooled liquid film in the field of gas centrifugal forces. Evaporation to the gas medium and condensation from the gas-steam mixture in the centrifugal contact apparatus, hydrodynamics peculiarities of liquid film on the rotating surface, and minimum wetting consumptions are also discussed in detail. Results are presented for different methods of specific power consumption issuing from the prospects of the methods used in the autonomous systems of water supply. L.K.S.

A91-20481
WORLD MODEL BASED REMOTE CONTROL AND TELEPERCEPTION FOR SPACE AND GROUND SERVICING APPLICATIONS
C. JACOBUS, H. GALLARDA, M. WALKER, D. CONRAD, J. BORENSTEIN (Michigan, Environmental Research Institute; Michigan, University, Ann Arbor) et al. IN: Intelligent robots and computer vision VIII: Systems and applications; Proceedings of the Meeting, Philadelphia, PA, Nov. 9, 10, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 78-93. refs
Copyright

The current status of efforts to develop software for a remote robotic servicing system based on a world model is reviewed, summarizing the results of a conference held in Ann Arbor in March 1989. The history of telerobotic technology is recalled; the requirements for more autonomous robots are discussed; and particular attention is given to the use of world modeling software to simulate robots and sensors, plan tasks, model and display workspaces, route information, and provide for operator interaction. A number of unresolved issues are identified, and the system architecture of a robotic testbed used to evaluate software designs is illustrated with diagrams. T.K.

N91-13875*# California Univ., Davis. Dept. of Mechanical, Aeronautical, and Materials Engineering.
MODELING PILOT INTERACTION WITH AUTOMATED DIGITAL AVIONICS SYSTEMS: GUIDANCE AND CONTROL ALGORITHMS FOR CONTOUR AND NAP-OF-THE-EARTH FLIGHT Final Report, period ending 30 Sep. 1990
RONALD A. HESS 1990 121 p
(Contract NAG2-221)
(NASA-CR-186105; NAS 1.26:186105) Avail: NTIS HC/MF A06 CSCL 05/8

A collection of technical papers are presented that cover modeling pilot interaction with automated digital avionics systems and guidance and control algorithms for contour and nap-of-the-earth flight. The titles of the papers presented are as follows: (1) Automation effects in a multiloop manual control system; (2) A qualitative model of human interaction with complex dynamic systems; (3) Generalized predictive control of dynamic systems; (4) An application of generalized predictive control to rotorcraft terrain-following flight; (5) Self-tuning generalized predictive control applied to terrain-following flight; and (6) Precise flight path control using a predictive algorithm. Author

N91-13876*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERIC EXTRAVEHICULAR (EVA) AND TELEROBOT TASK PRIMITIVES FOR ANALYSIS, DESIGN, AND INTEGRATION. VERSION 1.0: REFERENCE COMPILATION FOR THE EVA AND TELEROBOTICS COMMUNITIES
JEFFREY H. SMITH and MICHAEL DREWS 30 Mar. 1990 302 p
(Contract NAS7-918)
(NASA-CR-187429; JPL-PUBL-90-10; NAS 1.26:187429) Avail: NTIS HC/MF A14 CSCL 05/8

The results are described of an effort to establish commonality and standardization of generic crew extravehicular (crew-EVA) and telerobotic task analysis primitives used for the study of spaceborne operations. Although direct crew-EVA plans are the most visible output of spaceborne operations, significant ongoing efforts by a wide variety of projects and organizations also require tools for estimation of crew-EVA and telerobotic times. Task analysis tools provide estimates for input to technical and cost tradeoff studies. A workshop was convened to identify the issues and needs to establish a common language and syntax for task analysis primitives. In addition, the importance of such a syntax was shown to have precedence over the level to which such a syntax is applied. The syntax, lists of crew-EVA and telerobotic primitives, and the data base in diskette form are presented. Author

N91-13877# Ballistic Research Labs., Aberdeen Proving Ground, MD.
AN ALTERNATIVE TO SUPPRESSION: MODELING METHODOLOGY FOR ASSESSING INDIRECT EFFECTS OF WEAPONS AND HUMAN PERFORMANCE DEGRADATION
ADA W. GILMAN Aug. 1990 51 p
(AD-A226518; BRL-TR-3131) Avail: NTIS HC/MF A04 CSCL 23/2

Performance of weapon systems and failure of well planned military operations can frequently be attributed to either a malfunction or limitation of the human element. Hence, an accurate

quantification of weapons effects should include not only direct effects of weapons (physical destruction/degradation of targets and production of casualties) but also indirect effects. Most algorithms and equations used in military analysis today however do not consider indirect effects of weapons. Traditionally, the notion of suppression has been cited in such a context. The direct and psychological efforts of weapons are examined. A proposal for modeling them is presented. The difficulties in human performance degradation modeling in the context of modern warfare are discussed. An argument challenging the validity of continued usage of the traditional term suppression is presented. A definition of indirect effects of weapons is offered; a taxonomy of the relevant combat phenomenon is established. A modeling proposal on the quantification of indirect effects is described involving the establishment of five submodels representing several distinct elements of combat system: Individual/Personnel, Visual Detection, Immediate Physical Threat (Firing), Communication and Decision Making. GRA

N91-13878# Air Force Human Resources Lab., Wright-Patterson AFB, OH. Logistics and Human Factors Div.
THE POET REVEALED: A FUTURE FOR HUMAN-CENTERED DESIGN
EDWARD BOYLE Sep. 1990 17 p Submitted for publication
(AD-A226648; AFHRL-TP-90-64) Avail: NTIS HC/MF A03
CSCL 23/2

Human centered design technology as it might operate in the future is described. A prototype on screen ergonomic technology is described in the form of a story. The objective of the paper is to introduce general readers to computer graphics man-modeling work being done by the Air Force Human Resources Laboratory's Logistics Systems Branch. GRA

N91-13879*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
EMU HELMET MOUNTED DISPLAY Patent Application
JOSE MARMOLEJO, inventor (to NASA); STEPHEN SMITH, inventor (to NASA), ALAN PLOUGH, inventor (to NASA), ROBERT CLARKE, inventor (to NASA), WILLIAM MCLEAN, inventor (to NASA), and JOSEPH FOURNIER, inventor (to NASA) (Hamilton Standard, Windsor Locks, CT.) 25 Sep. 1990 14 p
(NASA-CASE-MSC-21460-1; NAS 1.71:MSC-21460-1; US-PATENT-APPL-SN-587919) Avail: NTIS HC/MF A03 CSCL 05/8

A helmet mounted display device is disclosed for projecting a display on a flat combiner surface located above the line of sight where the display is produced by two independent optical channels with independent LCD image generators. The display has a fully overlapped field of view on the combiner surface and the focus can be adjusted from a near field of four feet to infinity. NASA

N91-13880# Idaho National Engineering Lab., Idaho Falls. Human Factors Research Unit.
THE HUMAN FACTORS OF QUALITY AND QA IN R AND D ENVIRONMENTS
SUSAN G. HILL 1990 9 p Presented at the 17th Annual Conference of the American Society for Quality Control, Tucson, AZ, 9-12 Sep. 1990
(Contract DE-AC07-76ID-01570)
(DE91-001913; EGG-M-90048; CONF-9009153-3) Avail: NTIS HC/MF A02

Achieving quality is a human activity. It is therefore important to consider the human in the design, development and evaluation of work processes and environments in an effort to enhance human performance and minimize error. It is also important to allow for individual differences when considering human factors issues. Human Factors is the field of study which can provide information on integrating the human into the system. Human factors and quality are related for the customer of R and D work, R and D personnel who perform the work, and the quality professional who overviews the process of quality in the work. DOE

N91-13881 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE EFFECT OF CONDENSATION IN CLOTHING ON HEAT TRANSFER Final Report
W. A. LOTENS, F. J. G. VANDELINDE, and G. HAVENITH 2 Apr. 1990 40 p
(Contract B87-63)
(IZF-1990-B-5; TD-90-0033; ETN-91-98317) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

A condensation theory is presented, that enables the calculation of the rate of vapor transfer with its associated effects on temperature and total heat transfer, inside a clothing ensemble consisting of underclothing, enclosed air, and outer garment. The model is experimentally tested by three experiments. Impermeable garments are worn by subjects with and without plastic foil around the skin, blocking sweat evaporation underneath the clothing. Comparison is made between heat loss in impermeable and semipermeable garments and the associated discomfort and strain. Subjects working in impermeable garments in cool and warm environments at two work rates, with and without external radiation, are tested until tolerance. The measured heat exchange and temperatures are calculated with satisfying accuracy using the model. Numerical analysis shows that for total heat loss the major determinants are vapor permeability of the outer garment, skin vapor concentration, air temperature and clothing insulation. In cold conditions the condensation mechanism may completely compensate for the lack of permeability of the clothing as far as heat dissipation is concerned. In hot conditions impermeable clothing is more stressful. ESA

N91-13882# Royal Aerospace Establishment, Farnborough (England).
A SUBJECTIVE RATING SCALE FOR ASSESSING PILOT WORKLOAD IN FLIGHT: A DECADE OF PRACTICAL USE
A. H. ROSCOE and G. A. ELLIS (British Aerospace Public Ltd. Co., Bristol, England) 5 Mar. 1990 19 p
(RAE-TR-90019; RAE-FM-6; BR114794; ETN-91-98364)
Copyright Avail: NTIS HC/MF A03

The design and development of a ten point rating scale by means of practicing pilots are developed. Effort was concentrated upon developing a comparative scale that could help to answer the important and practical question of whether the workload is appropriate for the primary task under consideration. The Cooper-Harper scale was used to assess handling qualities and the Bedford scale to estimate workload levels, the latter being augmented by recording the pilot heart rate. The scale was based on the concept of space capacity. The examples of various flight trials and workload studies realized by pilots showed their satisfaction of the Bedford scale. ESA

N91-13883# Southampton Univ. (England). Human Factors Research Unit.
MODELLING THE EFFECTS OF VIBRATION ON VISUAL PERFORMANCE
A. D. DAVIES and M. J. GRIFFIN 1989 56 p
(ISVR-TR-171; ETN-91-98374) Avail: NTIS HC/MF A04

A model to account for and predict the effects of retinal image vibration on visual acuity is developed. It was assumed that the visual system performs a Fourier type analysis and that vibration may act primarily on the high spatial frequency region of the contrasty sensitivity function that was measured. A model of the blurring caused by image movement on the retina was developed using an exponential decay to represent the temporal characteristics of the retina. The usefulness of the temporal model as a predictor of target legibility during vibration is demonstrated. For sinusoidal single axis vibration performance during vibration is similar to performance with static images degraded to simulate legibility 18 degrees to 54 degrees after the modes of the vibration. The model can be applied to predicting the legibility of targets during multiple axis or random vibration provided that the maximum legibility points are identified. ESA

N91-13884# Southampton Univ. (England). Human Factors Research Unit.
EFFECTS OF ANTHROPOMETRIC AND POSTURAL VARIABLES ON THE TRANSMISSION OF WHOLE-BODY VERTICAL VIBRATION FROM SEAT-TO-HEAD
A. MESSENGER and M. J. GRIFFIN Sep. 1989 125 p Sponsored by Ministry of Defence, London, England
(ISVR-TR-172; ETN-91-98375) Avail: NTIS HC/MF A06

Studies are conducted to obtain quantitative data relating systematic changes in selected postural variables to variations in vibration transmitted through the body. The effects of varying head angle in pitch, roll and yaw axes are investigated as well as those of varying pelvic and spinal posture. The results suggest that displays viewed frequently should be placed at or below eye level and directly in front of the observer. At low frequencies, significant correlations are found between transmittibility and body dimensions, but in all axes monitored at the head, partial correlation techniques did not indicate any particular body dimension as being consistently important. The systematic studies are applied to helicopter seat design and it is shown that overall static comfort in the lower back region are greater when lumbar support is present. ESA

N91-14719*# Jeanneret and Associates, Inc., Houston, TX.
POSITION REQUIREMENTS FOR SPACE STATION PERSONNEL AND LINKAGES TO PORTABLE MICROCOMPUTER PERFORMANCE ASSESSMENT
P. R. JEANNERET Feb. 1988 103 p Prepared in cooperation with Essex Corp., Orlando, FL
(Contract NAS9-17326)
(NASA-CR-185606; NAS 1.26:185606; EOTR-88-11) Avail: NTIS HC/MF A06 CSCL 05/8

The development and use of a menu of performance tests that can be self-administered on a portable microcomputer are investigated. In order to identify, develop, or otherwise select the relevant human capabilities/attributes to measure and hence include in the performance battery, it is essential that an analysis be conducted of the jobs or functions that will be performed throughout a space shuttle mission. The primary job analysis instrument, the Position Analysis Questionnaire (PAQ), is discussed in detail so the reader will have sufficient background for understanding the application of the instrument to the various work activities included within the scope of the study, and the derivation of the human requirements (abilities/attributes) from the PAQ analyses. The research methodology is described and includes the procedures used for gathering the PAQ data. The results are presented in detail with specific emphasis on identifying critical requirements that can be measured with a portable computerized assessment battery. A discussion of the results is given with implications for future research. Author

N91-14720# Carlow Associates, Inc., Fairfax, VA.
HUMAN FACTORS ENGINEERING. PART 1: TEST PROCEDURES Final Report
15 May 1990 866 p
(AD-A226480; TOP-1-2-610-PT-1) Avail: NTIS HC/MF A99 CSCL 23/2

The material in this Test Operations Procedure (TOP) is intended to be used for the Human Factors Engineering (HFE) assessment of all types of materiel and systems tested by the U.S. Army Test and Evaluation Command (TECOM). Supplementary sources of guidance are indicated when required. TOP 1-2-610 encompasses the HFE procedures for the testing of design, functional performance, and environmental considerations for the major test functions (operability, maintainability, transportability, portability/usability, erectability, and habitability) applicable to the HFE assessment. This TOP contains two parts: Part 1, Test Procedures and Part 2, Human Factors Engineering Data Guide for Evaluation (HEDGE). Part 1, Test Procedures, provides guidance on how to plan and conduct an HFE test. Part 1 includes specific test procedures for measurement and assessment of environmental, design, and performance characteristics of test items and sample data collection forms such as checklists, questionnaire/interview forms, and other data collection forms. Part 2, the Human Factors Engineering Data Guide for Evaluation (HEDGE) provides planning guidance concerning what to test. HEDGE includes guidance on classification of the test item, identification of applicable test functions, test conditions, performance tasks, and detailed design criteria. GRA

N91-14721# Virginia Polytechnic Inst. and State Univ., Blacksburg.
ADAPTIVE HUMAN-COMPUTER INTERFACES USING EXPERT PROFILES Final Report, Sep. 1986 - Sep. 1987
ROBERT C. WILLIGES, JAY ELKERTON, KIM J. VICENTE, and BRIAN C. HAYES Jul. 1990 131 p
(Contract MDA903-84-C-2017)
(AD-A226906; HCI-87-01; ARI-RN-90-83) Avail: NTIS HC/MF A07 CSCL 23/2

Adaptive human-computer systems accommodate a wide variety of users learning to interact with computers because they adjust to different skill levels and provide novices with appropriate levels of expertise needed to perform certain tasks. This effort was directed toward developing improved models of experts based on goal-based models and toward assaying and isolating individual differences of inexperienced users in order to adapt the software interface to these individual differences. Results show that inexperienced users and that slower users were more variable in their search times than experienced users and that slower users selected more inefficient search commands. Two performance-based and one cognitive-based command selection aid improved search performance and strategies of slower, inexperienced users. Since spatial and verbal ability were found to correlate of slower, positively with search strategies, inexperienced users learned to select fewer and more efficient commands when provided with spatial augmentation (graphic presentation). GRA

N91-14722# Illinois Univ., Champaign. Dept. of Psychology.
INFORMATION EXTRACTION FROM VISUAL DISPLAYS AND THE EVENT-RELATED BRAIN POTENTIAL Interim Report, Aug. 1985 - Sep. 1986
CHRISTOPHER D. WICKENS, CARLA BOSCO, AMIR MANE, ARTHUR F. KRAMER, MICHAEL COLES, and EMANUEL DONCHIN Sep. 1990 41 p
(Contract MDA903-83-K-0255)
(AD-A227063; ARI-RN-90-120) Avail: NTIS HC/MF A03 CSCL 06/5

Three experiments, of increasing levels of complexity, are reported which examine two questions: (1) Will subjects extract more information from progressively more information stimuli in a probabilistic state estimation task, as inferred from reaction time measures; and (2) Will the amplitude of the P300 component of the event-related brain potential, reflect the amount of information extracted. The three experiments used different versions of a process monitoring task in which the process could be in one of two states, and information bearing on the expectancy of one state or the other was conveyed by discrete informative cues. Occasional probes signalled imperative responses to the expected or unexpected states. The data indicated that in the simplest version of the task with only two levels of information value (Experiment 1), both questions were answered affirmatively. GRA

N91-14723* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
VALVE FOR WASTE COLLECTION AND STORAGE Patent
WILLIAM E. THORNTON, JR., inventor (to NASA) and HENRY B. WHITMORE, inventor (to NASA) 3 Jul. 1990 15 p Filed 10 Aug. 1989 Division of US-Patent-Appl-SN-035401, filed 7 Apr. 1989
(NASA-CASE-MSC-21025-4; US-PATENT-4,937,891; US-PATENT-APPL-SN-392228; US-PATENT-APPL-SN-035401; US-PATENT-CLASS-4-209R; US-PATENT-CLASS-4-482; US-PATENT-CLASS-4-316; INT-PATENT-CLASS-E03D-9/04)
Avail: US Patent and Trademark Office CSCL 06/11

A method and valve apparatus for collection of fecal matter designed to operate efficiently in a zero gravity environment is

presented. The system comprises a waste collection area within a body having a seat opening. Low pressure within the waste collection area directs fecal matter away from the user's buttocks and prevents the escape of undersirable gases. The user actuates a piston covered with an absorbent pad that sweeps through the waste collection area to collect the fecal matter, scrub the waste collection area, press the waste against an end of the waste collection area and retracts, leaving the used pad. Multiple pads are provided on the piston to accommodate multiple uses of the system. Also a valve allows air to be drawn through the body, so the valve will not be plugged with fecal matter. A sheet feeder feeds fresh sheets of absorbent pads to a face of the piston with each actuation.

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

N91-14724* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
METHOD FOR WASTE COLLECTION AND STORAGE Patent
WILLIAM E. THORNTON, JR., inventor (to NASA) and HENRY B. WHITMORE, inventor (to NASA) 24 Jul. 1990 15 p Filed 10 Aug. 1989 Division of US-Patent-Appl-SN-035401, filed 7 Apr. 1989
(NASA-CASE-MSC-21025-2; US-PATENT-4,942,632; US-PATENT-APPL-SN-391911; US-PATENT-APPL-SN-035401; US-PATENT-CLASS-4-661; US-PATENT-CLASS-4-482; US-PATENT-CLASS-4-316; US-PATENT-CLASS-4-DIG.9; INT-PATENT-CLASS-A47K-11/00) Avail: US Patent and Trademark Office CSCL 06/11

A method for collection of fecal matter designed to operate efficiently in a zero gravity environment was invented. The system consists of a waste collection area within a body having a seat opening. Low pressure within the waste collection area directs fecal matter away from the user's buttocks and prevents the escape of waste gases. The user actuates a piston covered with an absorbent pad that sweeps through the waste collection area to collect fecal matter, scrub the waste collector area, press the waste against an end of the waste collection area and retracts, leaving the used pad. Multiple pads are provided on the piston to accommodate multiple usages. Also a valve allows air to be drawn through the body, which keeps the valve from becomming plugged with the feces. A sheet feeder feeds fresh sheets of absorbent pads to a face of the piston with each actuation.

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

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

N91-14725*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EXOBIOLOGY IN EARTH ORBIT: THE RESULTS OF SCIENCE WORKSHOPS HELD AT NASA, AMES RESEARCH CENTER
D. DEFREES, ed., D. BROWNLEE, ed., J. TARTER, ed., D. USHER, ed., W. IRVINE, ed., and H. KLEIN, ed. 1989 142 p Original contains color illustrations
(NASA-SP-500; NAS 1.21:500) Avail: NTIS HC/MF A07; also available SOD HC $6.50 as 033-000-01057-5; 5 functional color pages CSCL 06/3

The Workshops on Exobiology in Earth Orbit were held to explore concepts for orbital experiments of exobiological interest and make recommendations on which classes of experiments should be carried out. Various observational and experimental opportunities in Earth orbit are described including those associated with the Space Shuttle laboratories, spacecraft deployed from the Space Shuttle and expendable launch vehicles, the Space Station, and lunar bases. Specific science issues and technology needs are summarized. Finally, a list of recommended experiments in the areas of observational exobiology, cosmic dust collection, and in situ experiments is presented. M.G.

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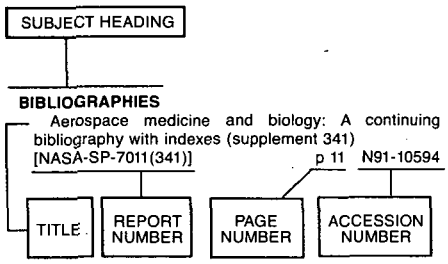

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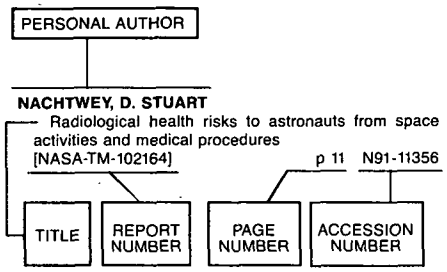

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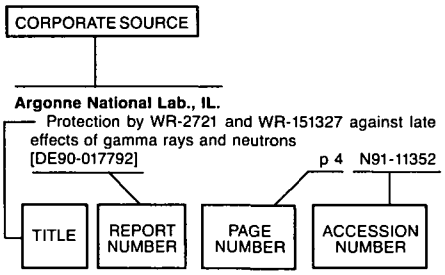

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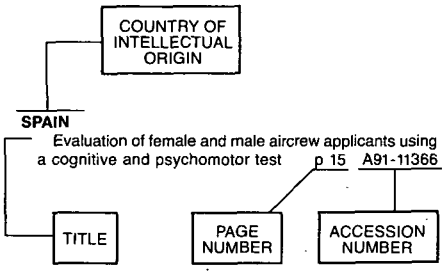

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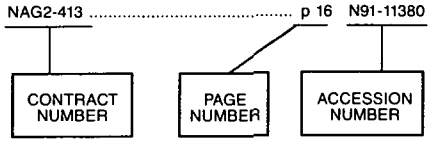

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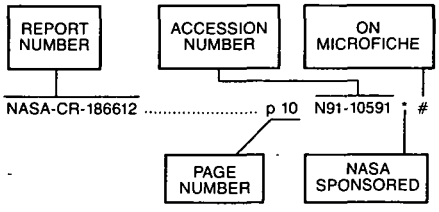

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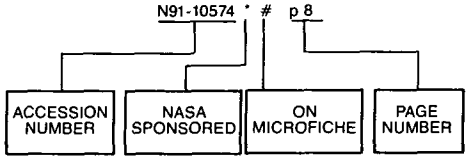

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