NASA SP-7011 (353)
September 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

NASA STI PROGRAM
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National Aeronautics and Space Administration
Office of Management
Scientific and Technical Information Program
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INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 238 reports, articles and other documents originally announced in August 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)	N91-23073 — N91-25099
IAA (A-10000 Series)	A91-36013 — A91-40566

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.

TABLE OF CONTENTS

Page

Category 51 Life Sciences (General) 197

Category 52 Aerospace Medicine 206
Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

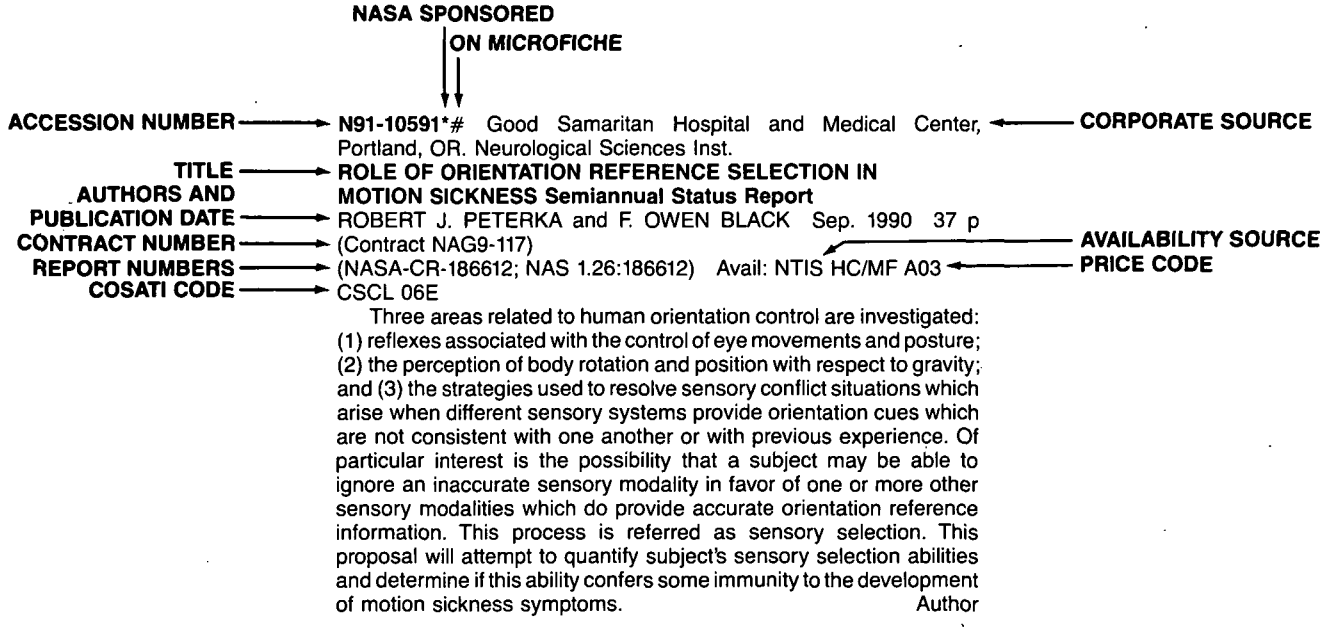
Category 53 Behavioral Sciences 224
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

Category 54 Man/System Technology and Life Support 226
Includes human engineering; biotechnology; and space suits and protective clothing.

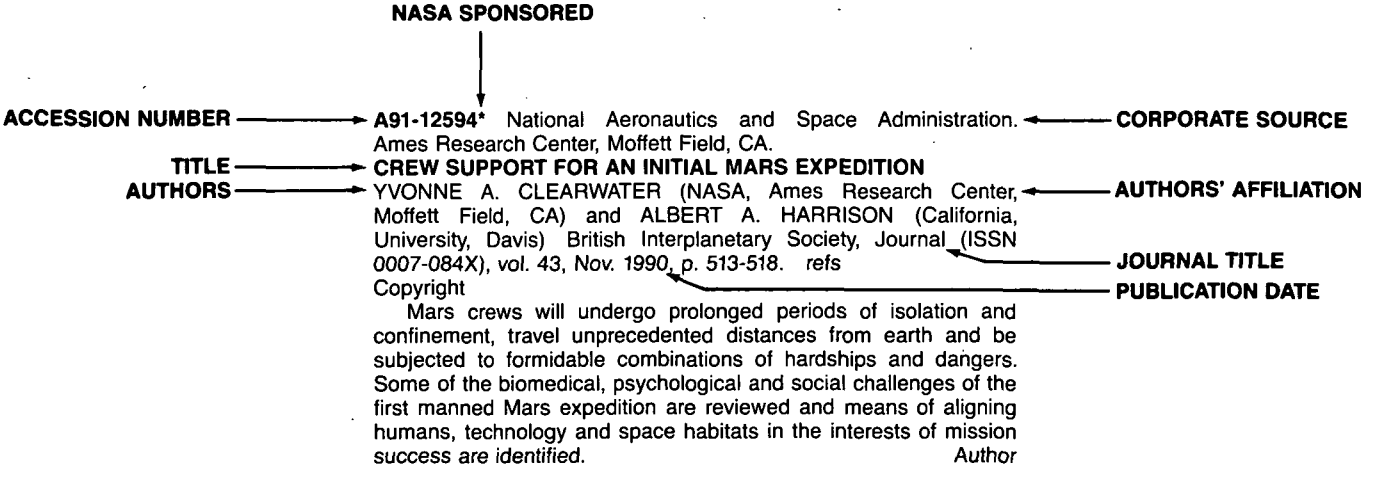
Category 55 Space Biology 235
Includes exobiology; planetary biology; and extraterrestrial life.

Subject Index A-1
Personal Author Index B-1
Corporate Source Index C-1
Foreign Technology Index D-1
Contract Number Index E-1
Report Number Index F-1
Accession Number Index G-1
Appendix APP-1

TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 353)

SEPTEMBER 1991

51

LIFE SCIENCES (GENERAL)

A91-36420
EFFECTS OF LEFT ATRIAL PRESSURE ON THE PULMONARY VASCULAR RESPONSE TO HYPOXIC VENTILATION
SHIAN GU, JOHN DUCAS, USHA SCHICK, and RICHARD M. PREWITT (Manitoba, University, Winnipeg, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 1991-1995. Research supported by Medical Research Council of Canada. refs
Copyright

Effects of hypoxic ventilation on the pulmonary arterial pressure-flow (P-Q) relationship in an intact canine preparation have been investigated. The hypothesis that, over a large range, changes in left atrial pressure (LAP) would alter the effects of hypoxic ventilation on pulmonary P-Q characteristics was tested. Seven dogs were the subjects of the experiment. The results obtained demonstrate that hypoxic ventilation causes an isolated increase in the extrapolated pressure intercept of the pulmonary P-Q relationship. The effects of hypoxic ventilation on pulmonary P-Q characteristics are not affected by the resting LAP. O.G.

A91-36423
PHRENIC NEURAL OUTPUT DURING HYPOXIA IN DOGS - CONSTANT-FLOW VENTILATION VS. SPONTANEOUS BREATHING
S. S. J. NAQVI, A. S. MENON, B. E. SHYKOFF, A. S. REBUCK, and A. S. SLUTSKI (Mount Sinai Hospital; Toronto Hospital; Toronto, University, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 2045-2051. Research supported by Medical Research Council of Canada. refs
Copyright

A91-36424* Washington Univ., Saint Louis, MO.
EFFECT OF DENERVATION OR UNWEIGHTING ON GLUT-4 PROTEIN IN RAT SOLEUS MUSCLE
ERIK J. HENRIKSEN, KENNETH J. RODNICK, CARL E. MONDON, DAVID E. JAMES, and JOHN O. HOLLOSZY (Washington University, Saint Louis, MO; Stanford University; USVA, Medical Center, Palo Alto, CA) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 2322-2327. NASA-supported research. refs
(Contract NIH-AG-00425; NIH-DK-42503)
Copyright

The study is intended to test the hypothesis that the decreased capacity for glucose transport in the denervated rat soleus and the increased capacity for glucose transport in the unweighted rat soleus are related to changes in the expression of the regulatable glucose transporter protein in skeletal muscle (GLUT-4). Results obtained indicate that altered GLUT-4 expression may be a major contributor to the changes in insulin-stimulated glucose transport that are observed with denervation and unweighting. It is concluded that muscle activity is an important factor in the regulation of the GLUT-4 expression in skeletal muscle. O.G.

A91-37268
INCREASING THE PHYSICAL ENDURANCE OF ANIMALS TREATED WITH PARA-AMINOBENZOIC ACID [POVYSHENIE FIZICHESKOI VYNOSLIVOSTI ZHIVOTNYKH POD VLIIANIEM PARAAMINOBENZOINOI KISLOTY]
N. I. ARLASHCHENKO, D. IA. OPARINA, and I. A. RAPOPORT (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia (ISSN 0002-3329), Mar.-Apr. 1991, p. 224-231. In Russian. refs
Copyright

The effect of administering para-aminobenzoic acid (PABA) to rats and mice prior to irradiation with radioactive cobalt (8 Gy dose at a rate of 48 Gy/min) on the level of physical endurance of the animals was investigated by estimating the physical capacity of the animals in swimming tests given 1, 3, 5, 7, 10, 14, 21, and 28 days after irradiation. It was found that PABA increased the level of physical endurance (by 10 to 40 percent) of both irradiated and nonirradiated animals. In addition, PABA was found to lower occurrences of hemorrhages and diarrhea due to irradiation. I.S.

A91-37456*
INTERNATIONAL UNION OF PHYSIOLOGICAL SCIENCES COMMISSION ON GRAVITATIONAL PHYSIOLOGY, ANNUAL MEETING, 11TH, LYONS, FRANCE, SEPT. 25-27, 1989, PROCEEDINGS
ORR E. REYNOLDS, ED. Meeting sponsored by International Union of Physiological Sciences, ESA, AN SSSR, NASA, and Galileo Foundation. Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, 192 p. For individual items see A91-37457 to A91-37527.

Topics discussed include recent space flight results in gravitational physiology, cardiovascular changes, current concepts in gravitational physiology, musculoskeletal changes, gravity and the cardiovascular system, hypergravic conditions, and head-down tilt. Papers are presented on the effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex, a comparative study of cardiovascular responses in primates exposed to tilt test and lower body positive pressure, catecholamines during short- and long-term head-down bedrest, and effects of a 40-day tail-suspension on rat weight-bearing bones. Attention is also given to otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus, cardiovascular responses to sustained acceleration, effects of high sustained hypergravity on plasma catecholamines, and the carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt. I.S.

A91-37459#
BONE CELLULAR EFFECTS AFTER WEIGHTLESSNESS EXPOSURE - AN HYPOTHESIS
L. VICO and C. ALEXANDRE (Saint-Etienne, Universite, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-8 to S-11. refs

The paper reviews published findings on the effect of short-term (from 7 to 21 days) exposures to weightlessness on the microstructure and growth of bone tissue in mammals flown aboard the Cosmos and Spacelab spacecraft. On the basis of these data, it is concluded that the observed bone cell alterations taking place

during space flights are a composite response to multiple factors including microgravity, the launch and landing conditions, a fluid shift, an altered circadian rhythmicity, and physiological stress. It is suggested that some of these artifacts could be minimized in studies on osteoblast cultures flown in space. I.S.

A91-37460#
EFFECTS OF SPACE FLIGHT ON DENDRITES OF THE NEURONS OF THE RAT'S BRAIN
P. V. BELICHENKO, M. A. MACHANOV, A. A. FEDOROV, T. A. LEONTOVICH (Brain Research Institute, Moscow, USSR), and I. B. KRASNOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-12 to S-15. refs

The effect of spaceflight on the dendritic system of mammalian-brain neurons was investigated by analyzing the geometry of dendrites (Ds) of giant multipolar neurons (GMNs) of the reticular formation (related to automatic motor reactions) and of the pyramidal neurons (PNs) of the visual cortex of adult male Wistar albino rats flown aboard Cosmos-1667 (7 days) and Cosmos-1887 (13.5 days). It was found that the exposure to microgravity caused basal dendrites of PNs to change their ordinary orientation in parallel to the oblique Ds and (2) the lengthening of the oiblique Ds. It is concluded that one of the compensatory changes of Ds in the visual cortex of adult rats includes a widening of the extent of their intrinsic connections (between different fields of a hemisphere) and of interhemispheric connections. I.S.

A91-37462#
HISTOMORPHOMETRIC ANALYSIS OF BONES OF COSMOS-1887 RATS
A. S. KAPLANSKII, G. N. DURNOVA, E. I. IL'INA-KAKUEVA, Z. F. SAKHAROVA, and E. V. VOROTNIKOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-20 to S-22. refs

The effect of weightlessness on the skeletal bone microstructure was investigated by analyzing histomorphometric and enzyme content changes in tibia and lumbar vertebrae (L4-L6) of Wistar male rats after a 13-day-long flight aboard Cosmos-1887. Two types of bone changes were identified: (1) changes taking place during flight due to microgravity, including symptoms of osteoporosis, and (2) changes that occurred immediately after flight, including a decrease of acid phosphatase in osteoclasts, indicating the onset of readaptation to earth's gravity. I.S.

A91-37464#
THE EFFECT OF SPACE FLIGHT ON THE ULTRASTRUCTURE OF THE RAT CEREBELLAR AND HEMISPHERE CORTEX
I. B. KRASNOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) and L. N. D'IACHKOVA (AN SSSR, Institut Evoliutsionnoi Morfologii i Ekologii Zhivotnykh, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-29, S-30. refs

The effect of a short space flight on the ultrastructure of the brain cortex of male and female rats was investigated by examining the ultrastructure of the nodulus cortex of rats after a 5-day flight aboard Cosmos-1514 and of the nodulus cortex and the somatosensory and visual cortex of rats after a 7-day flight aboard Cosmos-1667. Examination of the somatosensory and visual cortex tissues of rats flown for 7 days revealed ultrastructural changes which suggested a microgravity-induced reduction of afferent impulsation. However, in the visual cortex, most of the changed axonal terminals displayed only light degeneration, and the morphological signs of excitation seen in the somatosensory cortex were less obvious. I.S.

A91-37472*# Louisville Univ., KY.
FLUID/ELECTROLYTE BALANCE AND CARDIOVASCULAR RESPONSES - HEAD-DOWN TILTED RATS
X. J. MUSACCHIA (Louisville, University, KY), D. R. DEAVERS (University of Osteopathic Medicine, Des Moines, IA), and G. A. MEININGER (Texas A & M University, College Station) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-46, S47. refs
(Contract NSG-2191; NSG-2325; NAG2-386)

Results are presented on cardiovascular and fluid/electrolyte balance responses of rats to a 7-day-long whole-body suspension (WBS) with about 20-deg head-down tilt (HDT), followed by 7 days of recovery. Compared with horizontally positioned (N-HDT) rats serving as controls, the Na intake of HDT rats was significantly reduced during the first 3 days of HDT, and urinary and fecal Na loss exceeded the Na intake during days 5 and 6. Changes during the days of recovery showed adjustments and reestablishment of Na balance. Urinary K losses increased progressively during the 7 days of HDT, but, with the exception of days 1-3 of HDT, when the K intake was significantly reduced, the K balance was retained. Changes in cardiac responses (including elevations in mean, diastolic, and systolic arterial pressures) paralleled changes in fluid and electrolyte balance during the HDT period. I.S.

A91-37473#
HEMODYNAMIC RESPONSES TO -6 DEGREES HEAD-DOWN REST IN DOGS - A MODEL OF WEIGHTLESSNESS
W. G. SQUIRES, M. K. SMITH, S. NUNNELEY, and P. B. RAVEN (Texas Lutheran College, Brooks AFB; Texas College of Osteopathic Medicine, Fort Worth) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-48, S-49. refs
(Contract F49620-82-C-0035; F33615-84-R-0514; F33615-83-D-0602)

Hemodynamic changes in response to a 60-min -6 deg head-down rest (HDR) followed by 15 min recovery period were measured in cannulated dogs and were compared to changes reported for human subjects. It was found that the right-atrial pressure, which is an index of central venous pressure, increased rapidly during the first 15 min of HDR and plateaued soon after; both the rate of change and the plateau level were comparable to those reported for humans (Lollgen et al., 1984). The averaged responses of mean arterial pressure, heart rate, and cardiac output showed a lack of effect of HDR on these parameters. Results demonstrate that dogs subjected to HDR may be used as an animal model for invasive investigations of microgravity environment. I.S.

A91-37474#
COMPARATIVE STUDY OF CARDIOVASCULAR RESPONSES IN PRIMATES EXPOSED TO TILT TEST AND LBPP
C. C. TRAN, F. PAILLARD (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Laboratoire Central de Biologie Aerospatiale, Paris, France), O. LANGERON, D. PAYEN (Hopital Lariboisiere, Paris, France), F. LABORDE (Centre d'Etudes et de Recherches Animale, Paris, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-50, S-51. refs

Two methods widely used to simulate microgravity were compared by assessing cardiovascular responses elicited in a baboon: head-down tilt and lower body positive pressure (LBPP). Results showed that the values of carotid blood flow increased in response to head-down tilt but not to LBPP, where the carotid blood flow remained relatively stable (although values of heart rate were found to decrease under LBPP). It is suggested that

the failure of carotid blood flow to change (decrease) under LBPP was due to an increase in peripheral resistance, increasing the distribution of the aortic blood flow in carotid arteries. I.S.

A91-37484#
COMPARED EFFECTS OF A 13 DAY SPACEFLIGHT ON THE CONTRACTILE PROTEINS OF SOLEUS AND PLANTARIS RAT MUSCLES
X. HOLY, L. STEVENS, and Y. MOUNIER (Lille I, Universite, Villeneuve-d'Ascq, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-80, S-81. CNES-supported research. refs

The effects of a 13-day spaceflight on the in vitro kinetic characteristics of fibers isolated from the rat soleus and plantaris muscles were investigated in rats flown aboard Biocosmos 1887, and the kinetic changes observed under different Ca(2+) concentrations in the incubation medium were correlated with changes found in the contents of isoforms of the myosin light chains and of the troponin C (TnC) in the two muscles. Results show that, after the spaceflight, the calcium affinity increased only for the slow twitch muscle (soleus) but not for the fast plantaris muscle. The changes in calcium sensitivity as well as those of kinetic parameters observed in the two types of muscles could be correlated to changes in the type and/or in the relative contents of the myosin light chain and TnC. Moreover, the modifications were more important for the antigravitational soleus muscle than for the plantaris. I.S.

A91-37486#
EFFECT OF SIMULATED MICROGRAVITY ON THE ULTRASTRUCTURAL COMPOSITION OF RAT SOLEUS MUSCLE
D. DESPLANCHES, B. SEMPORE, R. FLANDROIS (Lyon I, Universite, Lyons, France), S. R. KAYAR, and H. HOPPELER (Bern, Universitaet, Switzerland) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-84, S-85. Research supported by Fondation pour la Recherche Medicale. refs

The effect of a 5-wk-long tail suspension on the ultrastructure of rat soleus were evaluated by counting the numbers of fibers and capillaries in the muscle and estimating the volume density of interfibrillar, subsarcolemmal, and total mitochondria and volume densities of myofibrils and satellite cells. It was found that the exposure of rats to hypodynamia-hypokinesia resulted in a greater decrease in the fiber mean cross-sectional area than that in the number of capillaries per fiber, resulting in a higher capillary density. The volume density of myofibrils was slightly reduced, while the total mitochondrial volume density remained unchanged. An increase observed in volume density of satellite cells suggested events leading to muscle regeneration. I.S.

A91-37487#
BIOMECHANICAL CHARACTERISTICS OF M. SOLEUS AND M. GASTROCNEMIUS OF RATS IN MUSACCHIA'S MODEL
J. HIDEG, A. POZSGAI (Hungarian Army Medical Corps, Hungary), F. GUBA, I. OCSOVSZKI, F. KEKES-SZABO (Medical University, Szeged, Hungary) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-86, S-87.

The effect of microgravity on the biomechanical characteristics of isolated m.soleus and m. gastrocnemius of rats were investigated using the Musacchia model of hypokinesis, in which the rat is so suspended that its weight is shifted to the forelimbs while the hind limbs are eased of burden. In the experiments, animals of one group were exposed to hypokinesis using restricting cages, the other group was subjected to Musacchia's immobilization method, and control animals could move without restriction. It was found that, in the animals exposed to whole-body hypokinesis (the first group), no changes of muscle weight or tension occurred in soleus and only small changes occurred in gastrocnemius. On the other hand, in animals immobilized according to Musacchia, the atrophy of slow fibers were found to be the prime effect of suspension. The slow type m. soleus showed marked decreases in contraction time and in convulsive half-time after 14 days of suspension, while m. gastrocnemius was less sensitive. I.S.

A91-37488#
TIME-COURSE OF SOLEUS MUSCLE-CHANGE IN AND RECOVERY FROM DISUSE ATROPHY
M. FALEMPIN, T. LECLERCQ, D. LETERME, and Y. MOUNIER (Lille I, Universite, Villeneuve-d'Ascq, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-88, S-89. CNES-supported research. refs

The dependence of the degree of muscle atrophy and the mechanical-parameter changes on the duration of the muscle disuse was investigated, together with the kinetics of recovery after the development of a maximal atrophy, in male Wistar rats subjected to hind-limb suspension (HS) for 2, 5, 8, 15, or 30 days; the effects of 2, 5, 8, and 15 day recovery, during which rats were allowed to walk normally in their cages, were tested only on rats suspended for 15 days. Examinations of morphometric characteristics and the peak tetanic tension values showed that structural muscular atrophy was a process which developed progressively until a plateau was reached after 15 days. Results also showed that a period of 15 days of spontaneous recovery was sufficient for the return of most of the studied parameters (such as the contraction time, the fatigue index, and the subtetanic tension at 20 Hz relative to the peak tetanic tension) to the values measured in the pre-HS period. I.S.

A91-37489#
EVIDENCES FOR SLOW TO FAST CHANGES IN THE CONTRACTILE PROTEINS OF RAT SOLEUS MUSCLE AFTER HINDLIMB SUSPENSION - STUDIES ON SKINNED FIBERS
L. STEVENS and Y. MOUNIER (Lille I, Universite, Villenueve-d'Ascq, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-90, S-91. CNES-supported research. refs

The effect of 15-day-long hind-limb suspension (HS) on the contractile properties of rat soleus were investigated by comparing the muscle tension values and the kinetics of fiber contraction of HS and control rats. It is shown that, after 15 days of HS, the usually slow characteristics of the soleus muscle are transformed into those of a faster muscle. I.S.

A91-37490#
THE EFFECT OF THE ANGULAR VELOCITY ON THE MUSCLE COMPOSITION IN JAPANESE QUAIL
J. JANKELA, K. BODA (Slovak Academy of Sciences, Institute of Animal Physiology, Ivanka pri Dunaji, Czechoslovakia), and M. BARANOVSKA (Institute of Zoohygiene and Veterinary Technique, Trnava, Czechoslovakia) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-92, S-93. refs

The effect of angular velocity (centrifugation for 96 hrs at 2G hypergravity at different values of the radius and frequency of rotation) on the composition of sarcoplasmic and myofibrillar proteins from breast and thigh muscles of Japanese quail was investigated. In these experiments, the control birds were mechanically loaded to 2 G and the experimental birds were exposed to angular velocities of 0.8, 0.9, 1.0, or 1.1 pi/sec. It was found that the concentrations of sarcoplasmic proteins in both the breast and the thigh muscles were significantly enhanced

in comparison to controls, due to an increased angular velocity. The content of myofibrillar proteins was reduced in both types of muscles. I.S.

A91-37491#
BONE EFFECTS OF 13 DAYS OF WEIGHTLESSNESS ON RAT AND MONKEY - SOME RESULTS OF BIOCOSMOS 1887 AND GROUND SIMULATIONS

E. ZERATH, C. NOGUES, M. BORNE, and P. SOURDAINE (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-94, S-95. CNES-supported research. refs

The effects of a 13-day spaceflight on bone tissue of rats and rhesus monkeys flown on Biocosmos 1887 were compared with the effect of 14-day-long tail suspension of rats in laboratory. Results show that, in monkeys, the 13-day spaceflight caused a lowering in the calcification rate during flight, with partial recovery occuring upon return. In rats, the spaceflight caused lower bone mass values in the humeral metaphyseal and vertebral areas; these results are comparable with those obtained from rats suspended for 14 days. I.S.

A91-37492#
EFFECTS OF A 40 DAY TAIL-SUSPENSION ON RAT WEIGHT-BEARING BONES

L. VICO, J. M. VERY, D. CHAPPARD, C. ALEXANDRE (Saint-Etienne, Universite, France), and V. E. NOVIKOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-96, S-97. refs
(Contract DRET-87-040)

Effects of a 40-day-long suspension (S) on the histomorphometric characteristics of long bones and the thoracic and lumbar vertebrae of male Wistar rats were investigated. The parameters determined in suspended and in control rats were the thickness of the primary spongiose and the bone mass parameters including the trabecular thickness, trabecular number, and the resorption activity. It was found that the most important effect of a 40-day suspension was the disappearance of the tibial primary spongiosa. In the lumbar vertebral bodies, the osteoclastic activity was found to be increased while the bone volume remained unchanged. Parameters measured in the thoracic vertebra were not affected. I.S.

A91-37493#
COMPETING ANTAGONISTS TO ENERGY PRODUCTION IN SPACE AND THEIR EFFECT ON CALCIUM METABOLISM

HARVEY A. TANNER (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-98, S-99. refs

The paper discusses literature reports on catabolic factors that are competing antagonists to energy production in space. It is concluded that all metabolic depressants, including different preflight, in-flight, and postflight sedatives; muscle relaxants; antiadrenergic agents; alcohol; and cigarette smoking can severely reduce cellular respiration in space and that the antagonistic effects can endure long after the precipitating factor is eliminated. Some calcium channel blockers that inhibit myocarial oxygen consumption result in reduced energy production, increased calcium mobilization, and impaired biosynthesis. Vitamin D supplements may be especially toxic to astronauts by enhancing calcium mobilization. Factors that may counteract the effects of catabolic factors in space include a calcium blocker nifedipine, coenzyme Q, fluoride, and vitamin C. I.S.

A91-37495#
OPPORTUNITY AND CHALLENGE IN LIFE SCIENCES RESEARCH ON SPACE STATION FREEDOM

MILTON R. HEINRICH (Zerog Corp., Los Altos Hills, CA) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-102, S-103.

The facilities provided by the Space Station Freedom for studying crew problems arising in space are discussed together with their possible countermeasures. Spacial attention is given to major facilities which will be used in all of the life-science activities, which include the Habitat Holding System, the Centrifuge, the Life Sciences Glovebox, and the Equipment Washer/Sanitizer. In addition, the life-science facilities will include specific items of generic equipment used in life sciences and materal sciences research, called the laboratory support equipment. I.S.

A91-37499#
SEX DIFFERENCES IN BLOOD CONSTITUENTS OF RATS FOLLOWING TAIL SUSPENSION

MASAYUKI NAKAYA, SACHIO IKAWA, KAZUO KOSUGI, and SHUJI TAKEUCHI (Jikei University, Tokyo, Japan) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-110, S-111.

The effect of sex of a mammal on changes in blood constituents induced by hypokinesia was investigated in rats subjected to 4 weeks of tail suspension (TS). It was found that the differences in blood constituents between male and female rats had the same trends in both the control and the TS groups. The average levels of the blood albumin, creatinine uric acid, glucose, triglyceride, serum iron, and hemoglobin in the TS rats were lower than those in the control group. These changes were more marked in male than in female rats. I.S.

A91-37501#
INFLUENCE OF SHORT AND LONG DURATION EXPOSURE TO HYPERGRAVITY IN A SINGLE-CELL ORGANISM, PARAMECIUM TETRAURELIA

G. RICHOILLEY, G. GASSET, R. TIXADOR, and H. PLANEL (Toulouse III, Universite, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-114 to S-116. CNES-supported research. refs

The results of an investigation into the effects of hypergravity on the growth of paramecia are presented. In this earth-based experiment, paramecia were exposed to different gravitational levels for various durations to examine growth rate, cell movement, and secondary effects. Control paramecia were set aside and the test cells were placed in hermetically sealed tubes and centrifuged at 2-10g or at 20g. A decrease is demonstrated in the cell growth rate of the cultures centrifuged for three days with the highest gravitational levels and longest test times inhibiting growth most significantly. The generation times of the paramecia are found to increase after centrifugation and are eventually restored. A cell displacement study shows that the cells move in the direction opposite to the centrifugal force for the first three hours, but move with the force after that time. The results support the negative geotaxis of paramecia and gravitational influence at the cellular level, and demonstrate the adaptation of paramecia to higher gravitational levels. C.C.S.

A91-37502#
ELECTROVESTIBULOGRAPHY IN EXPERIMENTAL ANIMALS

RENAUD CHARLET DE SAUVAGE, GILLES DOLIVET, JEAN-PAUL ERRE, and JEAN-MARIE ARAN (Institut National de la Sante et de la Recherche Medicale, Bordeaux, France) (International Union of Physiological Sciences Commission on Gravitational Physiology,

Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-117, S-118. refs

Using a combination of electrical and acoustical stimulations, compound responses of the vestibular nerve to low-frequency filtered clicks or continuous sounds were recorded in normal guinea pigs with implanted electrodes on the left round window and near the VIII nerve, with vertex and cerebellar references, respectively. Electrical stimuli (ES), consisting either of a 100-Hz sq voltage or negative current pulses of 300 microsec duration, were applied between round window and vertix. Vestibular stimulations consisting of pendular or constant angular accelerations were applied in the plane of the left semicircular canal with the animal placed head down. Results demonstrate that this technique represents a sensitive method for studies of the peripheral vestibular function. I.S.

A91-37504#
CARDIOVASCULAR RESPONSES TO SUSTAINED ACCELERATION

DAVID H. GLAISTER (RAF, Institute of Aviation Medicine, Farnborough, England) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-121 to S-124. refs

The systemic and pulmonary circulatory responses to hypergravity are described, and the physiology behind some of the methods that can be used to increase human tolerance to +Gz acceleration (a headwards acceleration with the inertial force vector acting towards the feet) is discussed. Results obtained show that at the G level of +5Gz a rapid drain-off of cerebral blood volume occurred with loss of consciousness and an overshoot in cerebral blood volume upon return to 1G indicates that a reactive hyperaemia follows a period of inadequate cerebral blood flow. O.G.

A91-37508#
COMPARATIVE ANALYSIS OF HYPERGRAVITY (2G) AND WEIGHTLESSNESS EFFECT ON THE BLOOD-FORMING SYSTEM OF MALE AND FEMALE MAMMALS

L. V. SEROVA and N. A. CHELNAIA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-137to S-140. refs

Effects of hypergravity on the blood-forming system of male and female mammals were investigated by measuring various characteristics of blood and bone marrow of male, female, and pregnant rats exposed to 2G in a centrifuge. The results are compared with those obtained in space flights of different duration aboard satellites of the Cosmos series. I.S.

A91-37510#
THE EFFECTS OF HYPERGRAVITATION, HYPODYAMY AND THEIR COMBINATION ON THE ULTRASTRUCTURE OF THE HEART MUSCLE OF JAPANESE QUAIL

A. BOZNER, J. DOSTAL (Bratislava, Comenius University, Czechoslovakia), K. BODA, M. GAZO, J. JANKELA (Slovak Academy of Sciences, Institute of Animal Physiology, Ivanka pri Dunaji, Czechoslovakia) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-143, S-144.

The effects of chronic exposures to hypergravity and hypokinesia and their combination on the ultrastructure of the heart muscle of Japanese quail were investigated in birds divided into five groups: (1) controls kept under normal conditions, (2) those located in the center of the centrifuge turntable during centrifuge runs, (3) those suspended in restricting jackets, (4) those chronically exposed to 2 G centrifugal force, and (5) those exposed to both hypergravity and hypokinesia. The numbers, the relative sizes, and the volume of mitochondria; the violume of myofibrils; and the number of mitochondrial cristae were evaluated. Results, presented in the form of graphs, showed that the most extensive changes in the heart-muscle mitochondria took place under the conditions of hypergravity combined with hypokinesia (group 5). Results in group 2 demonstrated the adverse effects of stress. I.S.

A91-37512#
MECHANICS OF CONTRACTION AND RELAXATION IN PAPILLARY MUSCLES OF HEALTHY AND CENTRIFUGATED BABOONS

YVES LECARPENTIER, D. C. C. TRAN, DENIS CHEMLA, MICHEL CLERGUE, FRANCINE LAMBERT (Institut National de la Sante et de la Recherche Medicale, Palaiseau; Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-147, S-148.

The effect of +Gz acceleration on the mechanical properties of cardiac muscles was investigated in baboons subjected to +Gz acceleration in a centrifuge, while sitting with the head toward the rotational axis; the centrifuge training consisted of three consecutive runs at +8 Gz, twice a week for 3 months. Two days after the last training session, the papillary muscles were removed from the left ventricle of anesthesized animals, the isolated muscles were electrically stimulated, and the mechanical parameters of the papillary muscles from trained baboons were compared to with those from control animals. It was found that mechanical indices in control animals did not differ significantly from those observed in trained animals, except for the time-to-peak shortening index (which increased from about 522 to about 578), time-to-peak force (an increase from about 482 to about 560), and the R2 ratio of max Vc to max Vr values of twitch-2 (which decreased from about 1.55 to about 1.25). I.S.

A91-37513#
31P-NMR SPECTROSCOPY STUDIES OF MYOCARDIUM SUBMITTED TO HYPERGRAVITATION

M. J. MALLIAVIN, CONG C. TRAN (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France), J. AUSSEDAT, A. RAY, S. LORTET (Laboratoire de Physiologie Cellulaire Cardiaque, Grenoble, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-149, S-150.

A spectroscopic investigation into the effects of repeated exposure to +Gz accelerations on myocardial energy metabolism are presented. A group of rats was exposed to hypergravitation in a centrifuge, and 31P-NMR spectroscopy was applied to the isolated perfused hearts of the centrifuged group, a control group, and a restrained acceleration group. By changing extracellular calcium concentration, the cardiac workload was modified, and spectroscopic measurements of PC, Pi, and ATP were used to estimate the cystosolic concentration of cardiac compounds. At the beginning of perfusion, the myocardial ATP and PC levels in centrifuged and restrained animals were lower than the control group, and the Pi level was higher in the accelerated groups. After perfusion, the left ventricular pressure in the centrifuged group was 40 percent lower than the other groups. The persistence of myocardial bioenergetic perturbations is theorized to be induced by hypergravitation. The effects of catecholamines released during acceleration can account for the degradation of myocardial ATP. C.C.S.

A91-37514#
STUDY OF AORTIC AND CAROTID BLOOD FLOW BY PULSED DOPPLER WITH IMPLANTABLE MICROPROBES IN HYPERGRAVITY

O. LANGERON, CONG C. TRAN, F. PAILLARD (Centre d'Etudes

et de Recherches de Medecine Aerospatiale, Paris, France), D. PAYEN (Hopital Universitaire Lariboisiere, Paris, France), F. LABORDE (Centre d'Etudes et de Recherches en Automatisme, Paris, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-151, S-152. refs

The effects of hypergravity on aortic and common carotid blood flows are examined by means of the pulsed Doppler method in conjunction with implantable microprobes. The stroke volume and cardiac output are monitored continuously and common carotid ouput can be computed with the method, and the microprobes eliminate the need for an external transducer which could produce errors. The flow probe and range-gated Doppler flowmeter employed to study two male baboons are described, and the blood flow measurements are explained. The baboons were exposed to sustained +Gz forces of between +1 and +6. Aortic and carotid parameters are shown to decrease with increasing load factor, and both blood flows cease at a +4 Gz threshold. Diastolic flow always ceases, but systolic flow can continue at the threshold plateau. The technique is found to be of significant value in studying the effects of hypergravity on the cardiovascular system. C.C.S.

A91-37515#
EFFECTS OF HIGH SUSTAINED HYPERGRAVITY ON PLASMA CATECHOLAMINES

P. LISCIA, P. QUANDIEU, CONG C. TRAN (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France), C. DROGOU, and P. BORREDON (DRET, Paris, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-153, S-154.

Catecholaminic changes due to mechanical stress are compared to those due to general emotional stress in nonhuman primates. An animal model was used to test the specificity of the catecholaminergic response to hypergravitational accelerations as compared to the same response caused by stress associated with the environment. Five primates were alternately exposed to hypergravity, restrained and exposed to 0.5 Gz in a centrifuge, and left sitting as controls. Plasma norepinephrine, epinephrine, and dopamine were analyzed at fixed times of the day. The results of the analyses show that the concentrations of the hormones are significantly different from the two control groups immediately following the acceleration of the subject to hypergravity. The catecholaminergic response to hypergravitation is demonstrated to be clearly different from the general emotional stress response, and a sympathicoadrenergenic response is demonstrated following a single exposure. C.C.S.

A91-38222
EFFECT OF FLUID AND SALT SUPPLEMENTS IN PREVENTING THE DEVELOPMENT OF 'OSTEOPENIA' IN HYPOKINETIC RATS

Y. G. ZORBAS, Y. F. FEDERENKO, and M. N. TOGAWA (Medical Engineering Institute, Tokyo, Japan) Acta Astronautica (ISSN 0094-5765), vol. 25, Feb. 1991, p. 111-116. refs
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It has been suggested that a daily intake of fluid and salt supplements may be used to prevent bone demineralization in human subjects after prolonged exposure to hypokinesia (diminished muscular activity). Thus, the objective of this investigation was to evaluate the effect of fluid and salt supplementation in the prevention of development of osteoporosis in 64 Wistar rats with an initial body weight of 339-345 g, after exposure to 90 days of hypokinesia. They divided into 4 equal groups: the first group of rats placed under ordinary vivarium conditions and served as vivarium control; the second group were also placed under ordinary vivarium conditions but received daily fluid and salt supplements; the third group were subjected to pure hypokinesia, i.e., without the use of any preventive measures; and the fourth group were submitted to hypokinesia and received daily fluid and salt supplements. Through the experimental period the second and fourth group of rats received 8 ml/100 g body wt water and 5 ml/100 g body wt NaCl daily. It was found that the daily intake of fluid and salt supplements caused an increase in the volume density of primary spongiosa of bones. It was concluded that a daily intake of fluid and salt supplements may be used to prevent the development of osteoporosis in rats subjected to prolonged motor activity restriction. Author

A91-38965#
RED CELL MEMBRANE UNDER ZERO GRAVITY - INTERPRETATION OF ARC EXPERIMENT ON STS51-C

L. DINTENFASS (Sydney, University, Australia) IN: Space commercialization: Platforms and processing; Symposium on Space Commercialization: Roles of Developing Countries, Nashville, TN, Mar. 5-10, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1990, p. 235-250. Research supported by Jones Lang Wootton, Rebecca Cooper Medical Research Foundation, CSIRO, Blood Viscosity Research Foundation, at al. refs
Copyright

The experiment on aggregation of red cells (ARC) performed on STS 51-C in January 1985 is considered. The experiment intended to study kinetics and morphology of ARC in the blood of patients with ischaemic heart disease, hyperlipidemia, diabetes, etc., and in the blood of healthy normal donors. Data obtained indicate that zero gravity affects cell-cell interaction, as patients blood showed normal rouleaux structure under zero gravity. Incidental observations on platelets reveal that they can remain monodisperse under zero gravity. It is concluded that zero gravity affects and modifies the microarchitecture of the red cell (and platelet) membrane and the activity of its receptors. O.G.

A91-39071
THE EFFECT OF LOW-FREQUENCY VIBRATION ON GABA METABOLISM IN SEVERAL BRAIN STRUCTURES [VLIIANIE NIZKOCHASTOTNOI VIBRATSII NA OBMEN GAMK V NEKOTORYKH STRUKTURAKH GOLOVNOGO MOZGA]

M. I. SAFAROV and S. A. KERIMOV (AN ASSR, Institut Fiziologii, Baku, Azerbaidzhan SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0204-8489), vol. 37, Mar.-Apr. 1991, p. 3-7. In Russian. refs
Copyright

Low-frequency vibration, irrespective of its duration (20 Hz, A=0.4 mm), is shown to increase the GABA level and glutamatedecarboxylase enzyme activity (EC 4.1.1.15) in the large hemispheres, cerebellum, and brain stem of adult (12 months) male rats. GABA aminotransferase activity (EC 2.6.1.19) remains largely unchanged. The observed shifts are more pronounced during 30-minute vibration than seven-hour and 30-day vibration. Increases in glutaminic and aspartic acid content during 30-minute vibration and decreases during seven-hour and 30-day vibration are observed in the selected brain structures. P.D.

A91-39072
AGE CHARACTERISTICS OF THE RESPONSE OF THE LYSOSOME SYSTEM OF NEUTROPHILIC LEUKOCYTES IN RABBITS' PERIPHERAL BLOOD TO IMMOBILIZATION [VOZRASTNYE OSOBENNOSTI REAKTSII LIZOSOMAL'NOGO APPARATA NEITROFIL'NYKH LEIKOTSITOV PERIFERICHESKOI KROVI KROLIKOV NA DEISTVIE IMMOBILIZATSII]

N. V. LUNINA and L. V. ABAKUMOVA (Luganskii Gosudarstvennyi Pedagogicheskii Institut, Lugansk, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0204-8489), vol. 37, Mar.-Apr. 1991, p. 60-65. In Russian. refs
Copyright

A91-39074
ADAPTIVE CHANGES IN LIPID PEROXIDATION UNDER THE CHRONIC EFFECT OF AN ELECTROSTATIC FIELD [ADAPTATSIONNYE IZMENENIIA PEREKISNOGO OKISLENIIA LIPIDOV V USLOVIIAKH KHRONICHESKOGO DEISTVIIA ELEKTROSTATICHESKOGO POLIA]
A. V. PARANICH, E. A. ROMODANOVA, and L. A. CHAIKINA (Khar'kovskii Gosudarstvennyi Universitet, Kharkov, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0204-8489), vol. 37, Mar.-Apr. 1991, p. 113-116. In Russian. refs
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The chronic effect of high-strength electrostatic fields on the peroxidation of lipids is studied as an aid in assessing the body's adaptive capacities. Experiments on young pubertal Wistar rats show that the chronic effect of the electrostatic fields brings lipid peroxidation (LPO) to a new level of the dynamic equilibrium. The metabolism of lipids is demonstrated to be sensitive to this factor. But the systems regulating LPO actively maintain a new equilibrium state. Inert LPO products of the lipopigment type can bind vitamin E, whose content in the tissues remains unchanged. P.D.

A91-39184
THE MACRO- AND MICROHEMODYNAMICS OF AN ORGAN AND THE SYSTEMIC CIRCULATION UNDER COMBINED EFFECTS OF HYPOXIA AND HYPOTHERMIA [ORGANNAIA MAKRO- I MIKROGEMODINAMIKA I SISTEMNOE KROVOOBRASHCHENIE PRI SOCHETANNOM DEISTVII GIPOKSII I GIPOTERMII]
B. I. TKACHENKO, A. V. SAMOILENKO, IU. A. KUDRIASHOV, A. IU. IUROV, A. A. NURMATOV (AMN SSSR, Nauchno-Issledovtel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) et al. Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, Dec. 1990, p. 1682-1690. In Russian. refs
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The effects of hypoxia (10 percent O2 in N2) combined with hypothermia (about 30 C) on the characteristics of hemodynamics and circulation in the perfused shank and small intestine of anesthesized cats were investigated. Results obtained showed a decrease in precapillary resistance and an increase in capillary filtration coefficients in both regions. The postcapillary resistance and the mean capillary pressure increased in the intestine and decreased in the shank. The dependence of hypoxic changes of macro- and microhemodynamics on the activity of adrenergic receptors in the cooled organism was studied in a decentralized shank. It was found that a blockage of the alpha-adrenoreceptors in a cooled animal resulted in a much greater reduction of the precapillary resistance of the shank, accompanied by a dramatic increase of the capillary filtration coefficient and by increases of capillary pressure and postcapillary resistance. I.S.

A91-39541
ACUTE HYPOXIA-INDUCED DIURESIS IN RATS
G. COLICE, S. YEN, G. RAMIREZ, J. DIETZ, and L.-C. OU (Dartmouth College, Hanover, NH; USVA Hospital, White River Junction, VT; South Florida, University, Tampa, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 551-554. refs
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Acute hypoxia elicits diuresus, natriuresis, and hypotension in many mammalian species, but the cause of this effect remains unclear. The present study, using chronically instrumented rats, was undertaken to assess a possible role of atrial natriuretic factor (ANF) in these hypoxic responses. Acute hypoxia (10.5 percent O2) increased urine output and sodium and potassium excretion. Systemic arterial blood pressure fell during acute hypoxia. Levels of ANF significantly increased with acute hypoxia. The plasma levels of ANF during acute hypoxia were similar to those found following bolus doses of exogenous ANF which are known to cause diuresis, natriuresis, and a fall in blood pressure. Increased ANF levels may play a role in mediating physiologic responses to hypoxia in the rat. Author

N91-23692# Lawrence Livermore National Lab., CA.
ABSOLUTE CALIBRATION IN VIVO MEASUREMENT SYSTEMS
D. A. KRUCHTEN and D. P. HICKMAN Feb. 1991 8 p
(Contract W-7405-ENG-48)
(DE91-009719; UCRL-ID-106311) Avail: NTIS HC/MF A02

Lawrence Livermore National Laboratory (LLNL) is currently investigating a new method for obtaining absolute calibration factors for radiation measurement systems used to measure internally deposited radionuclides in vivo. Absolute calibration of in vivo measurement systems will eliminate the need to generate a series of human surrogate structures (i.e., phantoms) for calibrating in vivo measurement systems. The absolute calibration of in vivo measurement systems utilizes magnetic resonance imaging (MRI) to define physiological structure, size, and composition. The MRI image provides a digitized representation of the physiological structure, which allows for any mathematical distribution of radionuclides within the body. Using Monte Carlo transport codes, the emission spectrum from the body is predicted. The in vivo measurement equipment is calibrated using the Monte Carlo code and adjusting for the intrinsic properties of the detection system. The calibration factors are verified using measurements of existing phantoms and previously obtained measurements of human volunteers. DOE

N91-23693# Ames Lab., IA.
EXCITED STATE STRUCTURE, ENERGY AND ELECTRON TRANSFER DYNAMICS OF PHOTOSYNTHETIC REACTION CENTERS: A HOLE BURNING STUDY Ph.D. Thesis
DE-MING TANG 22 Mar. 1991 254 p
(Contract W-7405-ENG-82)
(DE91-010181; IS-T-1490) Avail: NTIS HC/MF A12

The excited state structure, early time energy, and electron transfer dynamics for the bacterial photosynthetic reaction center of Rhodoseudomonas viridis, Rhodobacter sphaeroides, and the green plant photosynthetic reaction center of Photosystem 2 (PS 2) have been determined by hole burning spectroscopy. Transient hole burned spectra of the bacterial reaction centers reveal a special pair Franck-Condon marker mode progression with a superimposed zero phonon hole. Such progression is found to be absent in the green plant Photosystem 2 which raises the question of structural similarities between the PS 2 and bacterial reaction centers. The excited state decay times are obtained for all systems and found to be consistent with time domain experiments. Similar temperature dependence of the decay kinetics have been observed for both bacterial and PS 2 reaction centers. Study of different preparations of reaction center of Photosystem 2 utilizing hole burning spectroscopy indicates that Triton X-100 detergent significantly affect the absorption and persistent hole burned spectra and disrupts the energy transfer from the accessory chlorophyll to the active pheophytin. The comparison between the bacterial reaction centers and Photosystem 2 has been presented and discussed in order to understand the difference in their early time dynamics and the excited state structure. A theoretical model has been developed based on the principle of linear electron-phonon coupling and imhomogeneous broadening. Our experimental results are found to be in good agreement with the theoretical calculations. DOE

N91-23694*# National Aeronautics and Space Administration, Washington, DC.
SPACE LIFE SCIENCES: A STATUS REPORT
Feb. 1990 60 p Original contains color illustrations
(NASA-NP-120; NAS 1.83:120) Avail: NTIS HC/MF A04; 41 functional color pages CSCL 06B

The scientific research and supporting technology development conducted in the Space Life Sciences Program is described. Accomplishments of the past year are highlighted. Plans for future activities are outlined. Some specific areas of study include the following: Crew health and safety; What happens to humans in space; Gravity, life, and space; Sustenance in space; Life and planet Earth; Life in the Universe; Promoting good science and

good will; Building a future for the space life sciences; and Benefits of space life sciences research. E.R.

N91-23695# Lawrence Livermore National Lab., CA.
PROBLEMS IN UNDERSTANDING THE ORGANIZATION, STRUCTURE AND FUNCTION OF CHROMOSOMES
E. M. BRADBURY 1990 17 p Presented at the NATO Symposium, Scilly, Italy, May 1990
(Contract W-7405-ENG-36; DE-FG03-88ER-60673)
(DE91-009939; LA-UR-91-732; CONF-9005329-1) Avail: NTIS HC/MF A03

Despite intensive investigation of mammalian chromosomes, the basic rules that govern their organization, structure, and functions are largely unknown. This situation results from the current limitations in available technologies to elucidate the structures of such complex biological systems. Whereas the powerful techniques of molecular biology have successfully addressed at high resolution functional problems at the level of nucleic acid sequences, many lower resolution questions concerning the architecture of the cell nucleus, long range order in chromosomes, and higher order chromatin structures remain largely unanswered. Techniques are now emerging that should help to remedy this situation. The use of confocal microscopy with molecular probes will tell us at the level of the light microscope a great deal about the organization of the nucleus and how it changes in different cell types; advanced light sources have the potential to image hydrated biological systems down to 10 nm, and scanning electron tunneling and atomic force microscopies have demonstrated their ability to image molecules though their ability to usefully image biomolecules such as DNA remains to be shown. DOE

N91-23696# California Inst. of Biological Research, La Jolla.
NEW HOSTS AND VECTORS FOR GENOME CLONING
28 Feb. 1991 3 p Submitted for publication
(Contract DE-FG03-90ER-60997)
(DE91-009996; DOE/ER-60997/T1) Avail: NTIS HC/MF A01

The main goal was to develop new bacterial hosts and vectors for cloning human DNA in the bacterium E. coli. Because human DNA is both A+T-rich and highly repetitive, many human sequences are unstable as inserts in vectors that are propagated in bacteria. During the past eight months, what fraction of human DNA inserts in cosmid vectors is unstable was assessed, new host strains were developed that help stabilize unstable sequence features of human DNA, and the development was begun of a new generation of cloning vectors that should permit the more stable maintenance and more facile analysis of large human DNA inserts. DOE

N91-23697# Los Alamos National Lab., NM.
ROBOTICS FOR RECOMBINANT DNA AND HUMAN GENETICS RESEARCH
T. J. BEUGELSDIJK 1990 29 p Presented at the 5th *International Conference on Advanced Robotics, Pisa (Italy), 20-22* Jun. 1991
(Contract W-7405-ENG-36)
(DE90-016440; LA-UR-90-2884; CONF-910637-1) Avail: NTIS HC/MF A03

In October of 1989, molecular biologists throughout the world formally embarked on ultimately determining the set of genetic instructions for a human being. Called the Manhattan Project by some, a molecular biological pursuit of this goal is projected to require approximately 3000 man years of effort over a 15-year period. The Humane Genome Initiative is a worldwide research effort that has the goal of analyzing the structure of human deoxyribonucleic acid (DNA) and determining the location of all human genes. The Department of Energy (DOE) has designated three of its national laboratories as centers for the Human Genome Project. These are Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Lawrence Berkeley Laboratory (LBL). These laboratories are currently working on different, but complementary technology development areas in support of the Human Genome Project. The robotics group at LANL is currently working on developing the technologies that address the problems associated with physical mapping. This article describes some of these problems and discusses some of the robotics approaches and engineering tolls applicable to their solution. DOE

N91-23698# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURAL STUDIES OF MANGANESE AND HALIDE IN THE PHOTOSYNTHETIC OXYGEN EVOLVING COMPLEX Ph.D. Thesis
V. J. DEROSE Oct. 1990 214 p
(Contract DE-AC03-76SF-00098)
(DE91-009071; LBL-30077) Avail: NTIS HC/MF A10

Electron paramagnetic resonance (EPR) and x ray absorption spectroscopy (XAS) were used as probes of the manganese atoms of the oxygen evolving complex (OEC). XAS studies at liquid helium temperatures allowed the observation of a scatterer at greater then 3 A from the absorbing manganese. Extended x ray absorption fine structure (EXAFS) data taken on preparations from both spinach and the thermophilic cyanobacterium Synechococcus sp. fit to nearly identical parameters. By comparison with model compounds the scatterer at greater than 3 A fits well to a single manganese-manganese distance per the four manganese in the OEC cluster. The correlation between fluoride inhibition of oxygen evolution activity and enhancement of the g = 4 EPR signal which arises from the OEC in the S(sub 2) state was ascertained. The narrowing of the EPR signal is interpreted as being due to fluoride binding to the manganese. A damping of the scattering due to manganese at 2.7 A was observed in data from the fluoride-treated preparations poised in the S2 state. EXAFS of bromide-substituted PSII preparations from Synechococcus showed no change relative to EXAFS of chloride-containing samples. The substructure observed by high resolution EPR of the S2-state multiline signal also shows no change in the presence of bromide. These results argue strongly against the presence of a halide ligand bridging the manganese in the OEC, but do not exclude a single terminal halide ligand. Electron spin echo spectroscopy of (sup 15)N-containing preparations from Synechococcus identify nuclear envelope modulation due to nitrogen near the manganese of the OEC. The modulation frequency is consistent with its arising from an amino acid ligand such as a histidine. DOE

N91-23699# Technical Research Associates, Salt Lake City, UT.
ISOLATION, CLONING AND EXPRESSION OF THE GENES FOR MICROBIAL POLYURETHANE DEGRADATION Technical Report, 15 Nov. 1990 - 15 Feb. 1991
GAIL L. BOWERS-IRONS, ROBERT PRYOR, USHA CHARYULU, and RAMESH K. PRAKASH 20 Feb. 1991 9 p
(Contract N00014-90-C-0182)
(AD-A232108) Avail: NTIS HC/MF A02 CSCL 06/5

New degradation tests are in progress to determine if *polyurethane (Impranil-R) and/or urethane (Sigma) can be used* as a sole carbon source. Fifteen different cultures have been inoculated into 10 ml polyurethane- and urethane-minimal salts solutions. The DNA vector and fungal host, received from the Fungal Genetics Stock Center, Department of Microbiology, University of Kansas Medical Center are cosmid pSV50 in an E. coli host, LM83, and Neurospora crassa wild type strain (74-OR23-1VA), FGSC 2489. The genomic library will be constructed in E. coli HB101. The fungal vector host will be used for expression of the genes from HAFB-2F-Br. While the DNA isolation procedure is being optimized, concurrent experiments will be done to optimize the transformation frequency of both the E. coli competent cells and the Neurospora crassa host using previously published procedures. GRA

N91-24724# American Red Cross, Rockville, MD.
INTERNATIONAL CONFERENCE ON BIOPHYSICS OF TRANSMEMBRANE ELECTRIC FIELDS Report, 1 Jan. - 31 Dec. 1990
ARTHUR E. SOWERS 15 Nov. 1990 77 p Conference held

in Elkridge, MD, 23-26 Oct. 1990
(Contract N00014-90-J-1562)
(AD-A232057) Avail: NTIS HC/MF A05 CSCL 09/1

It is commonly accepted that efficiency of cell electrofusion is higher when cells are preliminary brought in closer contact. On this base two new approaches in cell electro fusion have been developed. The first one, fusion of cells on an electroconductive (cellulose) film, is very effective for spreading cells (e.g., mouse L-cells) that are able to attach to solid surfaces. The second, more universal, approach is electrofusion of cells in centrifugated pellets. Specific features of cell contacts and possible mechanism of electrofusion are discussed. Electric fields are supposed to initiate fusion process only in areas where plasma membranes of contacting cells are divided narrow extended gaps. GRA

N91-24725# Wake Forest Univ., Winston-Salem, NC. School of Medicine.
MULTIPLE NEURON RECORDING IN THE HIPPOCAMPUS OF FREELY MOVING ANIMALS Annual Progress Report, 1 Dec. 1989 - 30 Nov. 1990
SAMUEL A. DEADWYLER 27 Dec. 1990 6 p
(Contract AF-AFOSR-0092-90; AF PROJ. 3484)
(AD-A232934; AFOSR-91-0112TR) Avail: NTIS HC/MF A02 CSCL 06/4

Progress over the last year on the development of multineuronal recording systems has been significant. Since this was one of the main objectives of the consortium of three laboratories it has been a principle focus of the past years research efforts. This phase is near completion and currently being implemented in several research projects. Consequently most of the research effort in the past year has been directed toward these technological accomplishments. However in addition to the strides made in bringing the multineurone and multi-tasking computer systems to completion, several studies which were in preliminary stages at the time of submission are now near completion, several studies which were in preliminary stages at the time of submission are now near completion and are being prepared for publication. Specifically, these include the signal detection task and the DMTS task in which complex neurophysiological analyses have revealed striking new relationships to sensory processing strategies in the hippocampus and cortex. The accompanying report summarizes these and other accomplishments in the first year of the award. GRA

N91-24726# Colorado Univ., Denver. Center for Environmental Sciences.
EXPLORATORY DATA ANALYSIS ON DATA GENERATED IN THE DOE SUBSURFACE MICROBIOLOGY PROGRAM
R. R. MEGLEN Jun. 1990 96 p
(Contract DE-FG02-87ER-60557)
(DE91-007575; DOE/ER-60557/1) Avail: NTIS HC/MF A05

The preliminary results from the innovative subsurface microbiology research program indicate that new data on the nature of the link between the geosphere and biosphere have been generated. The diversity of scientific disciplines represented in the subsurface microbiology program reflects the complexity of the system under study. The research carried out by national laboratory and university research scientists is addressing fundamental questions about the abundance of microorganisms and factors controlling microbial activity in the complex subsurface hydrologic and geochemical environment. Long-term implications of this research for mitigating contamination are clear and researchers share the broader objective of linking the basic science with applied work. DOE

N91-24727# Pacific Northwest Lab., Richland, WA.
BIOLOGICAL EFFECTS OF ELECTROMAGNETIC FIELDS
L. E. ANDERSON Mar. 1991 6 p Presented at the International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility, Zurich (Switzerland), 12-14 Mar. 1991
(Contract DE-AC06-76RL-01830)
(DE91-010006; PNL-SA-18947; CONF-9103152-1) Avail: NTIS HC/MF A02

Natural background levels of atmospheric electric and geomagnetic field levels are extremely low. Over the past several decades, however, human beings and other life forms on this planet have been subjected to a dramatically changing electromagnetic milieu. Exponential increases in exposure to EM fields have occurred, largely because of technological advances associated with increased use of electricity; e.g., expanding power generation and transmission systems, the increased use of wireless communications, and radar. EM field generating devices have proliferated in industrial plants, office buildings, homes, public transportation systems, and elsewhere. Significant increases have occurred in EM field strengths spanning all frequency ranges; therefore, a brief overview is presented of the potential impacts of these fields, primarily at extremely low frequencies (ELF), but also at MW and RF. DOE

N91-25094*# Park (George W.) Seed Co., Inc., Greenwood, SC.
SEEDS IN SPACE EXPERIMENT RESULTS Abstract Only
JIM A. ALSTON *In* NASA, Langley Research Center, First LDEF Post-Retrieval Symposium Abstracts p 129 Jun. 1991
Avail: NTIS HC/MF A07 CSCL 06/3

Two million seeds of 120 different varieties representing 106 species, 97 genera, and 55 plant families were flown aboard the Long Duration Exposure Facility (LDEF). The seeds were housed on the space exposed experiment developed for students (SEEDS) tray in sealed canister number six and in two small vented canisters. The tray was in the F-2 position. The seeds were germinated and the germination rates and development of the resulting plants compared to the control seed that stayed in Park Seed's seed storage facility. The initial results are presented. There was a better survival rate in the sealed canister in space than in the storage facility at Park Seed. At least some of the seeds in each of the vented canisters survived the exposure to vacuum for almost six years. The number of observed apparent mutations was very low. Author

N91-25095*# Oklahoma State Univ., Stillwater.
SPACE EXPOSED EXPERIMENT DEVELOPED FOR STUDENTS (SEEDS) P-0004-2 Abstract Only
DORIS K. GRIGSBY *In* NASA, Langley Research Center, First LDEF Post-Retrieval Symposium Abstracts p 130 Jun. 1991
Avail: NTIS HC/MF A07 CSCL 06/3

This cooperative endeavor of NASA Headquarters, the NASA Langley Research Center, and the George W. Park Seed Company, resulted in the distribution, by the end of March, 1990, of approximately 132,000 space exposed experiment developed for students (SEEDS) kits to 64,000 teachers representing 40,000 classrooms and 3.3 million kindergarden through university students. Kits were sent to every state, as well as to 30 foreign countries. Preliminary radiation data indicates that layer A received 725 rads, while layer D received 350 rads. Germination rate was reported to be 73.8 percent for space exposed seeds and 70.3 percent for earth based control seeds. Tests conducted within the first six months after retrieval indicated space exposed seeds germinated in an average of 8.0 days, while earth based control seeds' average germination rate was 8.3 days. Some mutations (assumed to be radiation induced) reported by students and Park Seed include plants that added a leaf instead of the usual flower at the end of the flower front and fruit produced from a flower with a variegated calyx bore seeds producing albino plants, while fruit from a flower with a green calyx from the same plant bore seeds produced green plants. Author

N91-25096*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Biophysics Div.
FIRST BIOLOGICAL AND DOSIMETRIC RESULTS OF THE FREE FLYER BIOSTACK EXPERIMENT AO015 ON LDEF Abstract Only
G. REITZ, H. BUECKER, R. FACIUS, G. HORNECK, M. SCHAEFFER, J. U. SCHOTT, J. BAYONOVE, R. BEAUJEAN, E. V. BENTON, M. DELPOUX (Toulouse Univ., France) et al. *In*

NASA, Langley Research Center, First LDEF Post-Retrieval Symposium Abstracts p 131 Jun. 1991
Avail: NTIS HC/MF A07 CSCL 06/3

The main objectives of the Biostack Experiment are to study the effectiveness of the structured components of the cosmic radiation to bacterial spores, plant seeds, and animal cysts for a long duration spaceflight and to get dosimetric data such as particle fluences and spectra and total doses for the Long Duration Exposure Facility orbit. The configuration of the experiment packages allows the localization of the trajectory of the particles in each biological layer and to correlate the potential biological impairment or injury with the physical characteristics of the responsible particle. Although the Biostack Experiment was designed for a long duration flight of only nine months, most of the biological systems show a high hatching or germination rate. Some of the first observations are an increase of the mutation rate of embryonic lethals in the second generation of Arabidopsis seeds, somatic mutations, and a reduction of growth rates of corn plants and a reduction of life span of Artemia salina shrimps. The different passive detector systems are also in a good shape and give access to a proper dosimetric analysis. The results are summarized, and some aspects of future analysis are shown.
Author

52

AEROSPACE MEDICINE

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

A91-36419
EFFECT OF MICROGRAVITY ON THE RESPIRATORY SYSTEM
L. A. ENGEL (Westmead Hospital, Sydney, Australia) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 1907-1911. refs
Copyright

A review of the effect of microgravity on the respiratory system is presented on the basis of experimental data obtained during brief periods of weightlessness inside aircraft flying with parabolic trajectories. The following aspects of the respiratory function are discussed: redistributon of blood volume and extracellular fluid; lung volumes and flows; ventilation; distribution of ventilation and perfusion; chest wall configuration and mechanics; and aerosol deposition in the lung. Observations reveal a marked reduction in the inequality of ventilation distribution at 1 G and a greater uniformity of perfusion. Functional residual capacity decreases by about 10 percent and maximum expiratory flow rates are slightly decreased. Weightlessness substantially increases the abdominal contribution to tidal volume during resting breathing. There is no alteration in the temporal pattern of breathing. O.G.

A91-36421
SHIVERING ONSET, METABOLIC RESPONSE, AND CONVECTIVE HEAT TRANSFER DURING COLD AIR EXPOSURE
P. TIKUISIS, D. G. BELL, and I. JACOBS (Defence and Civil Institute of Environmental Medicine, North York, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 1996-2002. refs
Copyright

The onset and intensity of shivering of various muscles during cold air exposure have beeen examined using human male subjects grouped according to lean (LEAN, n = 6) and average body fat (NORM, n = 7). The subjects resting in a supine position and wearing shorts were exposed to 10 C air for 2 hours. Data obtained demonstrate that both the onset of shivering and the magnitude of the increase in metabolic rate due to shivering are higher for the LEAN group than for the NORM group. Results of the regression analysis indicate that the increase in metabolic rate due to shivering is attenuated by the square root of percent body fat for a given decrease of mean skin temperature. It is concluded that the lean group shivered at higher intensity, resulting in higher increases in metabolic heat production and convective heat loss than did the NORM group. O.G.

A91-36422
RESTRICTING ENVIRONMENTAL STIMULATION INFLUENCES LEVELS AND VARIABILITY OF PLASMA CORTISOL
JOHN W. TURNER, JR. and THOMAS H. FINE (Ohio, Medical College, Toledo) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, May 1991, p. 2010-2013. refs
Copyright

Effects of restricted environmental stimulation technique (REST) on plasma levels of cortisol and variabilty in plasma cortisol levels have been studied. Twenty-seven healthy subjects were placed in an ovoid chamber containing 25 cm of saturated MgSO4 solution maintained at 34.5 with a minimum of light, sound, and temperature awareness and spatial orientation. Variability in plasma cortisol was expressed in terms of standard deviaton. The REST study demonstrated across-session decreases of 21.6 percent in plasma cortisol and 50.5 percent in plasma cortisol variability, while no changes in these measures occurred in the non-REST environment. It is suggested that REST has an impact on both static and dynamic aspects of adrenocortical function, possibly altering the feedback monitoring of plasma cortisol. O.G.

A91-37457#
RESULTS OF STUDIES OF MOTOR FUNCTIONS IN LONG-TERM SPACE FLIGHTS
I. B. KOZLOVSKAIA, V. A. BARMIN, V. I. STEPANTSOV, and N. M. KHARITONOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-1 to S-3.

The effect of physical exercise on the intensity and the duration of motor function disturbances in humans due to exposures to microgravity were assessed in 25 crew members who underwent long-term (from 60 to 366 days) flights aboard the Salyut-6,7 or Mir space stations. The protocol of tests of motor functions was identical to that used by Kozlovskaya et al. (1982, 1984) and included tests and methods that allowed quantitative evaluations of changes in different parts of the motor system. It is shown that the intensity of motor-function deterioration did not correlate with the duration of flight but depended on the volume of physical exercises and the characteristics of physical exercises used during flights as a countermeasure to microgravity. I.S.

A91-37458#
DESTRUCTIVE AND ADAPTIVE PROCESSES IN HUMAN VERTEBRAL COLUMN UNDER ALTERED GRAVITATIONAL POTENTIAL
G. P. STUPAKOV, IU. V. MAZURIN, V. S. KAZEIKIN, I. B. MOISEEV, and V. V. KALIAKIN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-4 to S-7. refs

Results are presented on an assessment of destruction processes taking place in the vertebral column of flight personnel exposed to one of three classes of hypergravity conditions: (1) a single high-intensity impact exposure, related to an ejection process; (2) repeated impact exposures of average intensity, related to parachute; and (3) repeated in-flight accelerations. Using data obtained by Stupakov et al. (1987), a relationship was developed between the clinical recovery time and the extent of vertebral column destruction in these classes of hypergravity exposures.
I.S.

A91-37461*# National Aeronautics and Space Administration. *Lyndon B. Johnson Space Center, Houston, TX.*
METABOLIC CONSEQUENCES OF FLUID SHIFTS INDUCED BY MICROGRAVITY
N. M. CINTRON, H. W. LANE, and C. S. LEACH (NASA, Johnson Space Center, Houston, TX) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-16 to S-19. refs

The effects of fluid redistribution induced by weightlessness on the fluid and electrolyte regulation, the maintenance of optimum nutritional status, and on pharmacodynamics (i.e., the absorption, distribution, and elimination of pharmacologic agents) are examined on the basis of published data on flights aboard Skylab and Space Shuttle. Data are presented on changes in plasma osmolarity and the content of antinuclear factor, serum glucose, and the salivary scopolamine concentrations after oral administration before and during space flights. I.S.

A91-37463#
THE PATTERNS OF SPONTANEOUS OCULOMOTOR ACTIVITY DURING WEIGHTLESSNESS AND READAPTATION TO GRAVITY
L. N. KORNILOVA, A. M. GONCHARENKO (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), V. GRIGOROVA (Bulgarian Academy of Sciences, Institute of Physiology, Sofia, Bulgaria), and A. MANEV (Bulgarian Academy of Sciences, Institute of Space Research, Sofia, Bulgaria) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-23 to S-28. refs

Results are presented from the first part of the Soviet-Bulgarian 'Labirint' experiment, in which changes in oculomotor reactions of humans due to weightlessness were investigated by examining by electrooculography the patterns of spontaneous oculomotor activity in spacecraft crew prior to, during, and after spaceflights for 10 days (four subjects) or 241 days (one subject). In particular, periodic changes in the amplitude, frequency, and velocity of the slow phase of spontaneous nystagmus were analyzed along with the amplitude of the saccadic and smooth eye movements and the amplitude and velocity of the horizontal and vertical eye movements in response to a command. I.S.

A91-37465#
CARDIOVASCULAR DECONDITIONING DURING WEIGHTLESSNESS SIMULATION AND THE USE OF LOWER BODY NEGATIVE PRESSURE AS A COUNTERMEASURE TO ORTHOSTATIC INTOLERANCE
ANTONIO GUEELL, LAURENT BRAAK (CNES, Toulouse, France), and CLAUDE GHARIB (Lyon, Universite, Lyons, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-31 to S-33. refs

Results are presented on the effect of periodic exposures to lower body negative pressure (LBNP) sessions (three daily 20-min sessions at - 35 mb for the first 3 weeks of the experiment, followed by four daily sessions for the first 4 days of the last week and by six daily sessions for the last 3 days) on the cardiovascular deconditioning syndrom (as defined by Bungo et al., 1985) induced in humans by head-down bed rest. Results of continuous electrocardiography and periodic (each minute) measurements of systolic, diastolic, and mean arterial pressures showed that repeated applications of LBNP prevented the decrease in blood pressure values observed in no-LBNP subjects after a month-long bedrest in an antiorthostatic position. I.S.

A91-37466#
PHYSICAL FITNESS BEFORE AND AFTER ONE MONTH HEAD-DOWN BEDREST, WITH AND WITHOUT LOWER BODY NEGATIVE PRESSURE
D. RIVIERE, A. PERE, F. CRAMPES, M. BEAUVILLE (Hopital Purpan, Toulouse, France), A. GUELL (CNES, Toulouse, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-34, S-35. refs

The effect of lower body negative pressure (LBNP) on the physical fitness of humans during and after the exposure to antiorthostatic bed rest was investigated in subjects subjected to 30 days of -6 deg head-down bed rest in two experiments. In these experiments, subjects, who served alternately as controls and experimental subjects, and were subjected to three 20-min-long LBNP daily sessions for the first 3 days of the last week and to 6 daily sessions over the last 4 days. Physical fitness was assessed on day -6 by the maximal oxygen uptake during a cycloergometer exercise test. In two tests performed on day -1 and day 3 after the bed rest, oxygen uptake, heart rate, blood lactate, and hemoglobin concentrations were determined at rest and 10 min after cycling. It was found that, for the same absolute intensity of exercise, the oxygen uptake was not decreased after bed rest. However, in LBNP subjects there were increases of heart rate and of blood lactate, indicating a decrease in physical fitness. I.S.

A91-37467#
EFFECTS OF LOWER BODY NEGATIVE PRESSURE ON CARDIOVASCULAR ADAPTATION TO ONE MONTH HEAD-DOWN BEDREST
D. RIVIERE, F. CRAMPES, A. PERE, M. BEAUVILLE (Hopital Purpan, Toulouse, France), A. GUELL (CNES, Toulouse, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-36, S-37. refs

The effect of periodic lower body negative pressure (LBNP) sessions (three daily 20-min LBNP sessions for the first 3 weeks, followed by four daily sessions for the first 3 days of the last week and by 6 daily sessions for the last 4 days) on changes induced in the cardiovascular system of humans by 30 days of -6 deg head-down bed rest was investigated. In these experiments, subjects first served as controls and then were subjected to LBNP or vise versa. It was found that, compared with control subjects, in whom the cardiac output values tended to decrease after bed rest, the values of cardiac output in subjects receiving LBNP treatment increased or at least remained at the preexperimental level. The differences observed appear to be related to differences in blood volume changes due to LBNP. I.S.

A91-37468#
CARDIORESPIRATORY RESPONSES TO MAXIMAL AND SUBMAXIMAL EXERCISE IN SUPINE AND UPRIGHT POSITIONS
R. L. HUGHSON, H. XING, C. BORKHOFF, and G. C. BUTLER (Waterloo, University, Canada) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-38, S-39. NSERC-supported research. refs

The effects of maximal and submaximal exercise in the upright and supine postures on physiological parameters of the cardiorespiratory system were investigated in male human subjects, using the pseudorandom binary sequence (PRBS, Stegemann et al., 1985; Hughson et al., 1989) approach to submaximal testing. Subjects were tested on a cycle ergometer in both upright and supine positions, using three exercise protocols: (1) incremental exercise with 4 min at 25 W, followed by an increase of work

rate (WR) as a ramp at 20 W/min until exhaustion; (2) following a 4-min period at 25 W, the WR increased as a step function to 105 W for 6 min, with six repetitions; and (3) a PRBS test with each sequence having 63 units, each of 5 sec duration, for a total period of 315 sec, with WR set at either 25 or 105 W by a subroutine of the breath-by-breath program. Results show that the PRBS submaximal test is a sensitive method for a quick detection of altered cardiorespiratory function that occurs with loss of the normal head-to-foot gravity vector. I.S.

A91-37469*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
BAROREFLEX RESPONSES AND LBNP TOLERANCE FOLLOWING EXERCISE TRAINING
V. A. CONVERTINO, C. A. THOMPSON, D. L. ECKBERG, J. M. FRITSCH, G. W. MACK, and E. R. NADEL (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL; USVA, Medical Center; Virginia, Medical College, Richmond; J.B. Pierce Foundation Laboratory, New Haven, CT) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) *Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb.* 1990, p. S-40, S-41. refs

The hypothesis that endurance exercise training designed to increase aerobic capacity results in reduced orthostatic tolerance due to alterations of blood-pressure controlling mechanisms was reexamined using a specially designed training in which tolerance to orthostasis and the primary mechanisms associated with the blood-pressure control could be measured before and after the increase in aerobic capacity. Results demonstrate that maximal oxygen uptake can be significantly elevated in individuals of average fit without reducing lower body negative pressure tolerance. The exercise training was found to cause a resting bradycardia, which had no effect on the cardiac vagal reflex response. I.S.

A91-37470#
ORTHOSYMPATHETIC ACTIVITY DURING HEAD-OUT WATER IMMERSION AND DURING FLOATING
J. LECOMTE, G. V. LECOMTE, and D. LAGNEAUX (Liege, Universite, Belgium) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-42, S-43. refs

Changes in orthosympathetic activity caused in human subjects by head-out immersion in thermoneutral water were compared to those of subjects floating on a hypertonic aqueous solution of magnesium sulphate, by measuring urine contents of catecholamines before and after immersion/floating sessions. Heart rate and brachial systemic pressure were measured during all the procedures. Results indicated that, during immersion, the orthosympathetic control of the systemic circulation is diminished in response to increased hydrostatic pressure. During floating on a hypertonic medium the sympathetic activity remained at control levels. I.S.

A91-37471#
CARDIOVASCULAR RESPONSES TO MODERATE EXERCISE DURING WATER IMMERSION IN WOMAN
J. NAGANO (Bunka Women's University, Tokyo, Japan), S. TORIKOSHI, K. YOKOZAWA (Tokyo Women's Christian University, Japan), K. ITOH (Turumi University, Japan), Y. FUKASE (Rikkyo Saint Marguerite Women's College, Japan) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-44, S-45.

Cardiovascular responses of human body to moderate exercise in air were compared with responses to exercise performed under conditions of water immersion in experiments where female subjects exercised on an ergometer placed in air or in a bath filled with water to the level of axilla. In comparison to values obtained in air, the values for oxygen uptake and heart rate obtained under conditions of water immersion were lower. The values of systolic arterial pressure did not change significantly. I.S.

A91-37475#
EFFECTS OF LOWER BODY POSITIVE PRESSURE ON FOREARM VASCULATURE
G. LEFTHERIOTIS, J. L. SAUMET, N. HEMERY (CHRU, Angers, France), and G. GEELEN (Lyon I, Universite, Lyons, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-52, S-53. refs

The effect of lower body positive pressure induced by an antigravity suit (Anti-G suit) on the peripheral circulation was investigated by comparing values of several circulation parameters in human subjects during three successive periods (1) seating at rest, (2) 1 hr of standing on a tilt table while wearing a noninflated Anti-G suit, and (3) 1 hr of standing in an inflated Anti-G suit. Values of mean, systolic, and diastolic arterial pressure were measured every 10 min on the left arm, while the forearm venous compliance (FVC) and arterial blood flow were measured on the right arm, using venous occlusion plethysmography technique. Results showed that, after 1 hr of Anti-G suit inflation, the FVC increased by 16 percent (indicating a decrease in peripheral venous tone) and the values of mean and diastolic blood pressures increased by 4 and 7 percent, respectively. Heart rate decreased by 15 percent. The mechanism of the compensatory responses induced by Anti-G suit inflation is discussed. I.S.

A91-37476*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EFFECT OF SIMULATED WEIGHTLESSNESS ON THE POSTURAL RESPONSE OF MICROVASCULAR CUTANEOUS BLOOD FLOW
M. ARATOW, A. R. HARGENS, S. B. ARNAUD, and J.-U. MEYER (NASA, Ames Research Center, Moffett Field, CA) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-54, S-55. refs

The effect of simulated weightlessness (1 week of bed rest) on the response of cutaneous microcirculatory blood flow to postural changes was investigated by measuring rates of the cutaneous blood flow in the central forehead and in the dorsum of the left foot in subjects who were tested in -6 deg head-down tilt (HDT) and 60-deg head-up tilt (HUT) before and after the week of bed rest. It was found that, when the subjects were moved from HUT to HDT before the bed rest period, the forehead cutaneous blood flow increased (in comparison to no-tilt baseline), due to increased arterial pressure, by about 26 percent, and that the response was the same on the first and the second day after 1 week of bed rest. The cutaneous blood flow in the dorsum of the foot decreased by about 46 percent in response to tilting from HDT to HUT both before and after bedrest. I.S.

A91-37477#
ENDURANCE EXERCISE TRAINING REDUCES ORTHOSTATIC TOLERANCE IN HUMANS
PETER B. RAVEN and GLEN H. STEVENS (Texas College of Osteopathic Medicine, Fort Worth) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-56 to S-58. refs

The effect of an 8-month endurance treadmill-ramp training protocol designed to increase maximal oxygen capacity on the susceptibility of humans to orthostatic intolerance was investigated by measuring arterial pressure, maximal oxygen uptake, and several other physiological parameters during an application of graded lower body negative pressure. A comparison of pretraining with posttraining values showed that the maximal oxygen capacity

increased from 43.89 ml/kg per min to 56.91 ml/kg per min without a significant change in weight, lean body mass, or body surface area, while the maximal performance time increased from 15.50 min to 18.13 min. However, results also showed a significant reduction in orthostatic tolerance due to training, as evidenced by a change in cumulative stress index as defined by Luft et al. (1976). I.S.

A91-37478#
MICROCOMPUTER-BASED MONITORING OF CARDIOVASCULAR RESPONSES TO MICROGRAVITY SIMULATION (-7 DEGREES HDT)
E. LANSIMIES, K. TAHVANAINEN, M. MANTYSAARI, J. HARTIKAINEN, T. KARKI (Kuopio, University Central Hospital, Finland) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) *Physiologist, Supplement* (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-59 to S-62.

An integrated microcomputer-based system for the evaluation of cardiovascular responses to microgravity, simulated by -7 deg head-down tilt (HDT), was developed and tested. The software package includes procedures with on-line help for the following cardiovascular function tests: active orthostatic test, passive orthostatic test on a tilt table, microgravity simulation test on a tilt table, studies at rest in different body positions, deep breathing test (Wheeler and Watkins, 1977), Valsalva maneuver (Levin, 1966), sustained handgrip test (Ewing et al., 1974), pharmacological interventions (phenylephrine, atropine, and nitroglycerine tests), and mental arithmetics tests. I.S.

A91-37479#
THE EFFECT OF LBNP (LOWER BODY NEGATIVE PRESSURE) ON LOWER LIMB CAPACITANCE VESSELS DURING A 30 DAY -6 DEG HEAD-DOWN BEDREST
F. LOUISY, C. GAUDIN, J. M. OPPERT, A. GUEELL, and C. Y. GUEZENNEC (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-63, S-64. refs

The effect of lower body negative pressure (LBNP), applied to counteract the effect of weightlessness on lower-limb capacitance vessels was investigated by examining the leg venous distensibility (assessed by the strain gage plethysmography with venous occlusion) of human subjects exposed to -6 deg head-down 30-day-long bed rest. Results show that head-down bed rest increased the distensibility of capacitance vessels in lower limbs. However, during the exposure to head-down bed rest, the leg venous capacity changes measured in the LBNP and the no-LBNP groups were not statistically different, indicating that LBNP was not effective in counteracting the adverse effects of weightlessness on venous distensibility. I.S.

A91-37480*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
GRAVITY, CALCIUM, AND BONE - UPDATE, 1989
SARA B. ARNAUD and EMILY MOREY-HOLTON (NASA, Ames Research Center, Moffett Field, CA) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-65 to S-68. refs

Recent results obtained on skeletal adaptation, calcium metabolism, and bone browth during short-term flights and ground simulated-microgravity experiments are presented. Results demonstrate that two principal components of calcium metabolism respond within days to changes in body position and to weightlessness: the calcium endocrine system and bone characteristics. Furthermore, results of recent studies imply that bone biomechanics are more severely affected by spaceflight exposures than is the bone mass. I.S.

A91-37481#
CATECHOLAMINES DURING SHORT- AND LONG-TERM HEAD-DOWN BEDREST
J. M. COTTET-EMARD, J. M. PEQUIGNOT, L. PEYRIN, C. GHARIB (Lyon I, Universite, Lyons, France), and A. GUELL (CNES, Toulouse, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-69 to S-72. Research supported by CNES, DRET, and Fondation pour la Recherche Medicale. refs

Long-term studies of horizontal or head-down bedrest are useful in studying the effects of prolonged exposure to microgravity on the cardiovascular system. Experimental results are reported here which indicate a rapid and prolonged decrease in norepinephrine release during horizontal and head-down bedrest. It is argued that the reason for the immediate decrease in sympathetic nerve tone may result from stimulation of cardiopulmonary receptors due to fluid shift to the upper part of the body, and that the sustained decrease in sympathetic nerve activity is due to reduced energy output and cardiovascular adjustments. Head-down bedrest elicits an exaggerated sympathetic response to the tilt test which appears to be multifactorial, with causes including hypovolemia, decreased cardiac output, and modification of the barosensitivity and/or venous tone. C.D.

A91-37482#
TOWARD AN UNIVOCOUS INTERPRETATION OF CARDIOVASCULAR BIOMECHANICS IN HYPER AND MICROGRAVITY
P. QUANDIEU, C. C. TRAN (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France), PH. LIEBAERT (DRET, Paris, France), and D. GAFFIE (ONERA, Chatillon, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-73 to S-76.

The effects of short exposures to hypergravity and microgravity on the cardiovascular biomechanics and on the mechanics of the brain tissue are examined using a model of brain as a viscoelastic spherical mass enclosed in a totally rigid envelope (the skull), with a viscous liquid-type film (cerebrospinal fluid) between the first two entities. The brain is assumed to be composed of two phases; a solid phase (nerve tissue) and a liquid phase (the blood volume contained in a complex vascular system inside the solid phase). It is shown that exposures to hypergravity cause changes in two parameters: (1) mechanical stresses and (2) general deformation related to the decrease in blood mass under the effect of accelerations (i.e., a shift of fluids toward the lower part of the body). I.S.

A91-37483*# Karolinska Inst., Stockholm (Sweden).
AN APPROACH TO COUNTERACTING LONG-TERM MICROGRAVITY-INDUCED MUSCLE ATROPHY
P. A. TESCH (Karolinska Institutet, Stockholm, Sweden), P. BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL), and G. A. DUDLEY (Bionetics Corp., Cocoa Beach, FL) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-77 to S-79. refs
(Contract NAS10-10285)

To find means of alleviating muscle atrophy induced by long-term microgravity, the effects of a 19-week-long heavy-resistance training regime (using either concentric muscle actions only or concentric and eccentric muscle actions) on the strengths of the exercised knee extensor muscle group were investigated in two groups of male human subjects performing two types of training exercises: supine leg press or/and seated knee extension. Results show that a training program in which

both the concentric and the eccentric muscle action was performed led to substantially greater increases in maximal muscle strength than when only concentric exercises were performed. I.S.

A91-37485#
WATER INTAKE AT POST-EXERCISE COMPARING BETWEEN HEAD-UP AND -DOWN TILTING IN WOMAN
KIKUKO YOKOZAWA, SHIGEYO TORIKOSHI, JUNKO NAGANO, and YOJI SUZUKI (Tokyo Women's Christian University; Tokyo, University, Japan) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-82, S-83.

The effects of changes in body position after a mild prolonged (50 min of a 300 kpm/min) supine exercise to a 10-deg head-up tilt (HUT) or to a 10-deg head-down tilt (HDT) on the water intake and on cardiovascular responses of a human were investigated in female subjects by measuring water volume intake and body weight before, during, and after exercise in supine position and during the HUT and HDT. Values of the oxygen uptake, heart rate, arterial blood pressure, cardiac output, forearm blood flow, and skin temperature were measured throughout the experiments. It was found that values of water intake 15 min after the exercise were smaller in HDT than in HUT and that water intake was not significantly correlated with the body weight. Cardiovascular responses recovery in HUT were not significantly different from those measured in HDT. I.S.

A91-37496#
RELATIONSHIP BETWEEN HORMONES AND BRAIN WATER CONTENT MEASURED BY 1H MAGNETIC RESONANCE SPECTROSCOPY DURING SIMULATED WEIGHTLESSNESS IN MAN
N. MAURICE, B. ROUSSEL, H. MEHIER (Laboratoire RMN, Chamonix, France), G. GAUQUELIN, and C. GHARIB (Lyon I, Universite, Lyons, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-104, S-105. refs

The short-term effects of simulated weightlessness on the levels of two hormones involved in liquid volume regulation (plasma renin activity, PRA, and atrial natriuretic factor, ANF) were investigated in human subjects during a session of 5-hr-long head-down-tilt (HDT) at -6 deg, and the relationships between the PRA and ANF and the brain water content (measured using proton NMR spectroscopy) were examined. Results show that a 4-hr HDT induces an increase in total head water. The recorded values of hormonal variation agree with results of other investigations. Significantly, the pattern of variations in ANF was the same as the pattern of water volume variation. I.S.

A91-37497#
MECHANISMS OF LOWER BODY POSITIVE PRESSURE-INDUCED NATRIURESIS
G. GEELEN, G. GAUQUELIN, P. PASI (Lyon I, Universite, Lyons, France), A. HADJ-AISSA, N. POZET (Hopital E. Herriot, Lyons, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-106, S-107. Universite de Lyon I-supported research. refs

The mechanism responsible for the natriuresis induced by an application of lower body positive pressure (LBPP) was investigated in experiments where male subjects underwent 30 min of sitting, followed by 1 hr of head-up tilt (HUT) at 70 deg, and by 2 hrs more of HUT during which subjects wore inflated anti-G suits. Values of urine flow, osmolar and free water clearances, total and fractional Na(+) excretion, rates of glomerular filtration and proximal Na(+) reabsorpton, pulse rate, and blood pressure were measured at regular intervals. Results indicate the natriuresis induced by anti-G suit inflation involves a decrease in sodium reabsorption proximal to the distal tubule. This decrease could be ascribed to either one of the following mechanisms: (1) a change in peritubular Starling forces due to the pressure-natriuresis mechanism or (2) a decrease in sympathetic renal nerve activity. I.S.

A91-37503#
OTOLITH VERSUS VERTICAL SEMICIRCULAR CANAL INPUT IN THE INHIBITION OF HORIZONTAL POSTROTATORY NYSTAGMUS
E. KOENIG, W. DENGLER, M. FETTER, A. HANN, and J. DICHGANS (Tuebingen, Universitaet, Federal Republic of Germany) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-119, S-120. refs

The relative contributions of static and dynamic inputs are appraised in relation to the inhibition of horizontal postrotatory nystagmus (PRN). The experiment involved abruptly stopping the constant-velocity rotation of 90 degrees per second about the vertical head axis to generate PRN in ten human subjects. During PRN I and PRN II (secondary PRN in the opposite direction) the eye movements of the subjects were recorded after various numbers of forward head tilts of different durations which were initiated at different times. A maintained forward head tilt initiated shortly after rotation inhibits PRN I most strongly, and increasing inhibition is found for intermittent head tilts of increasing duration. PRN II is weaker for subjects with prone head tilts than for those in the upright position. The efficacy of PRN inhibition is found to vary directly with the amount of time the head is tilted, indicating that continuous contradictory otolith input provides maximum inhibition. The dynamic component of repeated short-duration head tilts is shown to be ineffective in the inhibition of PRN. C.C.S.

A91-37505#
PHYSIOLOGIC BASES FOR INCREASED G-LEVEL AND G-DURATION TOLERANCES
RUSSELL R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-125 to S-127. refs

The physiological mechanisms responsible for increased tolerance to high G levels and to increased G duration are discussed, with special attention given to methods for measuring the two types of tolerance. The roles of anti-G suit and of anti-G straining maneuver in increasing the arterial blood pressure and thus raising the G-level and G-duration tolerances are examined using mathematical relationships. I.S.

A91-37506#
CARDIOVASCULAR FUNCTION OF MAN EXPOSED TO LBNP TESTS
A. A. SAVILOV, V. I. LOBACHIK, and A. M. BABIN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-128 to S-132. refs

The pattern, the degree, and the mechanism of changes in the cardiovasuclar function induced by the application of LBNP are investigated, together with similarities and differences in circulation responses due to differences of the iniital state of intracardiac circulation, using echocardiography and radioisotope dilution as a method of physiological measurements. LBNP tests were used at pressures reduced by 25, 35, 40, and 50 mm Hg for 2 to 5 min. Cardiovascular responses to LBNP involved significant increases in heart rate and decreases in the left-ventricle systolic and diastolic volumes, which resulted in a corresponding reduction of stroke volume. In the case of a poor test tolerance,

presyncopal states were preceded by a secondary increase of the residual heart volume and pronounced decreases of other volume parameters and of contractility parameters. I.S.

A91-37507#
THE EFFECT OF EXTERNAL INSPIRATORY RESISTANCE TO BREATHING ON MAN'S ORTHOSTATIC TOLERANCE
V. M. BARANOV, V. P. KATUNTSEV, T. A. KABESHEVA, A. N. KOTOV, N. E. PANFEROVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-133 to S-136. refs

The concept that externally applied inspiratory resistance can enhance the chest's sucking action is investigated, and the benefit of increased venous return to a human subject's orthostatic tolerance is studied. A tilt table was employed to conduct orthostatic tests on male humans subjected to 20 minutes of a 70 degree head-up position. A control experiment established the baseline orthostatic tolerances; dry immersion was introduced in the next three tests to study orthostatic tolerance in the case of normal breathing, and with inspiratory resistances of 8.6 and 18.5 cm H2O. Orthostatic tolerance was found to decrease during water immersion since syncope developed in eight of the ten subjects. Syncopal events decreased when respiratory resistance was introduced in both of the last tests. Immersion hypodynamics and increased ambient temperatures are shown to decrease orthostatic tolerance, while the effect of external inspiratory resistance is the opposite. The conclusions are useful for the development of measures to counter the adverse effects of microgravity on humans. C.C.S.

A91-37509#
RESULTS OF EXAMINATIONS OF THE +GZ ACCELERATION TOLERANCE USING DIFFERENT ACCELERATION PROFILES
W. PAPENFUSS, G. KOLLANDE, B. ULLRICH, and R. ECKARDT (Institute of Aviation Medicine, Koenigsbrueck, Federal Republic of Germany) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-141, S-142.

The effect of acceleration profiles on +Gz-acceleration tolerance of human subjects exposed hypergravity force on a human centrifuge under conditions of three acceleration profiles: (1) acceleration increasing in steps of 0.5 Gz each, starting from 2 G up to a maximum of 5 Gz, with the onset rates of acceleration and deceleration of 0.1 G/sec; (2) the first G level of 3 Gz, the onset of acceleration of 0.5 G/sec, and that of deceleration 0.3 G/sec; and (3) a continuous acceleration increasing by 0.1 G/sec up to 7 Gz, followed by deceleration at 0.3 G/sec. It was found that the number of subjects reaching higher values of tolerance level (defined as the loss of the pulse amplitude and of the peripheral vision) increased with shorter times of exposure to hypergravity. No significant difference was observed due to an increase of resting intervals between the several increased G levels. I.S.

A91-37511#
STRESSES IN THE BRAIN MASS AND IN THE PERIPHERAL FLUIDS UNDER GZ ACCELERATION - STUDY OF A SIMPLE MODEL
P. LIEBAERT, D. GAFFIE, and P. QUANDIEU (DRET, Paris, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-145, S-146.

Using a simple model of brain, in which brain is considered as a viscoelastic mass surrounded by viscous fluid in a rigid envelope, a mechanical explanation is offered for stresses experienced by the brain under +Gz acceleration in two extreme cases (solid brain alone and liquid alone), in which the exterior forces are assumed to vary linearly with time. Results demonstrate that the levels of stress and deformation reached in rapid-onset-rate acceleration simulations are important enough to result in blood vessel collapse (at least in the case of veins). I.S.

A91-37516#
G-INDUCED LOSS OF CONSCIOUSNESS DETECTION LIMITS WITH TRANSCRANIAL DOPPLER MONITORING
J. M. CLERE, D. LEJEUNE, G. OSSARD, A. LEGER (Centre d'Essais en Vol, Bretigny-sur-Orge, France), and A. RONCIN (Tours, Universite, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-155, S-156. refs

The method of Spencer et al. (1989), who used a transcranial Doppler device to monitor blood flow in the middle cerebral artery, was used to detect in flight the high-G-induced loss of consciousness (LOC), in order to establish limits of Doppler device for this application. Results of Doppler monitoring during an instance of G-LOC demonstrated that blood flow in the middle cerebral artery during LOC was reduced but not completely stopped. The role of unequal brain vascularization and an ischemia threshold induced by lowered brain blood flow are discussed. I.S.

A91-37518#
ULTRASOUND TECHNOLOGY AND SPACE CARDIO-VASCULAR MEDICINE
PH. ARBEILLE, J. M. POTTIER, F. PATAT, M. BERSON, A. RONCIN (Institut National de la Sante et de la Recherche Medicale, Tours, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-159 to S-162. refs

The ultrasound methods available for monitoring cardiovascular activity are examined with emphasis on methods used in space medicine. Special attention is given to ultrasound facilities installed on board space vehicles Salyut VII, Space Shuttle Discovery, Mir, and Space Shuttle Challenger, which are all different. The main inflight experiments and the results are described. I.S.

A91-37519#
EFFECTS OF A 10-DAY PERIOD OF 6 DEGREE HEAD DOWN TILT (HDT)
FRIEDHELM BAISCH, L. BECK, HARTMUT MAASS, M. HEER, G. PLATH (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-163, S-164. refs

A head-down tilt (HDT) study was conducted to address issues related to the preparation for the D-2 Spacelab mission. Several examinations were undertaken in the areas of cardiovascular regulation and fluid and electrolyte metabolism and control. Six male subjects underwent a six degree HDT to reproduce the phenomena related to the exposure to microgravity, and data were collected. During a six-day period following the ten-day HDT, acute interventions were performed to change intravascular volume and measure or calculate physiological responses. Body fluid redistribution during the HDT phase is noted, with particular attention given to the changes in leg volume during the study. Weight loss, a decrease in skeletal muscle mass, and a constant loss of potassium are observed during the HDT phase. Significant changes are described in the lower part of the body, in plasma volume, and in cardiac output. Some of the results of HDT support the notion that HDT and microgravity produce similar effects. C.C.S.

A91-37520#
EFFECTS OF 10 DAYS HDT ON FLUID AND ELECTROLYTE METABOLISM
M. HEER, FRIEDHELM BAISCH, HARTMUT MAASS (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), C. DRUMMER, R. GERZER (Muenchen, Universitaet, Munich, Federal Republic of Germany) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-165, S-166. refs

Fluid and electrolyte turnover are investigated in six human subjects in the head-down-tilt (HDT) position. For a 22-day period a standardized diet and saline and metabolic i.v. infusions were administered to the test subjects. Urinary volume, electrolyte excretion, and other metabolic levels were measured for the prephase, HDT phase, and recovery phase of the test. Water and sodium balances were calculated by balancing the intakes and infusions with renal excretion and evaporative water losses. The posture change caused a mean weight change of 1.0 kg, and about 0.6 kg was recuperated at the end of the HDT period. At the end of the investigation about 1.24 + or - 1.03 kg had been lost. The cumulative water balance and net water losses are discussed, and a sodium loss is observed after tilting to HDT. Plasma responses remained unchanged throughout the course of the investigation. HDT is found to provoke a fluid redistribution, and the mechanisms that provoke the initial water and sodium losses are similar for both HDT adaptation and rapid i.v. infusions. C.C.S.

A91-37521#
EFFECTS OF HEAD DOWN TILT FOR 10 DAYS ON THE COMPLIANCE OF THE LOWER LIMB
JAY C. BUCKEY, LYNDA D. LANE, F. A. GAFFNEY (Texas, University, Dallas), GERNOT PLATH, FRIEDHELM BAISCH (DLR, Cologne, Federal Republic of Germany) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-167, S-168. refs

The effect of a 10-day-long -6 deg head-down tilt (HDT) on the degree of leg compliance was investigated in human subjects, using the venous occlusion plethysmography technique and ultrasonic plethysmography to monitor leg compliance before, during, and after HDT bed rest. Results demonstrate a clear trend toward greater leg compliance both during and after HDT. I.S.

A91-37522#
RESPONSES OF ADRENERGIC RECEPTORS TO SIMULATED WEIGHTLESSNESS (6 DEG HEAD DOWN TILT)
HARTMUT MAASS, JOAO TRANSMONTANO, and FRIEDHELM BAISCH (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-169, S-170. refs

The effects of a reduction in catecholamine concentration are examined with respect to the production pattern and influence of stress-related hormones under simulated weightlessness. A simulation of the reduction observed during bedrest is studied to determine whether the cells carrying adrenergic receptors are altered in terms of the density and responsiveness of the receptors. Alpha(2)- and beta(2)-receptors in human subjects were examined on different days of a head down tilt (HDT) for binding sites and the production of cyclic adenosine-3'-5'-monophosphate (cAMP). Fewer binding sites are found before HDT, and the densities increase only minimally during and after the tilt. A significant change in responsiveness is not shown for the beta(2)-receptors during the HDT as evinced by the cAMP data. The densities of adrenergic receptors during the HDT coincide inversely with catecholamine excretion rates. The cause of upregulation of adrenergic receptors during and following simulated weightlessness is suggested to be the reduction of catecholamine levels, although stress can make such results indistinct. C.C.S.

A91-37523#
THE EFFECTS OF A 10-DAY PERIOD OF HEAD-DOWN TILT ON THE CARDIOVASCULAR RESPONSES TO INTRAVENOUS SALINE LOADING
F. A. GAFFNEY, JAY C. BUCKEY, LYNDA D. LANE (University of Texas Southwest Medical Center, Dallas), A. HILLEBRECHT, H. SCHULZ (Max-Planck-Institut fuer experimentelle Medizin, Goettingen, Federal Republic of Germany) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-171, S-172.

A study was performed to examine the effects of a ten day period of -6 degree head-down tilt on the cardiovascular responses to intravenous saline loading. The hypothesis that relative hypovolemia and dehydration as produced by actual and simulated microgravity alter the response to intravenous saline loading was tested. Results show that all subjects tolerated the saline fluid load well and no symptoms were reported. Saline infusion produced significant but transient increases in total blood volume, plasma volume, heart rate, stroke volume, and cardiac output. R.E.P.

A91-37524#
EFFECT OF A 10-DAY HDT ON THE HEMODYNAMIC RESPONSE TO LBNP
L. BECK, FRIEDHELM BAISCH (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), G. BLOMQVIST, J. BUCKEY (University of Texas Southwest Medical Center, Dallas), PH. ARBEILLE (Tours, Universite, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-173, S-174.

The effect of application of 10-day-long head-down -6 deg tilt (HDT) on the hemodynamic responses of humans to LBNP was investigated using methodology described by Baisch et al. (1991), in which LBNP was applied before, during, and after HDT phases (both in the pre-HDT and the post-HDT phases, LBNP was applied in the -6 deg head-down position). In all three phases of experiment, the application of LBNP resulted in decreases of stroke volume and cardiac output and in increases of both the heart rate and the total peripheral resistance. Results showed that, during the HDT phase, the LBNP-induced changes in arterial pressure, stroke volume, and cardiac output were significantly more pronounced than they were in the pre-HDT and the post-HDT phases. I.S.

A91-37525#
VARIATIONS OF THE RENAL FLOW IN RELATION WITH THE VOLEMIA
PH. ARBEILLE, D. LEBOUARD, F. PATAT, J. M. POTTIER (Institut National de la Sante et de la Recherche Medicale, Tours, France), J. BUCKEY (Texas, University, Dallas) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-175, S-176. refs

Responses of renal flow to volemic changes induced by changes in gravity were studied in human subjects under following four conditions: (1 and 2) a one month exposure to head-down tilt (HDT) during which one half of subjects were subjected to repeated LBNP tests throughout the HDT period, (3) 10 days of HDT during which each subject had two LBNP sessions, and (4) a 25-day-long flight aboard the Mir space station. Results indicate that renal flow response is very sensitive to variations of volemia. It was observed in the case of central hypovolemia induced either by 0-g environment, by long-term HDT, or by LBNP maneuver, that the renal vascular resistance decreased significantly. In the case of hypervolemia induced by fluid loading or by repeated

LBNP test, the index of renal vascular resistance increased, suggesting an arterial vasoconstriction in the renal vascular bed. I.S.

A91-37526#
CAROTID BARORECEPTOR CARDIAC-VAGAL REFLEX RESPONSES DURING 10 DAYS OF HEAD-DOWN TILT
DWAIN L. ECKBERG and JANICE M. FRITSCH (USVA, Medical Center; Virginia, Medical College, Richmond) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-177.

Astronauts experience postflight orthostatic hypotension and may have impaired baroreflexes. Changes of carotid baroreceptor cardiac reflex function were studied in six men before and during 10 days of 6-deg head-down tilt. During held expiration, 40 mmHg of pressure was applied to a neck chamber, followed by 15 mmHg, R-wave triggered decrements to -65 mmHg. R-R intervals were plotted against carotid distending pressures. The slope of the response decreased from 5.0 + or - 0.4 msec/mmHg (control) to 3.6 + or - 0.7 (day 10, P = 0.11) and increased to 4.0 + or - 0.8 by day 7 of recovery. The range of R-R interval responses decreased from 263 + or - 31 (control) to 182 + or - 18 (day 10) (p = 0.03) and returned to 215 + or - 40 msec during recovery. These results suggest that head-down tilt may impair normal blood pressure control mechanisms by reducing both the gain and the range of carotid baroreflex responses. Author

A91-37527#
THE AUTONOMIC NERVOUS SYSTEM IN BLOOD PRESSURE REGULATION DURING 10 DAYS 6 DEG HEAD DOWN TILT
A. D. J. TEN HARKEL, FRIEDHELM BAISCH, L. BECK, and J. M. KAREMAKER (Amsterdam, University, Netherlands; DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-178, S-179. NWO-supported research. refs

The role of autonomic nervous system in the development of orthostatic intolerance due to an exposure to weightlessness was investiated in six human subjects subjected for 10 days to 6-deg head-down tilt (HDT). The parasympathetic part of the autonomic nervous system was tested by the heart rate (HR) response to forced breathing, while the efferent sympathetic part was tested by evaluating mental stress (MS) and by measuring the blood pressure (BP) and HR responses to sustained handgrip before, during, and after the HDT period. The efferent sympathetic and parasympathetic control was assessed by BP and HR responses to the Valsalva maneuver, while orthostatic control was assessed by 70-deg head-up tilt. Results indicate that the autonomic nervous reactivity upon maneuvers that are not influenced by fluid system was unchanged. In maneuvers that are dependent on blood volume and fluid distribution, the sympathetic reactivity was found to increase. I.S.

A91-37573#
MEDICAL SUPPORT OF LONG-TERM MISSIONS ABOARD 'MIR' ORBITAL COMPLEX
A. I. GRIGORIEV, V. V. BOGOMOLOV, and A. D. EGOROV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IN: Space - Technology, commerce and communications; Proceedings of the 4th Annual Conference, Washington, DC, Jan. 8-10, 1991. Lexington, MA, T.F. Associates, Inc., 1991, p. 78-81.

Medical monitoring of cosmonauts aboard the Mir orbital complex is discussed. Countermeasures used to adapt the body to microgravity are outlined and a brief and general overview is given of strategies to maintain high performance and minimize pathologies. C.D.

A91-37717#
NUTRITIONAL ASSESSMENT OF COCKPIT CREW MEAL
MAKOTO OHNO, NAOKO TAJIMA, CHIYOE YAMADA, MITSUYO YUZAWA, TSUTOMU ITAI (Japan Airlines, Flight Crew Medical Service Dept., Tokyo) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, Dec. 1990, p. 87-92. In Japanese, with abstract in English. refs

The energy and nutritional balance of 157 JAL cockpit crew meals were analyzed, and the results are reported. The energy of lunch or dinner meals was 1217 + or - 255 kcal, that of breakfasts was 808 + or - 227 kcal, and that of snacks was 717 + or - 203 kcal. The mean energy supply for a long-range flight of 9-13 hrs was 2281 kcal, corresponded nearly to the daily energy requirement of the average Japanese adult male. It is therefore concluded that the meals constitute an excessively high energy diet for the expenditure of energy involved in flying a JAL aircraft. Western-style meals contained more energy and fat than Japanese-style meals, while the amount of NaCl was almost identical. C.D.

A91-39073
CHARACTERISTICS OF ADAPTIVE SYSTEM REACTIONS IN OPERATORS WORKING SHIFTS (ACCORDING TO OMEGOMETRIC FINDINGS) [OSOBENNOSTI ADAPTIVNYKH SISTEMNYKH REAKTSII OPERATOROV, RABOTAIUSHCHIKH POSMENNO /PO REZUL'TATAM OMEGOMETRII/]
V. V. KAL'NISH, N. I. SYTNIK, S. A. IAKOVINA, and S. V. FEDORENKO (Kievskii Nauchno-Issledovatel'skii Institut Gigieny Truda i Professional'nykh Zabolevanii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0204-8489), vol. 37, Mar.-Apr. 1991, p. 103-107. In Russian. refs
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The evoked dynamics of the omega potential and its relation to certain parameters of the mental working capacity of operators at steam power plants are studied under actual conditions. The dependence of the omegagram type on the background level of the omega potential is determined. Twelve types of omegagrams comprising two A and B clusters with a negative correlation are distinguished. The highest level of mental working capacity is observed in operators when the background values of the omega potential does not exceed 45 mV and the omegagram type belongs to the B cluster. P.D.

A91-39101
BIORHYTHMOLOGICAL APPROACH TO STUDIES OF FUNCTIONAL ASYMMETRY IN SYSTEMS REGULATING EQUILIBRIUM AND ORIENTATION IN SPACE [BIORITMOLOGICHESKIE PODKHODY K IZUCHENIIU FUNKTSIONAL'NOI ASIMMETRII V SISTEMAKH RAVNOVESIIA I PROSTRANSTVENNOI ORIENTIROVKI]
V. A. GALICHII (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 17, Mar.-Apr. 1991, p. 17-23. In Russian. refs
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Circadien variability in the characteristics of asymmetry in the activity of paired organs that regulate equilibrium and orientation in space of humans was investigated in three subjects, using a methodology based on measurements of changes in the pattern of successive visual images during changes in the body position from vertical into horizontal and from the right-side horizontal to the left-side. Also assessed was the stability of subjects to interrupted cumulation of Coriolis acceleration in the morning vs the evening. Among the three subjects, two displayed asymmetry variations characterized by left-hand dominance and one showed asymmetry variations fluctuations that had a tendency for right-hand dominance. Moreover, the tendency for left-hand dominance was found to correlate with a greater stability to Coriolis acceleration; the stability was found to vary with the time of the day, with variability being different in different individuals. I.S.

A91-39102
DIURNAL DYNAMICS OR HORMONAL REGULATION OF THE WATER-SALT EXCHANGE IN HUMANS UNDER PROLONGED HYPOKINESIA [SUTOCHNAIA DINAMIKA GORMONAL'NOI REGULIATSII VODNO-SOLEVOGO OBMENA U CHELOVEKA PRI DLITEL'NOI GIPOKINEZII]
IU. V. SUKHANOV, I. M. LARINA, T. M. SMIRNOVA, and G. S. ARZAMAZOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 17, Mar.-Apr. 1991, p. 93-98. In Russian. refs
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The effect of prolonged antiorthostatic hypokinesia on the water-salt exchange and on its hormonal regulation was investigated, with and without taking into account diurnal changes in the dynamics of individual characteristics, in ten healthy men subjected to -5 deg head-down tilt (HDT) for 75 days. It was found that, at the end of the experiment, the levels of partial water and salt balances were lower than at the pre-HDT period and the blood-serum concentrations of aldesterone, sodium, and osmotically active molecules decreased. At the same time, the concentration of antidiuretic hormone and the renin activity increased. The 75-day HDT was also found to affect the sensitivity of hormonal systems to regulating stimuli and the hormonal sensitivity of the kidneys. I.S.

A91-39103
THE EFFECT OF COOLING IN WATER ON THE HORMONAL STATE OF THE HUMAN ORGANISM [VLIIANIE OKHLAZHDAIUSHCHEI VODNOI SREDY NA GORMONAL'NYI STATUS ORGANIZMA CHELOVEKA]
N. S. NIKULINA, K. M. KARLYEV, A. F. BOBROV, M. A. VERKHOTIN, and V. P. LAPSHIN (Institut Biofiziki, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 17, Mar.-Apr. 1991, p. 99-105. In Russian. refs
Copyright

A91-39104
THE CHARACTERISTICS OF ADAPTATION TO A MODERATE ALTITUDE HYPOXIA AND A HYPERTHERMIA IN HUMANS ENGAGED IN PHYSICAL ACTIVITY [OSOBENNOSTI ADAPTATSII CHELOVEKA K VLIIANIIU UMERENNOI VYSOTNOI GIPOTOKSII I GIPERTERMII PRI VYPOLNENII FIZICHESKOI NAGRUZKI]
E. A. KUSHNIRENKO, E. SOKOLOVSKI, L. TOMASHEVSKA, I. LASHCHINSKA, D. GEMBITSKA (Wojskowy Instytut Medycyny Lotniczej, Warsaw, Poland) et al. Fiziologiia Cheloveka (ISSN 0131-1646), vol. 17, Mar.-Apr. 1991, p. 118-124. In Russian. refs
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The effect of short-term altitude hypoxia at an elevated temperature combined with physical activity on the functional state of human body was investigated in subjects performing exercises on a bicycle ergometer in a pressure chamber either at sea-level or at a simulated altitude of 3000 m at two temperatures: 22-23 C and 40 C. It was found that the combined effects of hypoxia and elevated temperature led to changes in the circulation, thermal regulation, and metabolism in exercising subjects, that indicated a development of higher tolerance to physical loads, compared to subjects that exercised at elevated temperature but at sea level pressure. It is suggested that moderate hypoxia might increase the rate of heat elimination by the body surface and induce a more economic activity of the homeostatic systems. I.S.

A91-39185
THE FUNCTIONAL STATES OF A HUMAN ORGANISM FROM THE STANDPOINT OF DIELECTIC HARMONY BETWEEN THE WAVEFORM PROCESSES OF THE BRAIN, THE ORGANISM, AND THE HABITAT [PROBLEMA FUNKTSIONAL'NYKH SOSTOIANII CHELOVEKA S POZITSII DIALEKTICHESKOGO EDINSTVA VOLNOVYKH PROTSESSOV GOLOVNOGO MOZGA, ORGANIZMA I SREDY OBITANIIA]
V. A. ILIUKHINA (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, Dec. 1990. p. 1720-1729. In Russian. refs
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A91-39399
HUMAN CENTRIFUGE ONSET RATES
BERNHARD H. RICHTER (Environmental Tectonics Corp., Southampton, PA) and R. E. VAN PATTEN IN: Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings. Newhall, CA, SAFE Association, 1990, p. 214-217.
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The current worldwide interest in providing human centrifuges for both pilot training and research has led to renewed interest in the issue of Gz-onset rate in such machines. This interest stems from the fact that current fighter aircraft are capable of onset rates ranging from the F-16's 6/G/sec and higher. This paper briefly reviews the physiology of onset rate effects and concludes, on the basis of past human experimentation at high onset rates at high Gz levels, that it is desirable that a centrifuge intended for research should be capable of onset rates of about 1G/sec. For a training centrifuge it concludes that the benefits of an onset rate higher than 6G/sec would be difficult to justify on the basis of physiological or economic considerations. Engineering considerations demand, however, an ultimate rate capability sufficient to permit the simulation of air combat maneuvering profiles while remaining within the constraints of feasibly-sized gear trains and drive systems in order to provide an economical system with low operating cost. Author

A91-39501* National Aeronautics and Space Administration, Washington, DC.
SPACELAB LIFE SCIENCES 1 - REPRINTS OF BACKGROUND LIFE SCIENCES PUBLICATIONS
RONALD WHITE, ED. (NASA, Washington, DC) and JOEL LEONARD, ED. (Lockheed Engineering and Sciences Co., Washington, DC) Houston, TX, GE Government Services, 1991, 416 p. For individual items see A91-39502, A91-39504 to A91-39515.
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Results from investigations conducted in preparation for the first Spacelab life-sciences mission are summarized in selected previously published papers. Topics discussed are the role of calcium in osteoporosis, orthostaic hypotension, cardiovascular adjustments to gravitational stress, cell biology, exposure to stressful environments, heart-lung interactions in aerospace medicine, effects of weightlessness on human fluid and electrolyte physiology, macular bioaccelerometers on earth and in space, and metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates. O.G.

A91-39502
THE ROLE OF CALCIUM IN OSTEOPOROSIS
C. D. ARNAUD (California, University, San Francisco) and S. D. SANCHEZ (San Francisco Institute on Aging, CA) IN: Spacelab life sciences 1 - Reprints of background life sciences publications (A91-39501 16-52). Houston, TX, GE Government Services, 1991, p. 3-20. refs
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Effects of calcium supplementation on bone mass and fracture are considered. Results of the research indicate that osteoporosis occurs more frequently in postmenopausal white women and in the elderly, owing to a suspected functional or absolute decrease in the ability of the kidney to produce 1,25(OH)2D3. About 20 percent of women suffer osteoporotic fractures by age 65, and more than 30 percent sustain fractures by age 90. It is suggested that the impairments of intestinal calcium absorption observed during menopause and aging can be overcome only by inordinately large calcium intakes. An intake of 1000 to 1500 mg/day of calcium is recommended to women not taking estrogen replacement, while 2000 mg/day of calcium is considered to be safe for teenaged children and adults. O.G.

A91-39504
ORTHOSTATIC HYPOTENSION
C. G. BLOMQVIST (University of Texas Health Science Center, Dallas) (Cardiology, vol. 1, 1990, p. 1-20) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 25-44. refs
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The causes and treatment of chronic orthostatic hypotention are considered. Problems discussed include pathophysiology, neurohumoral regulation, clinical aspects, hyperreactive hypovolemic orthostatic hypotension, and normovolemic hyporeactive orthostatic hypotention. Results of the research indicate that trivial stresses (straining during micturition or defecation, exposure to a warm environment, and having an ordinary meal) can produce symptomatic hypotension in patients lacking essential elements of the blood preasure control system. Carbohydrates are more likely to induce hypotension than fats or proteins. Alcohol is prone to cause further vasodilatation. It is recommended to avoid vasoactive drugs. The response to vasolidators is amplified for lack of defense mechanisms, and the effects of vasoconstrictors and venoconstrictors may be greatly magnified by denervation hypersensitivity. O.G.

A91-39505
CARDIOVASCULAR ADJUSTMENTS TO GRAVITATIONAL STRESS
C. G. BLOMQVIST (University of Texas Health Science Center, Dallas) and H. L. STONE (University of Oklahoma Health Science Center, Oklahoma City) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 49-87. refs
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The effects of microgravity on the cardiovascular system are examined in a review essay. Topics discussed include hydrostatic pressure; immediate cardiovascular responses to posture changes and blood volume redistribution; cardiovascular adaptation to prolonged bed rest, zero gravity, and related conditions; and hypergravic conditions. O.G.

A91-39506
CELL BIOLOGY
A. COGOLI, T. H. IVERSEN, A. JOHNSSON, D. MESLAND, and H. OSER (Life sciences research in space, Paris, European Space Agency, 1989, p. 49-64) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 98-113. refs
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Microgravity effects in the context of cell biology are discussed with emphasis on past-time influences of gravity, which become encoded in genes and contribute to the form of an organism; anticipated influences of gravity, which contribute via sensors to the form dynamics of an organism; and real-time influences of gravity, acting directly on the molecular interactions of the biological machinery. The action of gravity via genes and sensors is considered to have much more relevance for multicellular organisms than for single cells. The most important difference between a particular effect of gravity on single cells and direct action of gravity on molecular interactions is in the reaction time to changed gravitation and in the reversibility of the effect. Whereas sensor activity shows short reaction times and reversibility, action on cellular dynamic systems is a relatively slow process yielding effects that may not be readily reversible. O.G.

A91-39507* State Univ. of New York, Buffalo.
EXPOSURE TO STRESSFUL ENVIRONMENTS - STRATEGY OF ADAPTIVE RESPONSES
LEON E. FARHI (New York, State University, Buffalo; Max-Planck-Institut fuer experimentelle Medizin, Goettingen, Federal Republic of Germany) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 121-134. refs
(Contract NAS9-16042)
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Stresses such as hypoxia, water lack, and heat exposure can produce strains in more than a single organ system, in turn stimulating the body to adapt in multiple ways. Nevertheless, a general strategy of the various adaptive responses emerges when the challenges are divided into three groups: (1) conditions that affect the supply of essential molecules, (2) stresses that prevent the body from regulating properly the output of waste products such as CO2 and heat, and (3) environments that disrupt body transport systems. Problems may arise when there is a conflict between two stresses requiring conflicting adaptive changes. An alternative to adaptation, creation of microenvironment, is often favored by the animal. Author

A91-39508
HEART-LUNG INTERACTIONS IN AEROSPACE MEDICINE
HAROLD J. B. GUY and GORDON KIM PRISK (California, University, La Jolla) (Heart-lung interactions in health and disease, New York, Marcel Dekker, Inc., 1989, p. 519-563) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 149-193. refs
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Heart-lung interactions in the aerospace environment are discussed using retrospective aviation physiology data and recent laboratory data. Problems under consideration include increased foot-to-head acceleration (+Gz), lung function during increased +Gz, cardiovascular effects of +Gz, and protective measures for extending +Gz tolerance. Particular attention is given to the effects of pressure breathing on lung volume and cardiovascular system, neurohormonal effects of microgravity, and adaptations to microgravity. O.G.

A91-39509
THREE HIERARCHIES IN SKELETAL MUSCLE FIBRE CLASSIFICATION - ALLOTYPE, ISOTYPE AND PHENOTYPE
JOSEPH F. Y. HOH, SUZANNE HUGHES, GREGORY HUGH, and IRENE POZGAJ (Sydney, University, Australia) (Cellular and molecular biology of muscle development, Elmsford, NY, Pergamon Press, Inc., 1989, p. 15-26) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 194-205. Research supported by Muscular Dystrophy Association of America, National Health and Medical Research Council of Australia, and Muscular Dystrophy Association of New South Wales. refs
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The experiments for testing the neural regulatory hypothesis for fiber type diversity are described. The data obtained through immunocytochemical techniques using monoclonal and polyclonal anti-myosin heavy chain antibodies reveal two hierarchically distinct levels of myogenic influences affecting fiber phenotype. A hierarchical classification is proposed in which jaw and limb muscles belong to different allotypes defining their phenotypic options. Within each allotype, myogenically distinct isotypes emerge during development. O.G.

A91-39510* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
EFFECTS OF WEIGHTLESSNESS ON HUMAN FLUID AND ELECTROLYTE PHYSIOLOGY
CAROLYN S. LEACH and PHILIP C. JOHNSON, JR. (NASA, Johnson Space Center, Houston, TX) (Physiological function in special environments, New York, Springer-Verlag, 1989, p. 138-146) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 210-218. refs
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Skylab and Spacelab data on changes occurring in human fluid and electrolyte physiology during the acute and adaptive phases of adaptation to spaceflight are summarized. The combined results for all three Spacelab studies show that hyponatremia developed within 20 h after the onset of weightlessness and continued throughout the flights, and hypokalemia developed by 40 h. Antidiuretic hormone was increased in plasma throughout

the flights. Aldosterone decreased by 40 h, but after 7 days it had reached preflight levels. O.G.

A91-39511* State Univ. of New York, Buffalo.
GRAVITATIONAL FORCE AND THE CARDIOVASCULAR SYSTEM
D. R. PENDERGAST, A. J. OLSZOWKA, M. A. ROKITKA, and L. E. FARHI (New York, State University, Buffalo) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 242-253. refs
(Contract NAS9-16042)
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Ground-based simulation studies have been conducted to clarify the problems of the cardiovascular adaptation to alterations in gravitational force. Simulated microgravity experiments resulted in increases in cardiac stretch, urine flow, and sodium excretion, which were accompanied by lower plasma renin, aldosterone, and ADH. There appears to be a decrease in plasma volume as well as in sympathetic tone after 2-3 days of 0 Gz. Complete adjustment to 0 Gz is found within 8 h without a decrease in plasma volume, when subjects are allowed to dehydrate mildly. O.G.

A91-39512* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MACULAR BIOACCELEROMETERS ON EARTH AND IN SPACE
M. D. ROSS, L. CUTLER, P. VAZIRI (NASA, Ames Research Center, Moffett Field, CA), G. MEYER, and T. LAM (Sterling Federal Systems, Inc., Palo Alto, CA) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 261-271. refs
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Spaceflight offers the unique opportunity to study linear bioaccelerometers (vestibular maculas) in the virtual absence of a primary stimulus, gravitational acceleration. Combined morphological-physiological studies of maculas fixed in space and following flight should reveal macular adaptive responses to microgravity, and their time-course. Ground-based research, already begun, using computer-assisted, three-dimensional reconstructions of macular terminal fields will lead to development of computer models of functioning maculas. This research should continue in conjunction with physiological studies, including work with multichannel electrodes. Author

A91-39513* Medicine and Dentistry Univ. of New Jersey, Camden.
METABOLISM OF NONESSENTIAL N-15-LABELED AMINO ACIDS AND THE MEASUREMENT OF HUMAN WHOLE-BODY PROTEIN SYNTHESIS RATES
T. P. STEIN (New Jersey, University of Medicine and Dentistry, Camden; Pennsylvania, University, Philadelphia), R. G. SETTLE, J. A. ALBINA, G. MELNICK (Pennsylvania, University, Philadelphia), and D. T. DEMPSEY IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 276-284. refs
(Contract NIH-AM-33431; NAS9-16874)
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Eight N-15-labeled nonessential amino acids plus (N-15)H4Cl were administered over a 10-h period to four healthy adult males using a primed-constant dosage regimen. The amount of N-15 excreted in the urine and the urinary ammonia, hippuric acid, and plasma alanine N-15 enrichments were measured. There was a high degree of consistency across subjects in the ordering of the nine compounds based on the fraction of N-15 excreted. Author

A91-39514* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
A SYSTEMS APPROACH TO THE PHYSIOLOGY OF WEIGHTLESSNESS
RONALD J. WHITE, JOEL I. LEONARD, JOHN A. RUMMEL, and CAROLYN S. LEACH (NASA, Johnson Space Center; Management and Technical Services Co., Houston, TX) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 285-300. refs
(Contract NAS9-15487; NAS9-16328)
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A general systems approach to conducting and analyzing research on the human adaptation to weightlessness is presented. The research is aimed at clarifying the role that each of the major components of the human system plays following the transition to and from space. The approach utilizes a variety of mathematical models in order to pose and test alternative hypotheses concerned with the adaptation process. Certain aspects of the problem of fluid and electrolyte shifts in weightlessnes are considered, and an integrated hypothesis based on numerical simulation studies and experimental data is presented. O.G.

A91-39515
PERCEPTION OF THE BODY IN SPACE - MECHANISMS
LAURENCE R. YOUNG (MIT, Cambridge, MA) IN: Spacelab life sciences 1 - Reprints of background life sciences publications. Houston, TX, GE Government Services, 1991, p. 301-345. refs
Copyright

The perception of body orientation and motion in space is considered, and the extent to which these perceptual abstractions can be related directly to the knowledge of sensory mechanisms is analyzed. Problems discussed include perception of orientation based on multiple sensory modalities, psychophysical measures of perception of orientation and motion, angular acceleration, the dynamic response of the otolith system, modeling visual effects on perceived orientation, and spatial orientation in altered environments. It is concluded that spatial orientation is based on the sensory mechanisms and their central integration. The existing models for multisensory spatial orientation are capable of predicting relationships among input motions and outut perceptions of motion. O.G.

A91-39535
PERMANENT GROUNDING AND FLYING RESTRICTIONS IN CANADIAN FORCES PILOTS - A 10-YEAR REVIEW
A. J. VAN LEUSDEN, P. R. PRENDERGAST, and G. W. GRAY (Defence and Civil Institute of Environmental Medicine, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 513-516. refs
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The medical files were reviewed of all Canadian Forces pilots in whom a permanent change in flying category was recommended during the period January 1, 1978 through December 31, 1987. In an average pilot population of 2,697 pilots, 60 permanent groundings (2.2 per thousand) and 209 permanent operational flying restrictions (7.7 per thousand) were assigned among 250 pilots. Coronary heart disease was the most common cause for permanent grounding (25 percent of total), followed by neurologic disorders including migraine (22 percent of total), other cardiovascular disorders, including mitral valve prolapse and arrhythmias, and psychiatric problems. Refractive errors were the most common basis for an operational flying restriction (25 percent), followed by orthopedic disorders (17 percent), mainly low back pain. The relevance of these observations is discussed in terms of medical selection and surveillance procedures. Author

A91-39537
SCOPOLAMINE BLOOD LEVELS FOLLOWING BUCCAL VERSUS INGESTED TABLETS
JOHN F. GOLDING, JOHN GERRELL (Institute of Naval Medicine, Gosport, England), and EDWARD GOSDEN (Chemical Defence Establishment, Salisbury, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 521-526. Research supported by Standing Committee on Submarine Escape and Rescue. refs
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Speed of absorption and elimination of an antimotion sickness drug sets limits on the protection afforded. The aim of this experiment was to determine whether a well proven antimotion sickness drug, scopolamine (hyoscine), could be absorbed more rapidly from buccal tablets than from the standard issue ingested

tablets. Plasma scopolamine levels were measured using a radioreceptor assay of repeated blood samples from 10 volunteers, each of whom took buccal and standard ingested tablets (both 0.6 mg scopolamine hydrobromide) on two different occasions, and from a further 8 volunteers following ingestion of a pharmacy-prepared scopolamine capsule (0.6 mg scopolamine hydrobromide). There was no statistically significant speed advantage for the buccal tablet (mean time to peak levels approx 50 min). Individual variation in the speed of scopolamine absorption and rate of elimination (mean half-life approx 170 min) was great. This may account for failure of motion sickness protection in some individuals. Author

A91-39538
VISUALLY-INDUCED SICKNESS IN NORMAL AND BILATERALLY LABYRINTHINE-DEFECTIVE SUBJECTS
B. S. K. CHEUNG (York University, North York; Defence and Civil Institute of Environmental Medicine, Downsview, Canada), I. P. HOWARD (York University, North York, Canada), and K. E. MONEY (Defence and Civil Institute of Environmental Medicine, Downsview, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 527-531. Research supported by Defence and Civil Institute of Environmental Medicine. refs

A group of nine normal subjects (with no overt vestibular dysfunction) and a group of six bilaterally labyrinthine-defective subjects were exposed to a visual field rotating about an earth-horizontal axis (orthogonal to the gravity axis). The visual stimulus was provided by a 3-m diameter sphere with random dots rotating at 30, 45, and 60 deg/sec about the stationary subject's roll, pitch, and yaw axes. The subject's head was positioned at the center of the sphere such that it experienced apparent motion in all three axes. Results indicated that in the normal group, symptoms of motion sickness were reported in 21 of 27 test trials. When labyrinthine-defective subjects were exposed to the roll and pitch stimulus, no sickness symptoms were reported or observed. These results, strongly suggest that the vestibular system is necessary for sickness induced by moving visual fields. Author

A91-39539
PROLONGED PHOTOSTRESS MACULAR RECOVERY AFTER REDUCED BLOOD PRESSURE
KJELL MYHRE (Royal Norwegian Air Force, Institute of Aviation Medicine, Oslo, Norway) and OLAF BRINCHMANN-HANSEN (Ulleval Hospital, Oslo, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 538-542. refs

In order to investigate an association between systemic blood pressure and restitution of normal visual function in dim illumination after photostress, macular recovery time and blood pressure were measured in two groups: (1) 90 young and healthy military pilots and applicants for military pilot training, and (2) 10 hypertensive patients before and after 12 weeks of antihypertensive treatment. Young normotensive subjects (20/20 vision) with low diastolic blood pressure performed less well (longer macular recovery time) than those with higher pressure ($r = -0.42$, p not greater than 0.05). Among the hypertensive patients three were given doxazosin; three, prazosin; and four, placebo. The treatment period produced significant fall in blood pressures, a small reduction in intraocular pressure (p not greater than 0.03) and a lengthening of initial monocular recovery period ($p = 0.04$) in addition to reduced monocular ($p = 0.015$) and binocular ($p = 0.022$) macular recovery in the remaining part of the 2-min test period. This observation may be important for antihypertensive treated patients whose occupation requires fast visual adjustment to changing stimuli in dim light. Author

A91-39540* Bionetics Corp., Cocoa Beach, FL.
IMPORTANCE OF ECCENTRIC ACTIONS IN PERFORMANCE ADAPTATIONS TO RESISTANCE TRAINING
GARY A. DUDLEY, BRUCE J. MILLER (Bionetics Corp., Cocoa Beach, FL), PAUL BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL), and PER A. TESCH (Karolinska Institutet, Stockholm, Sweden) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 543-550. refs (Contract NAS10-10285; NAS10-11624)

The importance of eccentric (ecc) muscle actions in resistance training for the maintenance of muscle strength and mass in hypogravity was investigated in experiments in which human subjects, divided into three groups, were asked to perform four-five sets of 6 to 12 repetitions (rep) per set of three leg press and leg extension exercises, 2 days each weeks for 19 weeks. One group, labeled 'con', performed each rep with only concentric (con) actions, while group con/ecc with performed each rep with only ecc actions; the third group, con/con, performed twice as many sets with only con actions. Control subjects did not train. It was found that resistance training wih both con and ecc actions induced greater increases in muscle strength than did training with only con actions. I.S.

A91-39542
THE EFFECT OF PROLONGED INTERMITTENT EXERCISE, COMBINED WITH FOOD DEPRIVATION, ON PLASMA METABOLITE CONCENTRATION
RUTH BURSTEIN, OFER SHPILBERG, BAREKET FALK (Sheba Medical Center, Ramat Gan, Israel), ARDON RUBINSTEIN (Tel Aviv Medical Center, Israel), NAVA BASHAN (Negev, University, Beersheba, Israel) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 555-558. refs

To examine the effect of continuous fasting combined with prolonged intermittent exercise on glucose homeostasis, 16 endurance-trained subjects, ranging in age from 18-21 years, were completely deprived of food during 81 h of field maneuvers. Water was supplied to avoid dehydration. Participants marched 10 h each night at an estimated intensity of 35-45 percent of mean maximum O2 uptake covering a total distance of 105 km, and had a relative rest during day time. Blood was sampled prior to the beginning of the march, at the end of 81 h, and after 24 h of recovery. Samples were analyzed for plasma glucose, insulin, alanine, free fatty acids (FFA), and 3-hydroxybutyrate (3-HB). Body weight decreased from a mean of 73.0 + or - 0.6 kg at premarch to 66.5 + or - 0.6 kg at 81 h of fasting, and remained unchanged at 24 h after march termination. Glucose, insulin, and alanine decreased, whereas FFA and 3-HB increased significantly at 81 h fast. Within 24 h of recovery all parameters changed significantly (p less than 0.05), approaching baseline values. The results indicate that, in trained individuals under extreme survival conditions, blood glucose is maintained above hypoglycemic levels at the expense of fat and fat-derived substrates that become the main energy sources utilized. Author

A91-39543
FLUID REPLACEMENT DURING SUSTAINED ACTIVITY IN THE HEAT - NUTRIENT SOLUTION VS. WATER
LESLIE LEVINE, MADELEINE S. ROSE, RALPH P. FRANCESCONI, P. DARRELL NEUFER, and MICHAEL N. SAWKA (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 559-564. refs

This study examined the thermoregulatory and hydrational status of men during sustained activity in a hot-dry (37 C, 20 percent rh) environment while they consumed only a nutrient solution (nutrient), or consumed only colored flavored water (control). Eleven heat acclimated young men attempted 24-h sustained activity experiments. These experiments consisted of alternating 45-min bouts of treadmill walking (410 W, about 30 percent maximum O2 uptake) and rest (including sedentary activity). Data were analyzed through 13 h (after 13 h subjects began to discontinue testing). No significant differences between trials were observed for metabolic rate, fluid intake, skin or rectal temperature,

sweating rate, plasma volume (as indicated by hemoglobin concentration), or plasma glucose concentrations. By the 8th hour, plasma osmolality was higher and by the 11th hour plasma free fatty acids were lower during the nutrient trial compared to the control. In separate experiments with nine different men, the gastric emptying rates of the nutrient solution and water were compared during exercise (55 percent maximum O2 uptake) in the heat (35 C, 20 percent rh). The gastric emptying rates of the nutrient solution and water were similar (about 20 ml/min). These data indicate that, during 13 h of sustained activity in a hot environment, the nutrient solution and water provided similar thermoregulatory and hydrational benefits. Author

A91-39545
TRANSCRANIAL DOPPLER EVALUATION OF SYNCOPE - AN APPLICATION IN AEROSPACE PHYSIOLOGY
PHILIP C. NJEMANZE (Chidicon Medical Centre, Owerri, Nigeria) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 569-572. refs

A noninvasive method which combines the simultaneous measurement of mean arterial blood pressure (MBP), heart rate (HR), and mean cerebral blood flow velocity (MFV) was used to monitor patients with history of syncope, in horizontal and vertical posture tilt at 80 deg. MFV in the right middle cerebral artery was measured using a transcranial Doppler instrument (TCD). MFV decreased concurrently with the onset of symptoms, and, at the time of syncope, reached an average of 68 percent below pretilt values. At the same time MBP showed an average decline of 25 percent, and HR increased by 38 percent. There was no correlation between MBP and MFV, at the onset of tilt, presyncope, and syncope. MFV, but not HR or MBP, showed significant transition from one condition to the other. These data suggest that there may be a useful application of TCD measurements of MFV in aeromedical evaluation of syncope or syncopal tendency. These measurements would necessarily be used in conjunction with a tilt-table procedure. Author

A91-39546
ASYMMETRIC VISUAL DEFICIT AT HIGH SUSTAINED GZ
MICHEL A. PAUL (Defence and Civil Institute of Environmental Medicine, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 573, 574. refs

Occasionally, acceleration research personnel see an individual who experiences consistent asymmetric visual deficits at high sustained Gz (HSG). Recently, one such centrifuge research subject from this laboratory was investigated with transcranial Doppler sonography. The results indicate an abnormal circle of Willis which could explain the asymmetric visual deficit at HSG. Author

A91-39547
COMMENTS ON ASYMMETRIC VISUAL LOSS ASSOCIATED WITH +GZ-STRESS
JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 575, 576.

The paper offers several possible explanations to the phenomenon of visual loss in one eye occurring prior to the loss of vision in the other eye during +Gz stress. It is pointed out that asymmetric visual field loss is most likely to result from an alteration of the anterior (internal carotid) circulation and, in addition, from reduced retinal perfusion. It is suggested that the prime etiologic candidate as an explanation for the asymmetric visual loss during +Gz stress seems to be an anatomic variation of arterial system that feeds the ophthalmic artery. I.S.

A91-39549
ENVIRONMENTAL TOBACCO SMOKE (ETS) IN AIRLINERS - A HEALTH HAZARD EVALUATION
L. C. HOLCOMB (Holcomb Environmental Services, Olivet, MI) and W. A. CRAWFORD Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 580-586. refs

Some passengers and airline attendants have expressed concern about exposure to environmental tobacco smoke (ETS) in commercial airlines. Irritation of the eyes and respiratory tract, odor, and personal sensitivities are often the bases of complaints. Previous studies demonstrate low concentrations of materials, including ETS. Attendants fly some 800 h per year, passengers much less. Based on previous studies and duration of exposures, the absorbed dose of ETS is less than a cigarette equivalent per year. Nicotine absorption of 0.2 to 0.3 mg in 8-10 h flights has been reported as unlikely to have physiologic effects. The retained 'dose' in relation to the hypotheses of risks to health based on the conflicting results of studies on 'passive smoking' are discussed. There are additional confounding factors in aircraft. It is considered that segregation into smoking and nonsmoking zones is reasonably effective in meeting the preferences of passengers. Author

A91-40464* California Univ., La Jolla.
MAXIMUM EXPIRATORY FLOW-VOLUME CURVES DURING SHORT PERIODS OF MICROGRAVITY
H. J. B. GUY, G. K. PRISK, A. R. ELLIOTT, and J. B. WEST (California, University, La Jolla) Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2587-2596. refs
(Contract NAG9-271; NAS9-16037)

Nine normal subjects were studied in a NASA microgravity research aircraft to elucidate the effect of normal gravitation on the shape of the maximum expiratory flow-volume (MEFV). They performed multiple MEFV maneuvers at 0, 1, and approximately 2 G. The MEFV curves for each subject were filtered, aligned at residual volume, and ensemble-averaged to produce an average MEFV curve for each state, allowing differences to be studied. Most subjects showed a decrease in the forced vital capacity at 0 G. The mean lung volume associated with a given flow was lower at 0 G over about the upper half of the vital capacity. There were consistent but highly individual changes in the position and magnitude of detailed features of the curve. This supports the concept that the location and motion of choke points that determine the detailed individual configuration of MEFG curves can be significantly influenced by gravitational forces, presumably via the effects of change in longitudinal tension on local airway pressure-diameter behavior and thus wave speed. P.D.

A91-40465
CEREBRAL O2 METABOLISM AND CEREBRAL BLOOD FLOW IN HUMANS DURING DEEP AND RAPID-EYE-MOVEMENT SLEEP
PETER LUND MADSEN, JES F. SCHMIDT, GORDON WILDSCHIODTZ, LARS FRIBERG, SOREN HOLM (Bispebjerg Hospital; State University Hospital, Copenhagen; Copenhagen County University Hospital, Glostrup, Denmark) et al. Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2597-2601. Research supported by Danish Medical Research Council. refs

A91-40466
CARDIOVASCULAR ADAPTATIONS IN ANDEAN NATIVES AFTER 6 WK OF EXPOSURE TO SEA LEVEL
D. C. MCKENZIE, L. S. GOODMAN, C. NATH, B. DAVIDSON, G. O. MATHESON (British Columbia, University, Vancouver; Simon Fraser University, Burnaby; Alberta, University, Edmonton, Canada) et al. Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2650-2655. refs

Six male Quechua Indians from high-altitude La Raya, Peru, were studied using noninvasive methods to determine the structural and functional changes in the cardiovascular system in response to a six-week deacclimation period at sea level. Cardiac output, stroke volume, and left ventricular ejection fractions were

determined employing radionuclide angiographic techniques at rest and during exercise on a cycle ergometer. Subjects at rest were given two-dimensional and M-mode echocardiograms and a standard 12-lead electrocardiogram. After the six-week period, all variables were remeasured using identical methods. Hemoglobin values decreased significantly over this period. The findings indicate that removing these natives from 4,300 m to sea level for six weeks results in only marginal changes in the cardiac structure and function. P.D.

A91-40467
FATTY ACIDS IN HUMAN PLATELETS AND PLASMA - FISH OILS DECREASE SENSITIVITY TOWARD N2 MICROBUBBLES
ANNE M. BAKKEN, MIKAEL FARSTAD, and HOLM HOLMSEN (Bergen, University, Norway) Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2669-2672. NAF-supported research. refs
Copyright

Platelet aggregation induced by N2 microbubbles (simulating microbubbles developed during deep diving) was measured in seven volunteers before and after intake of ethyl-eicosapentaenoate (-EPA, 3.5 g/da) and ethyl-doco-sahexaenoate (-DHA, 2.5 g/day) for 2 wk. The relative content of arachidonic acid (AA) decreased in platelets from all individuals, whereas the content of EPA and DNA increased. The decrease of AA was almost identical with the increase of EPA plus DHA. In plasma the AA content was unchanged, while EPA and DHA increased. The N2 microbubble-induced aggregation showed a significant negative correlation with the DHA content both in platelets and in plasma. Less aggregation was also observed with high EPA content in platelets or plasma. A significant correlation between AA content in platelets and aggregation was seen. Intake of marine oils may be beneficial to divers under deep diving and to patients during extracorporeal circulation, because this may reduce the microbubble-induced aggregation. Author

A91-40468
FINITE-ELEMENT SOLUTION OF THERMAL CONDUCTIVITY OF MUSCLE DURING COLD WATER IMMERSION
P. TIKUISIS (Defence and Civil Institute of Environmental Medicine, North York, Canada) and M. B. DUCHARME (Toronto, University, Canada) Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2673-2681. refs
Copyright

The in vivo or effective thermal conductivity (keff) of muscle tissue of the human forearm was determined through an FEM model solution of the bioheat equation. Data were obtained from steady-state temperatures measured in the forearm after 3 h of immersion in water at temperatures of 15, 20 and 30 C. Temperatures were measured every 0.5 cm from the longitudinal axis of the forearm to the skin about 9 cm distal from the elbow. Heat flux was measured at two sites on the skin adjacent to the temperature probe. The FE model is comprised of concentric annular compartments with boundaries defined by the location of temperature measurements. The convective heat exchange at the passing blood flow level is estimated to be approximately 60 percent of the total heat exchange between blood and tissue. There is a concurrent decrease in the temperature of the arterial blood as it flows radially from the axis to the forearm skin. Most of the heat loss from the forearm is convective heat transfer from the blood to the tissue. P.D.

A91-40469
IN VIVO THERMAL CONDUCTIVITY OF THE HUMAN FOREARM TISSUES
MICHEL B. DUCHARME (Toronto, University, Canada) and PETER TIKUISIS (Defence and Civil Institute of Environmental Medicine, North York, Canada) Journal of Applied Physiology (ISSN 8750-7587), vol. 70, June 1991, p. 2682-2690. Research supported by Defence and Civil Institute of Environmental Medicine. refs
Copyright

The effective thermal conductivities of the skin + subcutaneous fat (keff skin + fat) and muscle (keff muscle) tissues of the human forearm at thermal steady state during immersion in water at temperatures (Tw) ranging from 15 to 36 C were determined. The values of keff skin + fat and keff muscle, calculated from the FE solution for Tw not greater than 30 C, were not different from the average in vitro values obtained from the literature. The muscle tissue was shown to account for 92 + or - 1 percent of the total forearm insulation during immersion in water betweeen 15 and 36 C. P.D.

N91-23566# Norwegian Underwater Technology Center Ltd., Laksevaag.
EFFECTS OF WEIGHTLESSNESS (SEA WATER IMMERSION) ON BODY FLUID BALANCE AND CNS FUNCTIONS
A. HOPE, R. VAERNES, T. BERGAN, M. WARNCKE, H. SUNDLAND, C. JEPSEN, and B. LORENZ (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Hamburg, Germany, F.R.) *In* ESA, Space and Sea p 21-24 Dec. 1990 Sponsored by Norwegian Space Center, Oslo
Copyright Avail: NTIS HC/MF A13

The effects of weightlessness on body fluid balance and Central Nervous System (CNS) functions are explored. A body fluid loss of more than 3 kg was previously observed during three half hours of pool diving with the traditional hot water suits used during offshore diving. It was argued that this fluid loss, equalling 4 to 5 percent of body weight (BW), was caused by sweating and/or by diffusional effects of hyperosmotic sea water. The present two hour immersion experiment in thermoneutral (34.5 C) and warm (38 C) sea water (SW) showed that: the BW reduction of 0.8 kg during immersion in thermoneutral SW was caused by the diuresis (3.2 ml/min) blood samples and insensible water loss. Sweating did not occur and no indication of osmotic water loss was observed; in warm water immersion diuresis was reduced to 0.75 ml/min whereas the BW reduction was 1.7 kg. On average 1.2 kg fluid was lost by sweating; auditive evoked potentials (P 300) were unchanged and mental performance was not impaired during or after immersion. ESA

N91-23568# Soviet-French Joint Venture, Moscow (USSR).
REAL TIME ANALYSIS SYSTEMS OF THE PHYSICAL PARAMETERS OF THE ENVIRONMENT AND THE STATE OF A HUMAN ORGANISM FOR A LONG TERM EXPOSURE AT DIFFERENT GAS MIXTURES AND PRESSURE UP TO 100 BAR
G. I. KURENKOV, A. LELEVIER, B. O. JACHONTOV, and A. V. ROZHKOV *In* ESA, Space and Sea p 31-35 Dec. 1990
Copyright Avail: NTIS HC/MF A13

The changes of physical parameters of environment during diving cause the responsive reaction of the human organism, which depends on the value and the continuance of the influence. Taking into account the fact that in the conditions of the deep water diving the physical factors and organism state change constantly, the creation of the system of their real time (RT) analysis becomes actual. The RT system has necessary technical devices for automation of a system for divers' safety according to the parameters of pressure, humidity, constant CO2, O2, He, N2, and state of a human organism for a long term exposure at mixtures with different gases and pressure. The RT system was created and tested in the hyperbaric complex, USSR. ESA

N91-23570# Centre d'Etudes et de Recherches de Chronobiologie Humaine, Nice (France). Lab. Souterrain de Chronobiologie.
SOME PROBLEMS OF DESYNCHRONISATION OF SLEEP-WAKEFULNESS AND CIRCADIAN RHYTHMS FOR LONG DURATION SPACEFLIGHTS
MICHEL SIFFRE *In* ESA, Space and Sea p 43-59 Dec. 1990
Copyright Avail: NTIS HC/MF A13

Operational requirements of a space mission often impose a diminution of sleep duration increasing the time of activity. This puts the body in state of internal and/or external desynchronization i.e., biological rhythms are in shift or phase opposition between one function and another and with local launch time. This creates desynchronisis which is known to impair performance. But changes

in circadian periodicities are not tolerated in the same manner by all individuals. Crew selection guidelines must be developed based on chronobiological and neurobiological bases, so that circadian rhythms can be adapted to the repetitive work schedule shift and to repetitive partial sleep loss. The underground environment, where temperature is perfectly thermostated and atmosphere naturally renewed, makes a remarquable analog environment for spaceflights simulations, and for testing habitability and the effects of lack of external time synchronizers on humans. ESA

N91-23571# Compagnie Maritime d'Expertises, Marseille (France).
LONG DURATION HYPERBARIC CONFINEMENT: HYDRA 9
B. GARDETTE, M. COMET, C. GORTAN, M. NOVARA (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and H. G. DELAUZE *In* ESA, Space and Sea p 63-68 Dec. 1990
Copyright Avail: NTIS HC/MF A13

Hydra 9 onshore saturation dive was designed to define three important parameters: the utilization range (minimum and maximum depths) on hydrox (H2-O2); the long term (49 days) effects of hydrogen on exposition of human beings; and the study of human reaction to a long duration confinement and isolation in a pressurized chamber (73 days), considered as a simulation of space long duration flight by the European Space Agency. Fundamental results of the acute and chronic hydrogen effects and the human reaction to long duration confinement and isolation, were obtained. These reults will allow the optimization of the PH2 used in hydreliox breathing mixtures for very deep industrial interventions (500 to 700 msw) and the increase of European knowhow in long duration manned space missions. ESA

N91-23572# Japan Marine Science and Technology Center, Tokyo. Diving Science and Technology Dept.
MANNED DIVING ACTIVITIES IN JAMSTEC
NOBUO ITO *In* ESA, Space and ESA p 69-73 Dec. 1990
Copyright Avail: NTIS HC/MF A13

JAMSTEC (Japanese Marine Science and Technology Center) is engaged in research in diving technology, and also in training courses. Manned hyperbaric experiment series have been conducted since 1974 to ensure the safety of open sea operations and the medical fitness of divers. In July 1988, their diving record in the open sea reached 300 m. In the process of research and development on diving science and technology up to 300 m depth, experiences and results were stored. After being trained and educated, about 2500 commercial divers and managers have graduated from the courses and are currently engaged in various commercial activities during the past 17 years. ESA

N91-23588# Direction des Constructions et Armes Navales, Toulon (France).
A KO2 REBREATHER FOR EVA DENITROGENATION PROCEDURE
E. RADZISZEWSKI and JEAN CLAUDE LEPECHON (JCLP Hyperbarie, Paris, France) *In* ESA, Space and Sea p 187-190 Dec. 1990
Copyright Avail: NTIS HC/MF A13

In order to test the use of a KO2 rebreather for space denitrogenation, the performances of a standard KO2 unit were evaluated and thermal comfort discussed. After pure O2 rinsing out of the lungs and of the counter lung nitrogen, the experimental protocol includes periods of rest and exercise. Nitrogen excretion is then evaluated, as well as oxygen contamination of the cabin atmosphere. The equipment tested proved to be acceptable for denitrogenation, some minor improvements are recommended and feasibility and advantages of the method for Extra Vehicular Activity (EVA) and emergency O2 breathing are reviewed. ESA

N91-23700* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 346)
Feb. 1989 50 p
(NASA-SP-7011(346); NAS 1.21:7011(346)) Avail: NTIS HC A03; NTIS standing order as PB89-912300, $15.00 domestic, $30.00 foreign CSCL 06/5

This bibliography lists 134 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Jan. 1991. 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

N91-23701* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 347)
Feb. 1989 64 p
(NASA-SP-7011(347); NAS 1.21:7011(347)) Avail: NTIS HC A04; NTIS standing order as PB89-912300, $17.00 domestic, $34.00 foreign CSCL 06/5

This bibliography lists 166 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Feb. 1991. 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

N91-23702* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 348)
Apr. 1991 60 p
(NASA-SP-7011(348); NAS 1.21:7011(348)) Avail: NTIS HC A04; NTIS standing order as PB91-912300, $15.00 domestic, $30.00 foreign CSCL 06/5

This bibliography lists 154 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Mar. 1991. 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

N91-23703 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
OTOLITH RESPONSES IN MAN DURING PARABOLIC FLIGHT Final Report
J. T. MARCUS 5 Oct. 1990 28 p Sponsored by Space Research Organization Netherlands
(Contract A88/M/318)
(IZF-1990-A-32; TD-90-3407; ETN-91-99098; AD-B150721L)
Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

The influence of the varying gravito inertial (Gz) force during parabolic flight on the human otolith function is investigated. It is hypothesized that the Gz force initiates an otolith ocular response, that manifests itself primarily in modulation of optokinetic nystagmus slow phase eye velocity. Six subjects were seated in the ESA Caravelle, facing perpendicular to the aircraft's longitudinal axis. The Gz profile was subsequently: 1.8 Gz pull up, 0 G microgravity and 1.8 Gz recover, each phase lasting about 20 s. Vertical eye movements were recorded by electronystagmography throughout the parabolic maneuver. Conditions were: visual fixation, darkness, and optokinetic stimulation of 50 deg/s in an upward or downward direction, projected on a cylindrical screen at 0.6 m viewing distance. No consistent nystagmus or gaze shift was measured in darkness. An ANOVA revealed, however, a Gz modulation of OKN-SPV with downward enhancement of 5 deg/s in the 1.8 Gz hypergravity, as compared to the 0 G condition as well as to the 1 Gz condition. The otolith ocular pathway is modulating optokinetic eye movements in parabolic flight. The significant modulation in the transitions between 1 Gz and 1.8 Gz has relevance to the pilot, who experiences these transitions commonly. ESA

N91-23704*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
TRANSCAPILLARY FLUID SHIFTS IN HEAD AND NECK TISSUES DURING AND AFTER SIMULATED MICROGRAVITY
S. E. PARAZYNSKI (Denver General Hospital, CO.), ALAN R. HARGENS, B. TUCKER, M. ARATOW, J. STYF, and A. CRENSHAW Apr. 1991 19 p
(NASA-TM-103847; A-91096; NAS 1.15:103847) Avail: NTIS HC/MF A03 CSCL 06/19

To understand the mechanism, magnitude, and time course of facial puffiness that occurs in microgravity, seven male subjects were tilted 6 degrees head down for 8 hr, and all four Starling transcapillary pressures were directly measured before, during, and after tilt. Head-down tilt (HDT) caused facial edema and a significant elevation of microvascular pressures measured in the lower lip: capillary pressures increased from 27.2 +/- 5 mm Hg pre-HDT to 33.9 +/- 1.7 mm Hg by the end of tilt. Subcutaneous and intramuscular interstitial fluid pressures in the neck also increased as a result of HDT, while interstitial fluid colloid osmotic pressures remained unchanged. Plasma colloid osmotic pressures dropped significantly after 4 hr of HDT, suggesting a transition from fluid filtration to absorption in capillary beds between the heart and feet during HDT. After 4 hr of seated recovery from HDT, microvascular pressures remained significantly elevated by 5 to 8 mm Hg above baseline values, despite a significant HDT diuresis and the orthostatic challenge of an upright, seated posture. During the control (baseline) period, urine output was 46.7 ml/hr; during HDT, it was 126.5 ml/hr. These results indicate that facial edema resulting from HDT is primarily caused by elevated capillary pressures and decreased plasma colloid osmotic pressures. Elevation of cephalic capillary pressures sustained for 4 hr after HDT suggests that there is a compensatory vasodilation to maintain microvascular perfusion. The negativity of interstitial fluid pressures above heart level also has implications for the maintenance of tissue fluid balance in upright posture. Author

N91-23705# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
RESEARCH AND DEVELOPMENT INVOLVED IN CREATING A QUANTITATIVE EEG CARTOGRAPHY WIDE BAND ANALYSIS SYSTEM Ph.D. Thesis - Toulouse Univ. [ETUDE ET REALISATION D'UN SYSTEME RAPIDE DE CARTOGRAPHIE D'EEG QUANTIFIE A LARGE BANDE D'ANALYSE]
MOHAMED BOUAMAR 1991 162 p In FRENCH; ENGLISH summary Sponsored by Vivre Debout Association
(LAAS-91002; ETN-91-99240) Avail: NTIS HC/MF A08

Ways of improving the analysis band and the speed of processing systems in quantitative electroencephalography are described. The study and the realization of a fast system allowing for the acquisition and spectral analysis of a great number of electroencephalographic signals is presented. It is a multichannel acquisition system with large band and low noise differential inputs, linked to a master slave processing system built around a PC/AT and Digital Signal Processor (DSP). The system offers the user many possibilities of analysis leading to greatly varied study over a large frequency range. The evaluation of system performances is achieved by a simulation study of errors in processor calculations. In order to validate the system, a set of measurements on real electroencephalographic signals is achieved to highlight its analysis capacities and correlate the corresponding results with the clinical results. ESA

N91-23706# Wright State Univ., Dayton, OH.
HEPATIC METABOLISM OF PERFLUORINATED CARBOXYLIC ACIDS: A NUCLEAR MAGNETIC RESONANCE INVESTIGATION Annual Report, 15 Feb. - 14 Dec. 1990
NICHOLAS V. REO 14 Dec. 1990 11 p
(Contract AF-AFOSR-0148-90; AF PROJ. 2312)
(AD-A232033; AFOSR-91-0021TR) Avail: NTIS HC/MF A03 CSCL 06/1

This research project employs nuclear magnetic resonance (NMR) spectroscopy to investigate the metabolic aspects of the toxicity associated perfluorinated carboxylic acids. Fluorine-19 NMR has been used to monitor the metabolic fate of perfluoro-n-octanoic acid (PFOA) and perfluoro-n-decanoic acid (PFDA) in a rat. Spectra obtained at various times following the administration of PFOA and PFDA depict the presence of the parent compounds in samples of bile, serum, urine, and liver in vivo. Urine spectra also indicate the presence of a possible metabolite which has not been identified at this time. Carbon-13 NMR is providing information regarding the effects of PFOA and PFDA on hepatic carbohydrate metabolism. Preliminary data indicate that hepatic glycogenesis is severely inhibited in rats at 3 days post treatment with PFDA. Plasma glucose and hepatic glucose appear to behave similar to control animals during the first three days post treatment with PFDA, but data obtained at days 6 and 7 indicate that hepatic glucose utilization may be slowed. These data are preliminary and experiments are currently in progress to further characterize the perfluorocarbon-induced dysfunctions of liver metabolism. GRA

N91-23707# Uniformed Services Univ. of the Health Sciences, Bethesda, MD.
MOLECULAR STUDIES OF CYTOKINE INDUCTION Final Report, 1 Jun. - 15 Nov. 1989
CARL W. DIEFFENBACH 31 May 1990 32 p
(Contract MDA905-89-C-0014)
(AD-A232221) Avail: NTIS HC/MF A03 CSCL 06/5

While many of the molecular events in viral replication are well studied, the mechanisms by which viral infections trigger such constitutional symptoms as fever and malaise are unknown. We investigate the hypothesis that these viral constitutional symptoms can be triggered by the accumplation and release of dsRNA arising from viral replication. Total lung RNA from mice acutely infected with influenza virus but not from sham-infected mice was shown to induce fever, excess slow-wave sleep and enhanced amplitudes of electroencephalographic slow waves when injected into the rabbit brain. Influenza viral dsRNA was demonstrated in the active lung RNA preparations by reverse transcriptase-polymerase chain reaction techniques and was shown to be responsible for the rabbit responses by differential nuclease digestion. GRA

N91-23708# Washington Univ., Saint Louis, MO.
CONTROL OF BIOSONAR BEHAVIOR BY THE AUDITORY CORTEX Final Report, Jul. 1987 - Oct. 1990
NOBUO SUGA and STEPHEN GAIONI 21 Dec. 1990 15 p
(Contract AF-AFOSR-0250-87; AF PROJ. 2313)
(AD-A232699; AFOSR-91-0145TR) Avail: NTIS HC/MF A03 CSCL 06/4

The major aim of this project was to examine, by means of critical lesion experiments, whether the functional organization of the mustached bat's, Pteronotus parnellii, auditory cortex is related to biosonar behavior in the manner inferred from pervious neurophysiological experiments. First, we quantitatively analyzed the behavioral adjustments the bat makes in the frequency, intensity, duration, and rate of emission of its biosonar pulses during target-directed flight. Next, we examined changes in these behavioral adjustments following bilateral ablation of either the entire auditory cortex, or more localized cortical regions. We then focused on the role of the auditory cortex in the perception of biosonar signals. This was accomplished by conditioning the bats to discriminate between biosonar signals that varied along some stimulus parameter (e.g., echo delay) using a leg flexion shock avoidance procedure. We then created of the auditory cortex. Major results of each of these lines of research are described in this report. GRA

N91-23709# Naval Biodynamics Lab., New Orleans, LA.
HUMAN SHORT-LATENCY SOMATOSENSORY EVOKED POTENTIALS IN IMPACT ACCELERATION RESEARCH: EQUIPMENT, PROCEDURES, AND TECHNIQUES Final Report, 1984 - 1990
DAVID MATSON 1 Oct. 1990 23 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD
(AD-A232732; NBDL-89R001) Avail: NTIS HC/MF A03 CSCL 05/8

The Naval Biodynamics Laboratory has been investigating the

neurophysiological effects of impact acceleration on humans. The goal of this research program is to establish impact injury thresholds for properly restrained personnel. The techniques and equipment configurations developed for neuro-physiological impact research and offers suggestions for future research are summarized. The efforts have focused on the use of somatosensory evoked potentials to assess the integrity of the central nervous system of humans undergoing impact accelerations. In the experiments human research volunteers were exposed to impact acceleration ranging from three to fifteen times the force of gravity (3 to 15 g's) in various directions. These experiments provide data to help determine thresholds of injury to cervico-cortical neural pathways during impact events and indicate that the potential for injury may be reduced if these injury thresholds are taken into consideration in the designs of cockpits and emergency aircraft egress and recovery systems. GRA

N91-24056*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SIMULATION OF BLOOD FLOW THROUGH AN ARTIFICIAL HEART
CETIN KIRIS, I-DEE CHANG (Stanford Univ., CA.), STUART E. ROGERS, and DOCHAN KWAK *In* NASA, Washington, Technology 2000, Volume 2 p 133-145 1991
Avail: NTIS HC/MF A16 CSCL 06/16

A numerical simulation of the incompressible viscous flow through a prosthetic tilting disk heart valve is presented in order to demonstrate the current capability to model unsteady flows with moving boundaries. Both steady state and unsteady flow calculations are done by solving the incompressible Navier-Stokes equations in 3-D generalized curvilinear coordinates. In order to handle the moving boundary problems, the chimera grid embedding scheme which decomposes a complex computational domain into several simple subdomains is used. An algebraic turbulence model for internal flows is incorporated to reach the physiological values of Reynolds number. Good agreement is obtained between the numerical results and experimental measurements. It is found that the tilting disk valve causes large regions of separated flow, and regions of high shear. Author

N91-24057*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THREE-DIMENSIONAL STRUCTURE OF HUMAN SERUM ALBUMIN
DANIEL C. CARTER, XIAO-MIN HE, PAMELA D. TWIGG, and ELENA CASALE *In* NASA, Washington, Technology 2000, Volume 2 p 146-150 1991
Avail: NTIS HC/MF A16 CSCL 06/16

The binding locations to human serum albumin (HSA) of several drug molecules were determined at low resolution using crystallographic methods. The principal binding sites are located within subdomains IIA and IIIA. Preliminary studies suggest that an approach to increasing the in vivo efficacy of drugs which are rendered less effective or ineffective by virtue of their interaction with HSA, would be the use of competitive displacement in drug therapies and/or the development of a general inhibitor to the site within subdomain IIIA. These findings also suggest that the facilitated transfer of various ligands across organ/circulatory interfaces such as liver, kidney, and brain may be associated with binding to the IIIA subdomain. Author

N91-24058*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A NON-INVASIVE MEASURE OF MINERALS AND ELECTROLYTES IN TISSUE
SARA B. ARNAUD and BURTON SILVER (IntraCellular Diagnostics, Inc., San Jose, CA.) *In* NASA, Washington, Technology 2000, Volume 2 p 151-154 1991
Avail: NTIS HC/MF A16 CSCL 06/16

A system for collecting epithelial cells from the oral mucosa for the determination of ion concentration is discussed with application to the study of man's adaptation to microgravity. A number of characteristics of these cells influenced the choice for clinical testing. They are non-cornified epithelial cells located on the inferior aspect of the tongue; therefore, they are well protected from trauma. They have the capability of reflecting relatively recent physiologic changes since they are renewed every three days and have aerobic metabolism. Most importantly, they are easily accessible and can be removed by a wooden applicator stick with minimum discomfort. Smears of cells removed in this manner show predominantly individual cells rather than sheets of contiuous cells. This facilitates the visual isolation of single cells with the electron microscope for analysis. NASA's principle effort in the development of a test to measure the ion concentration in sublingual cells has been research by the biomedical program carried out by scientists with expertise in skeletal metabolism. These efforts were directed toward determining the biological meaning and deviations in interacellular ions in nonhuman primates and in male volunteers for experiments in a model for weightlessness. A brief one page summary of the experiments and results are presented. K.S.

N91-24076*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE TRANSFER OF TECHNOLOGY TO MEASURE SKIN BURN DEPTH IN HUMANS
WILLIAM T. YOST and JOHN H. CANTRELL *In* NASA, Washington, Technology 2000, Volume 2 p 308-314 1991
Avail: NTIS HC/MF A16 CSCL 06/16

Discussed here is the use of ultrasonic techniques originally used to locate cracks in metal structues to measure burn wound depth in humans. Acoustic impedance, performance tests, and the theoretical model are discussed. Measurements of skin burns on anesthetized pigs made with the the ultrasonic instrumentation were in agreement with diagnoses made by a physician, and subsequently confirmed by the healing process. Researchers felt that the concept proved useful in a clinical setting and that the instrument and concept were ready to extend to the manufacturer. Author

N91-24728 Tel-Aviv Univ. (Israel). Dept. of Bio-Medical Engineering.
INTERACTION BETWEEN LASER BEAM AND BIOLOGICAL TISSUE: A COMPARISON BETWEEN CO2, ND:YAG AND HO:YAG LASERS M.S. Thesis
RICARDO SCHLEIFER Sep. 1988 77 p In HEBREW; ENGLISH summary
(ITN-90-85022) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel, pricing information obtainable from document source

CO2 and Nd:YAG lasers are widely applied in surgery. The 10.6 micron wavelength radiation from the CO2 laser is highly absorbed in water, which is the main component of biological tissue. Vaporization and cutting are the main applications of this laser. The 1.06 micron radiation from the Nd:YAG laser is negligibly absorbed by water, hence its main use is in tissue coagulation. This radiation can be transferred through optical fibers and is widely used in endoscopic applications. The 2.1 micron radiation from the holmium laser is more absorbed in water than that from the Nd:YAG laser but less than that from the CO2 laser. This radiation can be transferred through optical fibers and the laser can be operated in continuous wave or pulsed wave modes. The tissue interaction of the above laser radiations was studied, especially that of the holmium lasers, which are under development. The assumptions are that the holmium laser will coagulate less and vaporize more than the Nd:YAG laser and will coagulate more and vaporize less than the CO2 laser. It was also assumed that less thermal damage will be caused to the tissue by the pulsed holmium laser than by the continuous wave holmium laser, when the beam energy is the same. In order to prove the above assumptions, about 250 experiments were performed on different kinds of tissue such as liver, kidney, pancreas and spleen. The experiments were carried out on dogs using the above four lasers with the same power and exposure time. Data on the different thermal damage zones were collected by analyzing the various histological sections. The results indicate that the holmium laser

coagulates more than the CO2 laser and vaporizes less than the Nd:YAG laser. More damage is caused to the tissue by the continuous wave holmium laser than by the pulsed holmium laser, when the same energy densities are applied. It was also shown that when the beam energy is fixed, the tissue thermal damage is directly proportional to the exposure time, i.e., inversely proportional to the power. ISA

N91-24729# Army Biomedical Research and Development Lab., Fort Detrick, MD.
EXPOSURE STANDARD FOR FOG OIL Technical Report, Dec. 1989 - Nov. 1990
WINIFRED G. PALMER 15 Nov. 1990 45 p
(AD-A231714; USABRDL-TR-9010) Avail: NTIS HC/MF A03
CSCL 06/7

Effects of mineral oils in animals and humans are evaluated and serve as the basis for the development of an exposure standard for fog oil. Considered are health hazards associated with fog oil purchased before and after the Military Specification was amended in April 1986 to exclude carcinogens. While repeated exposure to conventionally-refined mineral oils may cause pulmonary disease as well as severe dermatoses and cancer of the skin and scrotum, lipoid pneumonia is the major health hazard associated with highly refined mineral oils such as fog oils purchased after April 1986. While the course of lipoid pneumonia can be asymptomatic in some individuals, in others its symptoms can range from occasional cough to severe, debilitating dyspnea and pulmonary illness, occasionally ending in death. GRA

N91-24730# Office of Technology Assessment, Washington, DC.
IDENTIFYING AND CONTROLLING IMMUNOTOXIC SUBSTANCES: BACKGROUND PAPER
1991 96 p
(OTA-BP-BA-75) Avail: NTIS HC/MF A05; also available SOD HC $4.50 as 052-003-01231-6

The following subject areas are covered: the immune system and immunotoxicity; immunotoxicological tests; and Federal attention to immunotoxicants. Author

N91-24731* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 349)
May 1991 50 p
(NASA-SP-7011(349); NAS 1.21:7011(349)) Avail: NTIS HC A03; NTIS standing order as PB91-912300, $15.00 domestic, $30.00 foreign CSCL 06/5

This bibliography lists 149 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during April, 1991. 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

N91-24732# School of Aerospace Medicine, Brooks AFB, TX.
AN EVALUATION OF THE PHOTOPIC ELECTRORETINOGRAM USING LOWER EYELID ELECTRODES Interim Report, Jan. 1988 - Jan. 1990
LINDA B. ANDERSON and J. T. YATES Dec. 1990 15 p
(AD-A232988; USAFSAM-TP-90-23) Avail: NTIS HC/MF A03
CSCL 20/6

The use of corneal contact lens electrodes for recording Electroretinograms (ERG) is difficult in some patients (children) and impossible in others (hyperbaric patients) due to unusual recording conditions. After reviewing the various published methods already tested, a technique was used that employs a lower eyelid electrode. In addition, a Ping-Pong ball Ganzfeld was fabricated to mimic the Ganzfeld dome typically used in clinical laboratories. Three questions were then addressed: (1) the adequacy of the method for acquiring photopic ERGs; (2) the influence of the direction of gaze on ERG parameters; (3) the day-to-day reliability of the method. When ERGs derived from contact lens electrodes were compared with those obtained from lower eyelid electrodes under the same test conditions, it was found that the lower eyelid electrode waveforms were smaller in amplitude but identical in shape to wave forms produced by corneal contact lens electrodes. GRA

N91-24733# Pittsburgh Univ., PA. Dept. of Psychiatry.
ORGANIZATION OF THE HUMAN CIRCADIAN SYSTEM Final Report, 1 Dec. 1989 - 30 Nov. 1990
ROBERT Y. MOORE 24 Jan. 1991 7 p
(Contract AF-AFOSR-0097-90; AF PROJ. 2312)
(AD-A233026; AFOSR-91-0190TR) Avail: NTIS HC/MF A02
CSCL 06/5

Significant progress has been made in analyzing the anatomical makeup of the human suprachiasmatic nucleus (SCN) and adjacent structures. The largest population of neurons in the human SCN are neurotensin containing neurons. The human SCN also contains vasopressin, vasoactive intestinal polypeptide and neuropeptide y. Development of DiI methods to study connections between neuronal populations has been disappointing and new approaches are now being explored. GRA

N91-24734# Central Inst. for the Deaf, Saint Louis, MO.
AUDITORY-ACOUSTIC BASIS OF CONSONANT PERCEPTION. ATTACHMENTS A THRU I Final Technical Report, 30 Sep. 1986 - 31 Dec. 1989
JAMES D. MILLER 22 Jan. 1991 855 p
(Contract AF-AFOSR-0335-86; AF PROJ. 2313)
(AD-A233041; AFOSR-91-0130TR) Avail: NTIS HC/MF A99
CSCL 05/7

New facts of this auditory-acoustic basis perception were discovered as listed. (1) Plosive consonants can be distinguished from fricative consonants by the peak rate of rise intensity at their onsets. (2) The acoustic characteristics that serve to identify plosive bursts and voiceless fricatives by place of articulation can be usefully described in terms of format defined by a novel algorithm. (3) A connectionist software model that examines fourteen psychophysically relevent acoustic measures can classify any acoustic segment of speech by the location of its source in the talker's vocal tract. (4) Preliminary studies of sonorant and nasal consonants have identified the putative acoustic cues for their identification by human listeners and/or machines. (5) New methods for format tracking were developed. (6) An important set of software tools were developed that allow further studies of the auditory acoustic basis of consonant perception. (7) These tools have also aided in the studies of vowels and diphthongs, whose characteristics are being elucidated under primary support from the National Institutes of Health. GRA

N91-24735# School of Aerospace Medicine, Brooks AFB, TX.
CHOROIDAL NEVI IN USAF AVIATORS Interim Report, Jun. 1988 - Jun. 1989
DANIEL L. VANDIVORT, THOMAS J. TREDICI, and ROBERT P. GREEN, JR. Dec. 1990 6 p
(AD-A233042; USAFSAM-TP-89-11) Avail: NTIS HC/MF A02
CSCL 06/5

A choroidal nevus may be mistaken for a melanoma or it may develop into a malignant melanoma. We reviewed the records of over 5,000 aviators examined over the past 14 years at the USAF School of Aerospace Medicine. One hundred and fourteen aviators were noted to have one or more choroidal nevi (2.2 percent). These lesions were found not to affect the aviators' visual performance. However, it is recommended that these lesions be followed at regular intervals by an ophthalmologist. GRA

53

BEHAVIORAL SCIENCES

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

A91-37280
REACTION TIME TO MOTION OFFSET OF VISUAL STIMULI
G. DIMITROV, A. GUREVICH, and S. MATEEV (Bulgarian Academy of Sciences, Institute of Physiology, Sofia, Bulgaria) Bolgarskaia Akademiia Nauk, Doklady (ISSN 0366-8688), vol. 43, no. 11, 1990, p. 83-86. Research supported by Committee of Science of Bulgaria. refs
Copyright

An experiment is described whose aim was to assesss the factors and mechanisms that determine the reaction time to offset of motion, i.e., when the observer reacts as soon as possible after a moving stimulus stops. The following factors were considered: velocity of motion, size of the stimulus, and eccentricity of the stimulation. A hypothesis is proposed that seeks to explain this phenomenon by assuming that the velocity of motion can be considered as a kind of 'intensity' of the stimulus at the level of some neuronal structure. L.M.

A91-38669
IMPROVING AUDITORY WARNING DESIGN - RELATIONSHIP BETWEEN WARNING SOUND PARAMETERS AND PERCEIVED URGENCY
JUDY EDWORTHY, SARAH LOXLEY, and IAN DENNIS (Polytechnic South West, Plymouth, England) Human Factors (ISSN 0018-7208), vol. 33, April 1991, p. 205-231. refs
(Contract MINISTRY OF DEFENCE-SUPPORTED)
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This paper presents an experimental study of the effects of individual sound parameters on perceived (psychoacoustic) urgency. Experimental Series 1 showed that fundamental frequency, harmonic series, amplitude envelope shape, and delayed harmonics all have clear and consistent effects on perceived urgency. Experimental Series 2 showed that temporal and melodic parameters such as speed, rhythm, pitch range, and melodic structure also have clear and consistent effects on perceived urgency. The final experiment tested a set of 13 auditory warnings generated by an application of the earlier experimental findings. The urgency rank ordering of this warning set was predicted, and the correlation between the predicted and the obtained order was highly significant. The results of these experiments have a widespread application in the improvement of existing auditory warning systems and the design of new systems, where the psychoacoustic and psychological appropriateness of warnings could be enhanced. Author

A91-39105
DEPENDENCE OF THE SUCCESS OF FLIGHT TRAINING ON THE ACCENTUATION OF THE TRAINEE'S CHARACTER [ZAVISIMOST' LETNOGO OBUCHENIIA KURSANTOV OT AKTSENTUATSII IKH KHARAKTERA]
V. I. MEDVEDEV and S. E. AFANAS'EV (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 17, Mar.-Apr. 1991, p. 131-134. In Russian. refs
Copyright

A questionnaire designed to reveal psychological accentuations in the subject's character was filled out by 201 students of an aviation school in order to determine the relation between psychological accentuations and the ability to learn flying. The questionnaire helped to identify individual character types among the subjects, including the unstable, the hyperthymic, the epileptoid, the hysteroid, and the psychasthenic types. It was found that students with the hysteroid character accentuation were easier to train than those with psychasthenic or epileptoid accentuation. I.S.

A91-39421#
SUPERIMPOSED PERSPECTIVE VISUAL CUES FOR HELICOPTER HOVERING ABOVE A MOVING SHIP DECK
M. NEGRIN, A. J. GRUNWALD, and A. ROSEN (Technion - Israel Institute of Technology, Haifa) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 14, May-June 1991, p. 652-660. Previously cited in issue 18, p. 2924, Accession no. A90-42455. refs
Copyright

A91-39536
PERSONALITY TYPES AMONG EXPERIENCED MILITARY PILOTS
JAMES J. PICANO (U.S. Army, Letterman Army Medical Center, San Francisco, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 517-520. refs
Copyright

Three distinct personality subtypes were empirically identified in a sample of 170 experienced U.S. Army pilots, using a new measure of personality developed for use in occupational settings. The subtypes are similar to those previously derived in a sample of military aviation trainees. No significant differences across the clusters were found for the types of missions flown, years of aviation or military service, or number of flight hours. A significantly greater number of instructor pilots was found among a cluster which comprised the smallest percentage of pilots in the sample. Overall, the results support the notion that no one type of personality is a prerequisite for success in military aeronautics, and highlight the need for additional studies of personality type in military and commercial aviation, using more sophisticated measures of aeronautical adaptability. Author

N91-23564# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.
THE DIVING LABORATORY AS A SIMULATION ENVIRONMENT FOR MANNED SPACEFLIGHT
J. WENZEL, L. VOGT, and R. D. FISCHER *In* ESA, Space and Sea p 11-13 Dec. 1990
Copyright Avail: NTIS HC/MF A13

The underwater environment presents an interesting laboratory condition for the simulation and validation of manned space operations. Similarities between sea and space include both internal and external strains for the person under consideration. Some of the arguments are illustrated by video sequences comparing astronauts' activities during underwater training, parabola flight, and space mission. It is concluded that both basic training and mission specific simulation underwater is a valuable tool for the preparation of actual manned space projects. ESA

N91-23565# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Hamburg (Germany, F.R.). Dept. of Aviation and Space Psychology.
PSYCHOLOGICAL SELECTION OF ASTRONAUTS: RECENT DEVELOPMENTS AT THE DLR TESTING CENTRE IN HAMBURG (FED. REPUBLIC OF GERMANY)
C. FASSBENDER, K. M. GOETERS, and D. MANZEY *In* ESA, Space and Sea p 15-19 Dec. 1990
Copyright Avail: NTIS HC/MF A13

Since 1977 the Department of Aviation and Space Psychology of the DLR has been regularly involved in astronaut (payload specialist) selection on a European as well as on a national level. For several of these selection campaigns the DLR has devised and applied its own test system consisting of a combination of paper pencil tests, apparatus tests, and personal interview. The DLR selection procedures incorporate diverse factors of performance (e.g., perception, memory, multiple task performance) as well as of personality (e.g., social capability, motivation, stress resistance). With the plan for a European participation in the Space Station Freedom new challenges are posed for the selection of

all kinds of astronauts because of the specific demands of long duration space flights. These new challenges are discussed with regard to the problems of astronauts and recent developments at the DLR testing center concerning feasible psychological selection criteria and test methods for astronaut selection are presented. ESA

N91-23710# Federal Aviation Administration, Washington, DC. Research and Development Service.
INDIVIDUAL DIFFERENCES UNDERLYING PILOT COCKPIT ERROR Ph.D. Thesis - George Mason Univ.
ELEANA S. EDENS Apr. 1991 231 p
(DOT/FAA/RD-91/13) Avail: NTIS HC/MF A11

This research attempted to isolate personality, attitude, and cognitive factors that may influence pilot cockpit error. The mediating influence of situational awareness, psychological stress level, and pilot hazardous thought styles was also investigated. Within the literature addressing individual differences and performance, the focus was on individual differences and cockpit behavior and individual differences as predictors of aircraft accident involvement. Only a brief summary of the general literature of individual differences and performance is presented, as that body of studies is so vast. The study found that pilot situational awareness and pilot psychological stress levels do predict the frequency of attention/perception and judgement/decision pilot cockpit error. It was not established that individual difference variables (personality, individual attitudes, or cognitive ability) affected either the development of situational awareness or the display of psychological stress. Nor did the individual difference variables contribute substantially to hazardous cognitive styles. Hazardous cognitive styles were not related to pilot error in this study. Author

N91-23711# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.
HUMAN PERFORMANCE ASSESSMENT METHODS. ADDENDUM
ERIC FARMER, ed. Mar. 1991 78 p Lecture series held in Downsview, Ontario, 5-6 Jun. 1989; in Soesterberg, Netherlands, 12-13 Jun. 1989; and in Rome, Italy, 15-16 Jun. 1989
(AGARD-AG-308-ADD; ISBN-92-835-0600-6) Copyright Avail: NTIS HC/MF A05; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The results are presented of the second phase of AGARD Aerospace Medical Panel Working Group 12 on Human Performance Assessment Methods. The major goal of WG 12 was to develop the Standardized Tests for Research on Environmental Stressors or STRES Battery, satisfying conventional psychometric criteria such as reliability, validity and sensitivity for which an extensive data base may now be compiled among the NATO nations. The protocol for the 7 selected tests is presented. AGARDograph 308 also serves as the Lecture Series Notes for AGARD Aerospace Medical Panel Lecture Series 163, Human Performance Assessment Methods. Author

N91-23712# Syracuse Univ., NY. Dept. of Physics.
MECHANISMS OF HIGHER BRAIN FUNCTIONS: A STUDY OF MODELS OF PERCEPTION Final Report, 1 Apr. 1987 - 30 Sep. 1990
ERICH HARTH 10 Dec. 1990 7 p
(Contract DAAL03-87-K-0034)
(AD-A232389; ARO-24111.10-LS) Avail: NTIS HC/MF A02 CSCL 06/5

A model of visual perception, in which the influence of feedback pathways to the lateral geniculate nucleus was considered, was studied in extensive computer simulations. It was assumed that optimization algorithms were implemented by neutral circuitry and that a scalar feedback composed of central responses acts as objective function in the process. It is shown that under very simple assumptions a number of cognitive functions are performed by the model. The mathematical properties of the Alopex algorithms were studied and the method was applied successfully to a variety of optimization problems. GRA

N91-23713# Morehouse Coll., Atlanta, GA. Dept. of Psychology.
CULTURAL PARAMETERS OF STRESS Final Report, May - Aug. 1990
VERNESSA R. CLARK Feb. 1991 14 p
(Contract DAAL03-86-D-0001)
(AD-A232526; ARI-RN-91-29) Avail: NTIS HC/MF A03 CSCL 05/8

This paper discusses the role of culture diversity in the mediation of stress appraisal. First a discussion of mediators, such as ratings of life events and perceived control, is presented. This discussion is followed by a brief discussion of ways in which people of different cultures contend with stress. GRA

N91-23714# Massachusetts Inst. of Tech., Cambridge. Dept. of Brain and Cognitive Sciences.
STRATEGIES TO SUSTAIN AND ENHANCE PERFORMANCE IN STRESSFUL ENVIRONMENTS Annual Technical Report, 15 Dec. 1989 - 14 Dec. 1990
RICHARD J. WURTMAN, ANDREW B. DOLLINS, and HARRY J. LYNCH 31 Jan. 1991 7 p
(Contract AF-AFOSR-0125-90; AF PROJ. 2312)
(AD-A232698; AFOSR-91-0110TR) Avail: NTIS HC/MF A02 CSCL 06/10

This grant involves three studies. The first study is designed to determine the efficacy of the catecholamine precursor L-Tyrosine in reducing pilot performance deficits caused by a night of sleep deprivation. Preparations for this study and underway and testing should begin in mid-1991. The remaining studies are designed to examine the dose-response relationships between human plasma melatonin levels and various performance and behavioral indices. Towards this end, we will manipulate nocturnal melatonin levels by exposing people to varying intensities of light (Study 2), daytime levels by administering exogenous melatonin (Study 3). Testing for Study 2 should be complete and testing for Study 2 begun by April 1991. GRA

N91-23715# SRI International Corp., Menlo Park, CA.
SPATIOTEMPORAL CHARACTERISTICS OF VISUAL LOCALIZATION Final Report, Aug. 1988 - Oct. 1990
CHRISTINA A. BURBECK Nov. 1990 157 p
(Contract F49620-88-K-0008)
(AD-A232734; AFOSR-91-0053TR) Avail: NTIS HC/MF A08 CSCL 06/4

Psychophysical experiments were conducted to investigate how the human visual system determines the spatial structure of a visual scene. The theoretical basis of the research centers on three ideas: that local spatial filters constitute an initial stage of contrast-encoding; that the properties of these initial filters can affect accuracy of the judgements of the perceived separation; and that the actual encoding of interobject separation occurs at a higher level of processing with its own properties. The properties of the higher levels of processing can be determined by controlling the input from the local spatial filters. Unlike thresholds that are determined primarily at lower levels of processing, thresholds for spatial relationships were found to be highly sensitive to the context in which the stimuli are presented and highly insensitive to those spatial and temporal characteristics that are known to play major roles in the determination of contrast detection thresholds. Context was found to affect both the threshold and the perceived value of interobject separations. Furthermore, the effects of context vary over time, being profound at short durations (100 ms) and small or negligible at long durations (500 ms). The effects of context on the accuracy of judgements of spatial relationships at brief durations were found to depend on the spatial proximity and spatial similarity of the targets and the background context. GRA

N91-23716# Vision Sciences Research Corp., San Ramon, CA.
QUANTIFYING IMPROVED VISUAL PERFORMANCE THROUGH VISION TRAINING Final Report, 1 Jul. - 31 Dec. 1990
ARTHUR P. GINSBURG 22 Feb. 1991 57 p LIMITED REPRODUCIBILITY: Availability: Document partially illegible
(Contract F49620-90-C-0063)
(AD-A232799; AFOSR-91-0188TR) Avail: NTIS HC/MF A04 CSCL 06/4

This project developed a criterion-free vision training test to improve contrast sensitivity in normal and abnormal vision. The scientific development, evaluation and refinement of noninvasive techniques for improving contrast sensitivity is important since contrast sensitivity is predictive of much everyday visual performance. Two novel techniques of contrast sensitivity training were tested. Static contrast sensitivity at low and high spatial frequencies was first measured and then trained on a CRT display. Additional measures were obtained before and after training on a contrast sensitivity chart and on detection and discrimination of complex targets. Large increases in contrast sensitivity due to vision training were found in some normal and amblyopic observers. There were large individual differences in the amount of improvement on contrast sensitivity and performance tasks. Increased contrast sensitivity ranged from 11.5 to 69.2 percent in normals and from 1.5 to 69.5 percent in amblyopes. Improvement in detection and discrimination of real-world targets ranged from 0 to 81.2 percent in normals and from 0 to 96.2 percent in amblyopes. These results suggest that two-alternative forced-choice methods are effective training procedures in many normal and amblyopic observers. GRA

N91-24736# Naval Aerospace Medical Research Lab., Pensacola, FL.
MODELING FOR HUMAN PERFORMANCE ASSESSMENT Annual Report, 15 Nov. 1989 - 15 Nov. 1990
R. R. STANNY 20 Nov. 1990 16 p
(Contract DA PROJ. 3M2-63002-D-995)
(AD-A232905) Avail: NTIS HC/MF A03 CSCL 05/8

This Annual Report describes two lines of research performed during Fiscal Year 1990 at the Naval Aerospace Medical Research Laboratory. One research line involved developing a generic model of human performance tests, such as those in the United Triservice Cognitive Assessment Battery and the Walter Reed Army Institute of Research Performance Assessment Battery. Several performance-test models were developed using the plan of the generic task. The generic model might serve both as a vehicle for quantifying laboratory performance and a blueprint for analyses of operational systems. A second research line focused on a risk identification study of 31 Navy and Marine aircraft carrier combat occupations. The data were from task analyses performed by Cooper, Schemmer, Fleishman, Yarkin-Levin, Harding, and McNelis (1987). The purpose was to examine whether knowledge of a stressor's effects on abilities might be used to predict those combat jobs most affected by the stressor. Notable among the abilities exhibiting substantial variation in importance across jobs (a necessary property for predicting differential stressor effects) were far vision, spatial orientation, flexibility of closure, and rate control. Examining the effects of stressors on these and related abilities may yield information of value in predicting the threats posed by stressors to different members of this set of occupations. GRA

N91-24737# Northwestern Univ., Evanston, IL.
MECHANISMS OF MOTION PERCEPTION: INTEGRATION OF DIRECTION, VELOCITY, AND SPACE Final Report, 1 Jan. 1989 - 30 Jun. 1990
ROBERT SEKULER 10 Feb. 1991 211 p Prepared in cooperation with Brandeis Univ., Waltham, MA
(Contract AF-AFOSR-0243-89; AF PROJ. 2313)
(AD-A233340; AFOSR-91-0189TR) Avail: NTIS HC/MF A10 CSCL 06/4

Statistically complex displays were used to probe higher order mechanisms of human motion perception. Overall, the project sought to characterize human visual mechanisms that extract information from these and other displays. A fundamental contribution of the project has been the continued refinement of mathematical models in which motion information is extracted and processed, via non-linear interactions, by an ensemble of directionally-selective visual mechanisms. Additionally, one entirely new line of research examines the formation of the visual system's abstract representation of information about change in target direction. GRA

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A91-36932
TARGET TRACKING BY A HUMAN OPERATOR
S. S. TOUMODGE (Aerospace Corp., Los Angeles, CA) IN: Signal and data processing of small targets 1990; Proceedings of the Meeting, Orlando, FL, Apr. 16-18, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 378-385. refs
Copyright

In this paper target tracking as an hierarchical information extraction process is defined and spatio-temporal factors in vision affecting motion detection are briefly discussed. The relativistic aspects of motion perception which quantify perceived extent, time, and velocity of moving objects are introduced. A systems approach to the operator-display interaction is also investigated and the role of the human operator as an optimal position and velocity estimator and controller is presented. Author

A91-37494*# Commissariat a l'Energie Atomique, Saint-Paul-les-Durance (France).
PLANTS AND MEN IN SPACE - A NEW FIELD IN PLANT PHYSIOLOGY
M. ANDRE (CEA, Centre d'Etudes Nucleaires Cadarache, Saint-Paul-les-Durance, France) and R. D. MACELROY (NASA, Ames Research Center, Moffett Field, CA) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-100, S-101. refs

Results are presented on a comparison of nutritional values of and human psychological responses to algae and of higher plants considered for growth as food on long-term missions in space, together with the technological complexities of growing these plants. The comparison shows the advantages of higher plants, with results suggesting that a high level of material recycling can be obtained. It is noted that the issue of space gravity may be not a major problem for plants because of the possibility that phototropism can provide an alternative sense of direction. Problems of waste recycling can be solved in association with plant cultivation, and a high degree of autonomy of food production can be obtained. I.S.

A91-37498#
HEMODYNAMIC, PLASMA RENIN ACTIVITY AND NOREPINEPHRINE CHANGES INDUCED BY ANTI-G SUIT INFLATION IN MAN
G. GEELEN (Lyon I, Universite, Lyons, France), J. L. SAUMET (Angers, Universite, France), P. ARBEILLE, F. PATAT, J. GUILLUT (Tours, Universite, France) et al. (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-108, S-109. Universite de Lyon I-supported research. refs

The effect of a lasting exposure to anti-G suit inflation on the cardiac volume and cardiac output (CO) was investigated in human subjects undergoing a 30-min control period of sitting followed by a 3-hr-long head-up tilting (HUT) to 70 while standing, with an anti-G suit applied during the last 2 hrs of HUT. Results of echocardiography performed at 30 min before and 30 and 90 min after the anti-G suit inflation showed that, in standing condition (i.e., with mild unloading of the left ventricle), the exposure to anti-G suit inflation induces a significant increase in the left ventricular end diastolic volume, indicating an increase in preload. However, the early increase in CO is short-lasting, since it disappeared after 90 min of anti-G suit inflation. There was an early and sustained decreases in plasma renin activity and plasma norepinefrine, indicating an inflation-induced baroreceptor-mediated decrease in sympathetic activity. I.S.

A91-37500*# Baylor Coll. of Medicine, Houston, TX.
DEVELOPMENT OF AN ARTIFICIAL GRAVITY SLEEPER (AGS)
DAVID CARDUS, WESLEY G. MCTAGGART (Baylor College of Medicicne, Houston, TX), PETER DIAMANDIS (International Space University, Boston, MA), and SCOTT CAMPBELL (Institute for Circadian Physiology, Boston, MA) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-112, S-113. refs
(Contract NAGW-1691)

The design and construction of a 2-meter radius 'human compatible' centrifuge termed the Artificial Gravity Sleeper (AGS) is considered. The centrifuge will accommodate up to four subjects at a time, operate at a broad range of speeds, and have safety features. Experiments that will be conducted on the AGS will help to investigate the quality of sleep during 100 percent gradient centrifugation. A microgravity simulation also will be studied using bed rest to assess the ability of 100 percent gradient centrifugation to function as a countermeasure to cardiovascular deconditioning. O.G.

A91-37517#
A MATHEMATICAL MODELING OF THE CEREBROVASCULAR SYSTEM
D. GAFFIE, P. LIEBAERT, and P. QUANDIEU (ONERA, Chatillon, France) (International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings. A91-37456 15-51) Physiologist, Supplement (ISSN 0031-9376), vol. 33, Feb. 1990, p. S-157, S-158.

A mathematical model is presented which represents the cerebrovascular system, and the global functioning of the system is observed when different perturbations are applied. A compartmental approach is employed for the model and the effects of perturbations on a viscous incompressible fluid flowing through an elastic tube are considered. The perturbation actions, conservation laws of mass and momentum, and assumptions regarding the Reynolds number and flow direction are presented. A state law called the tube law characterizes the transmural pressure. Unsteady and nonlinear phenomena are found in calculations of the simplest case, which can lead to significant perturbations of flow. The simultaneous action of surface volume forces dependent on time and boundary conditions is shown to cause the propogation of waves and the collapse of the tube. C.C.S.

A91-38220
A CLOSED-FORM DYNAMICAL ANALYSIS OF AN ORBITING FLEXIBLE MANIPULATOR
J. K. CHAN and V. J. MODI (British Columbia, University, Vancouver, Canada) Acta Astronautica (ISSN 0094-5765), vol. 25, Feb. 1991, p. 67-75. refs
(Contract NSERC-5-80029)
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The governing equations of motion for the in-plane dynamics of a Space Station based manipulator with flexible links and joints are presented. In general, the coupled nonlinear equations are also nonautonomous due to the presence of prescribed maneuvers of the robot. An approximate analytic closed-form solution for the system in the post-maneuver phase is obtained using the variation of parameters method. Accuracy of the solution is verified by comparison with results obtained through numerical integration of the exact equations of motion. The results suggest that the approximate solution predicts the system response with adequate accuracy, even in the presence of relatively large disturbances. The approach can be used to advantage in conducting detailed parametric analysis to identify critical conditions with a considerable saving in computational cost. Author

A91-38668
TRACKING STRATEGIES AND COGNITIVE DEMANDS
BARRY P. GOETTL (Clemson University, SC) Human Factors (ISSN 0018-7208), vol. 33, April 1991, p. 169-183. USAF-supported research. refs
Copyright

The processing demands of two tracking strategies are investigated using an optimum-maximum procedure. Subjects performed two one-dimensional tracking tasks concurrently. Ten subjects employed a double-impulse strategy, and 10 subjects used a continuous strategy. On each task control dynamics were manipulated within subjects, as was the level of optimization. Results showed dual-task decrements but little performance trade-off. These results challenge but do not rule out a resource competition interpretation. Subjects employing the continuous strategy were more adversely affected by increased tracking order than were subjects using the double-impulse strategy. This finding suggests that the continuous strategy demands more central processing resources than does the double-impulse strategy. The implications of these results for workload analysis and dual-task methodology are discussed. Author

A91-38747* Stanford Univ., CA.
EXPERIMENTS IN GLOBAL NAVIGATION AND CONTROL OF A FREE-FLYING SPACE ROBOT
M. ULLMAN and R. H. CANNON, JR. (Stanford University, CA) IN: Dynamics and control of multibody/robotic systems with space applications; Proceedings of the ASME Winter Annual Meeting, San Francisco, CA, Dec. 10-15, 1989. New York, American Society of Mechanical Engineers, 1989, p. 37-43. refs
(Contract NCC2-333)
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This paper reviews initial work at the Stanford University Aerospace Robotics Laboratory (ARL) in developing and controlling a free-flying space robot. The objective of this project is to develop a laboratory version of a space robot that is capable of performing target tracking, acquisition, and manipulation. In particular, this paper focuses on the problems associated with capturing a free-floating object that is initially out of reach of the robot. A set of rules is presented for generating an appropriate intercept trajectory. A controller architecture suitable for carrying out these motions is also described. Finally the results of computer simulations illustrating the behavior of these algorithms are shown along with a description of the physical hardware on which they will be tested. Author

A91-38748* Massachusetts Inst. of Tech., Cambridge.
ON THE DYNAMIC SINGULARITIES IN THE CONTROL OF FREE-FLOATING SPACE MANIPULATORS
E. PAPADOPOULOS and S. DUBOWSKY (MIT, Cambridge, MA) IN: Dynamics and control of multibody/robotic systems with space applications; Proceedings of the ASME Winter Annual Meeting, San Francisco, CA, Dec. 10-15, 1989. New York, American Society of Mechanical Engineers, 1989, p. 45-52. refs
(Contract NAG1-489)
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It is shown that free-floating space manipulator systems have configurations which are dynamically singular. At a dynamically singular position, the manipulator is unable to move its end effector in some direction. This problem appears in any free-floating space

manipulator system that permits the vehicle to move in response to manipulator motion without correction from the vehicle's attitude control system. Dynamic singularities are functions of the dynamic properties of the system; their existence and locations cannot be predicted solely from the kinematic structure of the manipulator, unlike the singularities for fixed base manipulators. It is also shown that the location of these dynamic singularities in the workplace is dependent upon the path taken by the manipulator in reaching them. Dynamic singularities must be considered in the control, planning and design of free-floating space manipulator systems. A method for calculating these dynamic singularities is presented, and it is shown that the system parameters can be selected to reduce the effect of dynamic singularities on a system's performance. Author

A91-38749
EXPERIMENTAL CONTROL RESULTS IN A COMPACT SPACE ROBOT ACTUATOR
S. W. TILLEY, M. G. HOLLARS, and K. S. EMERICK (Loral Aerospace Corp., Space Systems Div., Palo Alto, CA) IN: Dynamics and control of multibody/robotic systems with space applications; Proceedings of the ASME Winter Annual Meeting, San Francisco, CA, Dec. 10-15, 1989. New York, American Society of Mechanical Engineers, 1989, p. 53-57. refs
Copyright

In the Space Station era, more operations will be performed robotically in space in the areas of servicing, assembly, and experiment tending. These robots may have various sets of requirements for accuracy, speed, and compliance, and force generation. A prototype of a single degree of freedom robot joint utilizing a dc brushless motor and harmonic drive has been built. This experiment addresses some inherent mechanical limitations, namely the joint's backdriveability and low frequency structural resonances. These effects are controlled and diminished by instrumenting the actuator system with a torque transducer on the output shaft. This noncollocated inner loop is closed to ensure that commanded joint torque is accurately delivered to the manipulator link. The added use of torque feedback is demonstrated to yield superior performance in positioning accuracy while allowing for an order of magnitude larger range of programmable joint compliances. Author

A91-39375
COMBAT SURVIVAL AT 9G - TEST RESULTS OF ADVANCED G-PROTECTION EQUIPMENT ON THE F-15 AND F-16
CHARLIE J. PRECOURT and LEWIS D. JOLLETT (USAF, Flight Test Center, Edwards AFB, CA) Cockpit (ISSN 0742-1508), Jan.-Mar. 1991, p. 6-11.
Copyright

The results of a flight test evaluation of three prototype positive pressure breathing (PPB) antiacceleration (anti-G) systems in the F-16 and a fourth PPB system, the tactical life support system in the F-15 are presented. Pressure assisted breathing reduces the amount of physical effort required to sustain necessary blood pressure levels during high sustained G (HSG) situations. During the test flights the PPB concept proved itself to be a dramatic success in terms of enhancing the pilot's anti-G capability. Other major benefits of the PPB system were reduced pilot workload due to greater ease in breathing during HSG and a reduction in the straining effort necessary to maintain vision at a given G-level as compared to present anti-G systems. R.E.P.

A91-39376
ANNUAL SAFE SYMPOSIUM, 27TH, NEW ORLEANS, LA, DEC. 5-8, 1989, PROCEEDINGS
Symposium sponsored by SAFE Association. Newhall, CA, SAFE Association, 1990, 231 p. For individual items see A91-39377 to A91-39399.
Copyright

The present symposium of the SAFE Association discusses a laser ordnance initiation system in an F-16 sled, mechanical and gas-activated pyrolasers for laser ordnance initiation systems, a new electronic anti-G valve and regulator ensemble, the development of CREST subsystems, and the evolution of on-board inert gas-generation systems. Attention is given to a 99-percent purity molecular sieve oxygen concentrator, the development of an advanced-technology ballistic-powered inertia reel, flight escape systems, and skeletal segment development for an advanced manikin. Also discussed are new nonmelting lightweight parachute fabrics, utilization of emergency medical kits by air carriers, safety in expert systems, ejection-seat rocket-catapult design for reduced G-field influence, advanced airborne oxygen sensors, the Minipac II ejection seat, advanced technology application in the production of space suit gloves, and a canopy-breaking system for nondelay pilot rescue. P.D.

A91-39378
NEW ELECTRONIC ANTI-G VALVE AND REGULATOR ENSEMBLE
J. M. CLERE, H. MAROTTE, D. LEJEUNE (Centre d'Essais en Vol, Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France), R. ZAPATA, and P. PELLOUX-GERVAIS (L'Air Liquide, Sassenage, France) IN: Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings. Newhall, CA, SAFE Association, 1990, p. 6-9. refs
Copyright

Human laboratory studies in the development of a new electronic regulator and an anti-G valve are presented. Positive pressure breathing is set from 4 to 6 G; a ready pressure of 0.5 kPa or 3.5 mmHg increases breathing comfort. The anti-G suit is inflated from 2 to 9 G with a ready pressure of 1 kPa. Centrifuge testing demonstrates the short response time (0.1 s) of the valve, sufficient breathing flow for straining manuevers, and reliability of this prototype system. Diagrams show simulation of 7 G during static tests, and a set of assisted positive pressure breathing (APPB) at +66(z) in the centrifuge. The anti-G valve ensemble can be used for developing new APPB schedules in association with a computer. P.D.

A91-39381
MODERN PNEUMATIC TECHNOLOGY AND THE CHALLENGES OF PHYSIOLOGICAL PROTECTION FOR THE PILOT OF ADVANCED FIGHTER AIRCRAFT
HENRI MAROTTE, JEAN-MICHEL CLERE (Centre d'Essais en Vol, Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France), GEORGES GUTMAN, and RAYMOND BEAUSSANT (Intertechnique, Plaisir, France) IN: Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings. Newhall, CA, SAFE Association, 1990, p. 47-52.
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The present study describes a new oxygen and anti-G system designed to provide high-altitude breathing protection and improved anti-G protection, and to use a molecular sieves oxygen concentrator (MSOC) supply for the oxygen regulator and engine bleed for the G-valve. It uses only modern pneumatic technology for its vital parts, and remains fully independent of other aircraft systems, with the exception of its surveillance functions, which use electronics so as to be easily interconnected with the aircraft's central surveillance system. There are schemes illustrating the pilot valve technology, the pilot valve technology adapted for MSOC gas supply, the demand flow (ground level performance), a positive pressure breathing (PPB) schedule for the VHA 90 partial pressure suit, assisted PPB and G-suit pressure, emergency functions, and an interconnection anti-G valve. P.D.

A91-39391
ADVANCED TECHNOLOGY APPLICATION IN THE PRODUCTION OF SPACE SUIT GLOVES
PHIL SPAMPINATO, DAVE CADOGAN, and TONY MCKEE (ILC Dover, Frederica, DE) IN: Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings. Newhall, CA, SAFE Association, 1990, p. 164-169.
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The present study reviews a new space-suit glove designed for NASA Johnson and describes its production method. The advantages of three distinct manufacturing technologies are

characterized: laser scanning, CAD/CAM, and stereo lithography. A two-phase plan to determine the feasibility of utilizing these advanced technologies included evaluation and selection of optical sensing equipment, interfacing and manipulation of scanned data on a CAD system, and evaluation of bladder form fabrication methods. The feasibility of implementing these technologies is considered proven. The second phase is to include a cost/benefit analysis to determine if and when the equipment cost for implementation will pay for itself in savings and glove production. Another conclusion confirmed by this study is that these technologies have been far more potential than for gloves alone. P.D.

A91-39397
POSITIVE PRESSURE BREATHING AND G (PPB&G) CHEMICAL PROTECTIVE SYSTEM - AN INTEGRATED APPROACH
LISA JACKSON and JOHN DAMRON (ILC Dover, Frederica, DE) IN: Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings. Newhall, CA, SAFE Association, 1990, p. 202-206.
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A totally integrated chemically hardened PPB&G protective system is described and illustrated with drawings. The system overcomes past deficiencies by combining advanced technology in the areas of protection from high Gs, extreme altitude, and chemical and biological agents. The PPB&G system's five principle subsystems are: (1) jerkin with sleeves and extended bladder, (2) fully-encapsulating anti-G suit with extended bladder, (3) a chemical protective under-the-helmet hood with integrated positive pressure mask, (4) an HGU-55/P helmet with integrated occipital bladder, and (5) a system distribution and flow control block which integrates the protective functions into the operational aircraft aircrew support system. P.D.

A91-39544
THE DURABILITY OF HYDROGEL EXTENDED-WEAR CONTACT LENSES WORN FOR DAILY WEAR BY USAF AIRCREW MEMBERS
RICHARD J. DENNIS, JEFFREY R. HILL, and NORMA S. KETCHUM (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 565-568. refs
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Hydrogel extended-wear contact lenses, worn on a daily-wear regimen, were tested for 1 yr by USAF aircrew members. A total of 62 eyes were fitted with Hydrocurve II (55 percent water content) spherical lenses, 29 with Hydrocurve lenses, 29 with Hydrocurve II (55 percent water content) toric lenses, and 61 with CSI-T (38.5 percent water content) spherical lenses. The mean lens replacement rate for torn lenses per aircrew member was determined to be 1.45 lenses a year. The replacement rate of Hydrocurve II spherical lenses compared to CSI-T lenses was not statistically significant. However, the replacement rate for Hydrocurve II toric lenses was significantly lower than both Hydrocurve II spherical lenses and CSI-T lenses (p less than 0.01). The extended-wear lenses tested in this study appeared to be durable enough for the rigors of daily wear. Author

A91-39548
EVALUATION OF THE DISPOSABLE ABSORPTION CONTAINMENT TRUNK FOR FEMALE U-2 AND TR-1 PILOTS
JANE F. BARLOW and SUSAN E. RICHARDSON (Ninth Strategic Hospital, Beale AFB, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 577-579. refs
Copyright

The Disposable Absorption Containment Trunk (DACT), initially designed as a short-term-use urine collection device for female cosmonauts, is evaluated for the extended and repetitive use required for integration into the U-2 and TR-1 aircraft. In these experiments, six female subjects were tested wearing a custom-fit DACT and the 1030 full pressure suit ensemble with torso harness. The subjects were strapped into the U-2 ejection seat with parachute and seat kit for 10.75 hrs every 3 days for a total of five sessions, and the DACT was evaluated for absorptive capability and comfort. It was found that the DACT can reliably absorb up to 950 ml of urinary outputs and menstrual flow, with only minimal leakage from higher urinary outputs and with no irritants severe enough to compromise flight. I.S.

A91-39550
THE FAILURE ANALYSIS OF COMPOSITE MATERIAL FLIGHT HELMETS AS AN AID IN AIRCRAFT ACCIDENT INVESTIGATION
YEHEZKEL G. CAINE, ORIT BAIN-UNGERSON, IGAL SHOCHAT (Israeli Air Force, Aeromedical Centre, Ramat Gan, Israel), and GAD MAROM (Jerusalem, Hebrew University, Israel) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, June 1991, p. 587-592. refs
Copyright

Understanding why a flying helmet fails to maintain its integrity during an accident can contribute to an understanding of the mechanism of injury and even of the accident itself. In this work, a post-accident evaluation of failure modes in glass and aramid fiber-reinforced composite helmets was performed. Optical and microscopic (SEM) techniques were employed to identify specific fracture mechanisms. They were correlated with the failure mode. Stress and energy levels were estimated from the damage extent. Damage could be resolved into distinct impact, flexure, and compression components. Delamination was identified as a specific mode, dependent upon the matrix material and bonding between the layers. From the energy dissipated in specific fracture mechanisms, the minimum total energy imparted to the helmet-head combination and the major injury vector direction and magnitude were calculated. The level of protection provided by the helmet can also be estimated. Author

A91-39882
WHAT EYE MODEL SHOULD WE USE FOR MRT TESTING?
GERALD C. HOLST and ALLEN R. TAYLOR (Martin Marietta Electronic Systems Center, Orlando, FL) IN: Infrared imaging systems: Design, analysis, modeling, and testing; Proceedings of the Meeting, Orlando, FL, Apr. 16-18, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 67-75. refs
Copyright

Two new eye models for the laboratory measuring minimum resolvable temperature (MRT) values are discussed. In the first model an observer is allowed to move his head to optimize his detection threshold, and in the second the distance to the display is fixed. The results obtained are compared to the NVL model, the Sendall-Rosell model, and the Campbell-Robson eye models. All the models provide the same shaped MRT curve at high spatial frequencies to within a constant. Large discrepancies exist at low spatial frequencies due to inability to model the eye's inhibitory response. O.G.

A91-39883
EVALUATION OF DISPLAY SYSTEM ENHANCEMENTS TO ASSIST AN OPERATOR IN THE DETECTION OF POINT TARGETS
R. D. REEVES and D. C. THORNTON (Spar Aerospace, Ltd., Defence Systems Div., Weston, Canada) IN: Infrared imaging systems: Design, analysis, modeling, and testing; Proceedings of the Meeting, Orlando, FL, Apr. 16-18, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 76-89. Research supported by Defence Research Establishment Valcartier. refs
Copyright

A series of experiments examining an operator's ability to detect an unresolved target in backgrounds representatives of a slow scan, large volume, and infrared surveillance system is described. It is found that there is an inverse relationship between screen refresh rates and the probability of target detection. High refresh rates approach a contrast-limited threshold, and low rates produce

higher detection threshold than can be attributed to eye integration effects alone. The effects of amplitude quantization on contrast threshold over a range of noise conditions reveal that quantization levels below the observer's contrast threshold do not affect performance. The operator's ability to detect a uniform target of fixed but unknown dimensions is characterized by a contrast threshold dependence proportional to the square root of the target area, with contrast threshold sensitivity decreasing for large target areas. O.G.

A91-39884
HUMAN RECOGNITION OF INFRARED IMAGES
JEFFREY S. SANDERS, CARL E. HALFORD, and KEITH A. KRAPELS (Memphis State University, TN) IN: Infrared imaging systems: Design, analysis, modeling, and testing; Proceedings of the Meeting, Orlando, FL, Apr. 16-18, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 106-113. refs
Copyright
Human recognition of infrared images has been studied using signal detection theory. An experiment in which human observers discriminated between different types of modern armored vehicles at various resolutions addresses the tasks of identification friend or foe and identification. The vehicles are ones that would be encountered in a hypothetical confrontation between NATO and Warsaw Pact forces. The resolution threshold for the identification friend or foe is determined. O.G.

N91-23567# JCLP Hyperbarie, Paris (France).
SUBSEA HABITATS AND SPACE SIMULATION
JEAN CLAUDE LEPECHON *In* ESA, Space and Sea p 25-30 Dec. 1990 Sponsored in part by Atelier d'Architecture Aquatique, France
Copyright Avail: NTIS HC/MF A13
Saturation diving was developed in the 1960's with subsea habitats and then used in the 1970's with deep diving systems and hyperbaric centers. Simulation of confinement can be carried out in saturation while simulation and training to extravehicular activity (EVA) must be performed in a pool. An integrated underwater safe center project which combines hyperbaric confinement and EVA sorties in a pool is presented. This center can also be used to train ground base team and payload specialists in communication techniques and procedures, during confinement and EVA exercices. ESA

N91-23569# OHB-System G.m.b.H., Bremen (Germany, F.R.). Space and Environmental Technology.
PAYLOAD RELATED CREW OPERATIONS: FROM PAST MISSIONS TO COLUMBUS
JAMES R. KASS, ERICH SCHAFHAUSER, and CARLO VIBERTI (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, Space and Sea p 37-41 Dec. 1990
Copyright Avail: NTIS HC/MF A13
Manned operations in an orbiting laboratory for extended periods of time have many characteristics in common with work in the deep sea, and are accompanied by a number of similar problems. The scenario of manned payload operations in space are addressed: some aspects with their parallel in deep sea work become evident. The analysis results from a study carried out with the ESA/ESTEC in preparation for the Columbus program, and uses as a baseline the lessons learned from past manned missions. Some highlights of these results are presented. ESA

N91-23573# Societe d'Architectures en Milieux Extremes, Paris (France).
EUROPEAN STAKES AND MEASURES PERMITTING THE MANAGEMENT OF GEOMETRIC DIMENSIONS [ENJEUX EUROPEENS ET MESURES PERMETTANT DE GERER LES DIMENSIONS GEOMETRIQUES]
M. FABRE *In* ESA, Space and Sea p 75-80 Dec. 1990 In FRENCH
Copyright Avail: NTIS HC/MF A13
Within the Columbus program, the studies defining and optimizing the pressurized spaces must be based on extremely rigorous and highly performant modular and repetitive geometric dimensions, in compliance with ergonomic data inherent to the indispensable presence of man. These studies must also satisfy the following demands: they must comply, at all levels, with the geometric dimensional concepts of the decimal metric system and the international norms inherent to this system; they must be compatible, as much for the Columbus Attached Laboratory and the Columbus autonomous laboratory or Free Flyer as for the Hermes hold and pressurized airlock and the dynamic envelope of the cylindrical portion of the Ariane cap, with the most highly performant industrial geometric dimension norms and rules of international level, whether or not they come from the U.S. or are in use in Japan, USSR, etc.; they must generate a unique base denominator of geometric measurement in compliance with the international metric system. ESA

N91-23574# Compagnie Maritime d'Expertises, Marseille (France). Diving and Safety Dept.
COMPARISONS BETWEEN UNDERWATER AND SPACE WORKING ENVIRONMENTS FOR ON BOARD ACTIVITIES OPTIMIZATION (COLUMBUS SPACE PROGRAMME)
JEAN-PIERRE IMBERT and CARLO VIBERTI (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, Space and Sea p 85-88 Dec. 1990
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The design of the standard racks for the Columbus laboratories, along with the rack transfer scenario, needs to be evaluated for the definition and optimization of crew on board tasks. In water tests seem to be the best way to conduct intravehicular activity (IVA) simulation and the problem of such tests definition is addressed. The method of intervention is reviewed under the light of the commercial diving experience: it seems that closed circuit breathing apparatus could be used which would make IVA simulation more realistic. The water physical properties are expected to induce differences but adequate arrangement of the rack mock up could minimize these biases. Obviously, underwater simulation is best to study operational problems, including supervision and monitoring. ESA

N91-23575# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EVA SERVICING: THE HERMES CAPABILITY
A. ACCENSI, I. SKOOG, and J. CHEVALLIER (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France) *In its* Space and Sea p 89-94 Dec. 1990
Copyright Avail: NTIS HC/MF A13
Experience demonstrates that external intervention capabilities are an integral part of an in orbit infrastructure; allied to the development of Hermes and Columbus, ESA has embarked upon the establishment of an Extra Vehicular Activity (EVA) capability. Following the establishment of EVA mission requirements, ESA initiated in 1987, preparatory studies for the evaluation of operational scenarii and alternative design concepts which resulted in the definition of the technical requirements for the Europen EVA system. The various design options for meeting these requirements were evaluated in detail within the on going Hermes phase C activities. The design tradeoff placed particular attention to the close man system integration of the EVA system; crew safety and human factors engineering were consequently used as key design drivers in the derivation of the EVA system design reference. ESA

N91-23576# Center for Industrial Research, Oslo (Norway).
MAN-MACHINE INTERACTIONS AND MULTIMEDIA APPLIED TO ROV OPERATIONS
EIVIND KJENNERUD *In* ESA, Space and Sea p 95-99 Dec. 1990
Copyright Avail: NTIS HC/MF A13
To evaluate new technology for improving efficiency and safety

in the man machine interface in Remotely Operated Vehicles (ROV) underwater interventions, a demo lab was built. By means of recent research in multimedia applications and artificial reality, an attempt to create a more intuitive and operator friendly control room environment is made. ESA

N91-23577# Companhia Espacial Portuguesa Ltd., Lisbon.
THE BERLENGA UNDERWATER SURVEY PROJECT
DINIS AFONSO RIBEIRO *In* ESA, Space and Sea p 101-102 Dec. 1990
Copyright Avail: NTIS HC/MF A13

A very general overview of a planned underwater survey is given and some practical ways to establish better contacts in Portugal are suggested. Applying high technology to underwater archaeology may provide a symbolic way to link projects aimed at the future, with the study of past explorations, easing the future shock in the Portuguese society. ESA

N91-23579# Compagnie Maritime d'Expertises, Marseille (France).
NEUTRAL BUOYANCY AND MICROGRAVITY: EXTRAVEHICULAR ACTIVITIES WITH A HUMID WATER SUIT [SIMULATION DES ACTIVITES SPATIALES EXTRA VEHICULAIRES EN IMMERSION AVEC UN SCAPHANDRE HUMIDE]
C. GORTAN, L. DECRAMER, and D. HORNET (Dassault Espace, Saint-Cloud, France) *In* ESA, Space and Sea p 107-112 Dec. 1990 In FRENCH
Copyright Avail: NTIS HC/MF A13

Within the framework of simulation of extravehicular activities in water, water immersion provides great interest with regard to the use of equipment, recreating axes near as possible the principle mobility constraints which astronauts confront in pressurized space suit. The humid water suit is considered. In immersion, the use of this equipment requires diving breathing apparatus to be carried and therefore astronauts need elementary diving training. The small constraint is well compensated by the possibilities offered by this equipment. In fact, in water it is possible to simulate almost all the phases of extravehicular sorties, including dressing and undressing, operations which are impossible with a pressurized clothing. Before a pressurized submergeable model of the European space suit is available, this humid water suit concept should be immediately usable in the development phase of the Hermes program for the evaluation of diverse interfaces linked to extravehicular activities both in the equipment planning and in procedures. ESA

N91-23583# McDonnell-Douglas Space Systems Co., Houston, TX. Space Station Div.
EVA/ROBOTICS INTEGRATION FOR SPACE STATION FREEDOM
R. M. MACHELL, L. V. RAMON, and D. E. ANDERSON *In* ESA, Space and Sea p 145-149 Dec. 1990
Copyright Avail: NTIS HC/MF A13

Space Station Freedom is being designed to be assembled and maintained on orbit by astronauts in space suits and by the use of telerobotic devices. Undersea experience in the cooperative use of divers and robots is being applied to the integration of astronauts in Extra Vehicular Activity (EVA) and telerobots for on orbit assembly and external maintenance tasks. Evaluation of on orbit assembly and external maintenance tasks and worksites will determine which tasks should be done by EVA and which by telerobots. Priority emphasis is being given to telerobotics wherever practical. Neutral buoyancy testing in underwater test tanks is being conducted to evaluate EVA worksites and tasks in simulated weightlessness. Common designs for EVA and telerobotics hardware interfaces are being developed. The extensive analysis and test activities provide substantial confidence in the ability to assemble and maintain the Space Station Freedom on orbit. ESA

N91-23584# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Inst. for Flight Systems Dynamics.
MULTISENSORY TELEROBOTIC CONCEPTS FOR SPACE AND UNDERWATER APPLICATIONS
G. HIRZINGER, J. DIETRICH, and B. BRUNNER *In* ESA, Space and Sea p 151-161 Dec. 1990
Copyright Avail: NTIS HC/MF A13

The telerobotic concepts as presently developed for a space Robot Technology Experiment (ROTEX) to fly with the next Spacelab mission D2 in 1992 are outlined; the robot is supposed to work in an autonomous mode, teleoperated by astronauts, and teleoperated from ground. One of its key features is a recently developed multi sensory gripper with highly integrated, miniaturized sensor technology including stiff and compliant six axis force torque sensing, nine laser range finders, tactile arrays, grasp force control using a new electrical gripper drive and a stereo camera pair. Sensory feedback schemes and man machine interface concepts using a six degrees of freedom control ball and stereo imaging is explained. Sensory simulation on ground using advanced stereo graphics is supposed to predict the sensor based path refinement on board, while real time fusion of stereo images and laserscan information helps to predict the motion of floating objects to be grasped. A lightweight robot concept with new intelligent joint drives and grid structure composite arms for the astronaut training on ground is discussed. The telerobotic concepts are structured thus that they are equally applicable to space and underwater situations. ESA

N91-23586# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
HOW TO DESIGN EFFICIENT MMI FOR SPACE
MURIEL DIDIER *In its* Space and Sea p 173-177 Dec. 1990
Copyright Avail: NTIS HC/MF A13

The difficulties met when trying to design an efficient Man Machine Interface (MMI) for space are addressed and a way that can be followed to turn the difficulties around is shown. The problems of designing MMI for space come mainly from the environment (microgravity environment) and not so much from the task and the operator that can be easily identified. The methodologies and tools usually used when designing for a 4 g environment have to be adapted to the 0 g environment. The experience gained on Columbus when designing restraints for the crew project gives an example of a way that can be followed. ESA

N91-23589# Societe d'Etudes des Systemes d'Automation, Toulouse (France).
OBJECT ORIENTED PROGRAMMING IN MMI: A SOFTWARE TOOL FOR ANALYSIS AND PLANIFICATION OF A RADAR IMAGING MISSION
J. L. WIPPLER and J. P. AGUTTES (Centre National d'Etudes Spatiales, Toulouse, France) *In* ESA, Space and Sea p 191-194 Dec. 1990
Copyright Avail: NTIS HC/MF A13

The design of a system analysis computerized tool used to be focused mainly on the modelization of the phenomena in study. When in a prephase A study, since many options are still open and many technical teams are involved, this leads to a simulation package that can be difficult to use and to modify. Such a computerized tool, implemented on a personal computer compatible, in the MS Windows environment and using object oriented programming is described. This tool carries powerful modeling capabilities, yet features flexibility and evolution potential, while presenting a friendly user interface for ease of use to cooperants in the 'Radar 2000' program. It is composed of several cooperative components: a worldwide radar mission data base; a system builder to create a scanario; and a simulator to evaluate overall mission performances. From several similar object oriented projects, a tentative conclusion on the usefulness of such object oriented approaches can be drawn. ESA

N91-23717# Navy Clothing and Textile Research Facility, Natick, MA.

EFFECTIVENESS OF A PROTOTYPE MICROCLIMATE COOLING SYSTEM FOR USE WITH CHEMICAL PROTECTIVE CLOTHING Final Report, Jul. 1989 - May 1990

NANCY A. PIMENTAL, WALTER B. TEAL, and BARBARA A. AVELLINI Dec. 1990 26 p

(AD-A231572; NCTRF-180) Avail: NTIS HC/MF A03 CSCL 06/9

Facility conducted laboratory evaluations of a prototype, portable microclimate cooling system (MCS) designed for use with chemical protective clothing. The MCS circulates chilled liquid through a torso vest. A backpack unit contains an ice pack; a pump and motor assembly and a rechargeable battery are mounted on a chest or waist strap. Total weight of the MCS is 9.3 kg (20.4 lbs). To examine the effectiveness of the system in reducing heat strain, seven male test subjects participated in a laboratory heat stress evaluation. To determine the cooling power and efficiency of the MCS, thermal manikin testing was conducted. GRA

N91-23718*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

ATMOSPHERIC LEAKAGE AND CONDENSATE PRODUCTION IN NASA'S BIOMASS PRODUCTION CHAMBER. EFFECT OF DIURNAL TEMPERATURE CYCLES

RAYMOND M. WHEELER, JOHN H. DRESE (Bionetics Corp., Cocoa Beach, FL.), and JOHN C. SAGER Feb. 1991 15 p (Contract NAS10-11624)

(NASA-TM-103819; NAS 1.15:103819) Avail: NTIS HC/MF A03 CSCL 06/11

A series of tests were conducted to monitor atmospheric leakage rate and condensate production in NASA's Biomass Production Chamber (BPC). Water was circulated through the 64 plant culture trays inside the chamber during the tests but no plants were present. Environmental conditions were set to a 12-hr photoperiod with either a matching 26 C (light)/20 C (dark) thermoperiod, or a constant 23 C temperature. Leakage, as determined by carbon dioxide decay rates, averaged about 9.8 percent for the 26 C/20 C regime and 7.3 percent for the constant 23 C regime. Increasing the temperature from 20 C to 26 C caused a temporary increase in pressure (up to 0.5 kPa) relative to ambient, while decreasing the temperature caused a temporary decrease in pressure of similar magnitude. Little pressure change was observed during transition between 23 C (light) and 23 C (dark). The lack of large pressure events under isothermal conditions may explain the lower leakage rate observed. When only the plant support inserts were placed in the culture trays, condensate production averaged about 37 liters per day. Placing acrylic germination covers over the tops of culture trays reduced condensate production to about 7 liters per day. During both tests, condensate production from the lower air handling system was 60 to 70 percent greater than from the upper system, suggesting imbalances exist in chilled and hot water flows for the two air handling systems. Results indicate that atmospheric leakage rates are sufficiently low to measure CO2 exchange rates by plants and the accumulation of certain volatile contaminants (e.g., ethylene). Control system changes are recommended in order to balance operational differences (e.g., humidity and temperature) between the two halves of the chamber. Author

N91-23719 Institute for Perception RVO-TNO, Soesterberg (Netherlands).

THE DEVELOPMENT OF HIGHLY PRACTICED SKILLS: A STARTING POINT FOR DRIVER MODELLING Final Report

W. B. VERWEY Oct. 1990 32 p

(IZF-1990-B-16; TD-90-3409; ETN-91-99099) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

In order to develop reliable intelligent interfaces in motor cars, a driver model should be developed which reflects human information processing mechanisms and, more specifically, mechanisms of skill acquisition, namely involuntary priming and voluntary preparation. On this basis three alternative models of skill acquisition are proposed that differ with respect to the effects of voluntary control at the perceptual and response level of information processing. Subjects carried out two-choice reactions in rapid succession. The most important experimental manipulations were whether the first choice reaction predicted the second and the degree of transfer of training to conditions where predictivity changed. Stimulus presentation was for some subjects always visual whereas for other subjects only the first stimulus was visual and the second was auditory. The results support a model asserting that involuntary effects of priming evolve only at the perceptual level but not at the response level. They support earlier findings that preparation for the second reaction occurs, in part, before execution of the first one. Correlational analyses of individual differences indicate that an overlapping strategy during training yields involuntary priming whereas a sequential strategy without overlapping preparation does not. The results are in close agreement with a connectionist control model of human information processing which consists of separate processing modules each of which can be described as a neural network. Implication for the Generic Intelligent Driver Support (GIDS) system are presented. ESA

N91-23720# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

HEAT STRAIN AND WORK TOLERANCE TIMES WITH VARYING LEVELS OF CANADIAN FORCES NBC PROTECTIVE CLOTHING, AMBIENT TEMPERATURE, PHYSICAL WORK INTENSITY, AND WORK/REST SCHEDULES Final Report

T. MCLELLAN, I. JACOBS, and B. BAIN Nov. 1990 96 p

(AD-A232653; DCIEM-90-51) Avail: NTIS HC/MF A05 CSCL 06/5

Canadian Forces personnel must be able to sustain operations in an environment contaminated with nuclear, biological and/or chemical (NBC) agents. Clothing has been designed that protects the individual from a hostile NBC environment. This clothing, however, impairs body heat loss. The degree of impairment is magnified if metabolic heat production is increased and/or environmental temperature increases. The purpose of the present study, therefore, was to examine the effects of environmental temperature and metabolic rate on soldiers' physical work tolerance times (WTT) while wearing various levels of NBC clothing. Twenty-three male soldiers were allocated to exercise at either a light or heavy metabolic rate in an environmental chamber that controlled ambient conditions at either a cool 18 C or hot 30 C temperature. Subjects were tested wearing three levels of protective clothing: their regular combat fatigues (Low); fatigues and the NBC overgarment (Med); fatigues, NBC overgarment, rubber gloves and boots, and protective respirator (High). WTT was defined as the time until body temperature increased to 39.3 C (normal being 37 C), heart rate reached 95 percent of an individual's maximum, dizziness or nausea precluded further exercise or 5 hours had elapsed. GRA

N91-23721# Naval Biodynamics Lab., New Orleans, LA.

SHIP ROLL STABILIZATION AND HUMAN PERFORMANCE Final Report

T. R. MORRISON, T. G. DOBIE, G. C. WILLEMS, and J. L. ENDLER Jan. 1991 27 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD

(AD-A232721; NBDL-90R007) Avail: NTIS HC/MF A03 CSCL 06/10

The purpose of this study was to assess possible performance enhancements due to roll stabilization. Psychomotor performance was assessed under no motion, roll stabilized, and non-roll stabilized motion conditions in the Naval Biodynamics Laboratory Ship Motion Simulator. Twelve human research volunteers participated as subjects in the study. The motion conditions were measured and recorded at sea abroad an FFG-7 class frigate outfitted with five roll stabilizers. The following performance tests were used: four-choice reaction time; memory and search task; critical instability tracking. Three questionnaires were used, namely motion sickness symptomatology, magnitude estimate of motion sickness, and magnitude estimate of motion. It was found that

subject performance was not affected by roll stabilized motion compared to non-roll stabilized motion in these experimental conditions. Subjects accurately judged the non-roll stabilized motion condition to be greater than the roll stabilized condition, but reported no differences in motion sickness in the two conditions. GRA

N91-23722# *University of Northern Arizona, Flagstaff.*
EFFECTS OF BRIGHT ILLUMINATION ON ORAL TEMPERATURE AND COGNITIVE PERFORMANCE IN HUMANS DURING NIGHTTIME HOURS *Technical Report, May* - Dec. 1990
PATRICK HANNON, GEORGE BRAINARD, WILLIAM GIBSON, JONATHAN FRENCH, and DAVID ARNALL 15 Jan. 1991 2 p
(Contract AF-AFOSR-0305-90; AF PROJ. 2312)
(AD-A232787; AFOSR-91-0064TR) Avail: NTIS HC/MF A01
CSCL 05/8

The objective of this study was to compare the effects of bright and dim illumination on sublingual temperature and behavioral measures to determine if illumination treatment can reduce fatigue and enhance human work performance during specific evening and nighttime periods. Lighting levels for work are typically task specified for actual optimal visual stimulation without considering potential biological and behavioral effects of the light stimuli. This research effort investigated the possibility that human performance may be less than optimal under the 50 to 500 lux light environment that is typical of many work station settings and that performance may be improved under bright wide spectrum illumination. The document presents this information in a one page presentation. GRA

N91-23723# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
QUANTIFYING PERFORMANCE DEGRADATION DUE TO THE HUMAN-MACHINE INTERFACE OF TELEMANIPULATORS Interim Report, Jan. - Dec. 1990
STEVEN J. REMIS and DANIEL W. REPPERGER Dec. 1990 101 p
(Contract AF PROJ. 7231)
(AD-A232814; AAMRL-SR-90-510) Avail: NTIS HC/MF A06
CSCL 23/2

As a first step in evaluating operator interfaces to telerobots, task performance data were collected from humans hands-on, with and without the subjects wearing a unilateral exoskeletal device. These baseline studies show the degradation in task performance caused solely by the exoskeleton, exclusive of any slave robotic system. This subsystems-level approach to performance measurement is motivated by the increasing modularity among robotic designs, and the need to quantify the performance degradation caused by each subsystem. The experiments described in this paper show that the unilateral exoskeleton decreases the human's available information capacity by approximately 36 percent, depending on the subject and the difficulty of the task. This decrease in available information capacity is similar when viewing the peg-into-hole task using the one dimension of Fitts' Law or when breaking this task into the two tasks of ballistic motion and accurate positioning. Future work involves evaluating the teleoperated performance of these tasks, plus similar hands-on and teleoperated experiments with the operator wearing a bilateral exoskeleton. This matrix of experiments can be repeated for other telerobotic interfaces to understand the benefits and limitations of the variety of available human machine interfaces. GRA

N91-24052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
PHYSICAL/CHEMICAL CLOSED-LOOP WATER-RECYCLING
CAL C. HERRMANN (Bionetics Corp., Moffett Field, CA.) and THEODORE WYDEVEN *In* NASA, *Washington, Technology 2000,* Volume 2 p 95-105 1991
Avail: NTIS HC/MF A16 CSCL 06/11

Water needs, water sources, and means for recycling water are examined in terms appropriate to the water quality requirements of a small crew and spacecraft intended for long duration exploration missions. Inorganic, organic, and biological hazards are estimated for waste water sources. Sensitivities to these hazards for human uses are estimated. The water recycling processes considered are humidity condensation, carbon dioxide reduction, waste oxidation, distillation, reverse osmosis, pervaporation, electrodialysis, ion exchange, carbon sorption, and electrochemical oxidation. Limitations and applications of these processes are evaluated in terms of water quality objectives. Computerized simulation of some of these chemical processes is examined. Recommendations are made for development of new water recycling technology and improvement of existing technology for near term application to life support systems for humans in space. The technological developments are equally applicable to water needs on Earth, in regions where extensive water recycling is needed or where advanced water treatment is essential to meet EPA health standards. Author

N91-24053*# National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, MS.
NEW RESEARCH ON BIOREGENERATIVE AIR/WATER PURIFICATION SYSTEMS
ANNE H. JOHNSON, R. D. ELLENDER, and PAUL J. WATKINS (University of Southern Mississippi, Hattiesburg.) *In* NASA, Washington, Technology 2000, Volume 2 p 107-113 1991
Avail: NTIS HC/MF A16 CSCL 06/11

For the past several years, air and water purification systems have been developed and used. This technology is based on the combined activities of plants and microorganisms as they function in a natural environment. More recently, researchers have begun to address the problems associated with indoor air pollution. Various common houseplants are currently being evaluated for their abilities to reduce concentrations of volatile organic compounds (VOCS) such as formaldehyde and benzene. With development of the Space Exploration Initiative, missions will increase in duration, and problems with resupply necessitates implementation of regenerative technology. Aspects of bioregenerative technology have been included in a habitat known as the BioHome. The ultimate goal is to use this technology in conjunction with physicochemical systems for air and water purification within closed systems. This study continued the risk assessment of bioregenerative technology with emphasis on biological hazards. In an effort to evaluate the risk for human infection, analyses were directed at enumeration of fecal streptococci and enteric viruses with the BioHome waste water treatment system. Author

N91-24059*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OXYGEN PRODUCTION USING SOLID-STATE ZIRCONIA ELECTROLYTE TECHNOLOGY
JERRY W. SUITOR and DOUGLAS J. CLARK *In* NASA, Washington, Technology 2000, Volume 2 p 155-160 1991
Avail: NTIS HC/MF A16 CSCL 06/11

High purity oxygen is required for a number of scientific, medical, and industrial applications. Traditionally, these needs have been met by cryogenic distillation or pressure swing adsorption systems designed to separate oxygen from air. Oxygen separation from air via solid-state zirconia electrolyte technology offers an alternative to these methods. The technology has several advantages over the traditional methods, including reliability, compactness, quiet operation, high purity output, and low power consumption. Author

N91-24060*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
MONITORING AND CONTROL TECHNOLOGIES FOR BIOREGENERATIVE LIFE SUPPORT SYSTEMS/CELSS
WILLIAM M. KNOTT and JOHN C. SAGER *In* NASA, Washington, *Technology 2000, Volume 2* p 161-167 1991
Avail: NTIS HC/MF A16 CSCL 06/11

The development of a controlled Ecological Life Support System (CELSS) will require NASA to develop innovative monitoring and control technologies to operate the different components of the system. Primary effort over the past three to four years has

been directed toward the development of technologies to operate a biomass production module. Computer hardware and software required to operate, collect, and summarize environmental data for a large plant growth chamber facility were developed and refined. Sensors and controls required to collect information on such physical parameters as relative humidity, temperature, irradiance, pressure, and gases in the atmosphere; and PH, dissolved oxygen, fluid flow rates, and electrical conductivity in the nutrient solutions are being developed and tested. Technologies required to produce high artificial irradiance for plant growth and those required to collect and transport natural light into a plant growth chamber are also being evaluated. Significant effort was directed towards the development and testing of a membrane nutrient delivery system required to manipulate, seed, and harvest crops, and to determine plant health prior to stress impacting plant productivity are also being researched. Tissue culture technologies are being developed for use in management and propagation of crop plants. Though previous efforts have focussed on development of technologies required to operate a biomass production module for a CELSS, current efforts are expanding to include technologies required to operate modules such as food preparation, biomass processing, and resource (waste) recovery which are integral parts of the CELSS. Author

N91-24090# Wichita State Univ., KS. Dept. of Industrial Engineering.
COGNITIVE PERFORMANCE CAPABILITIES IN THE COCKPIT
RANDALL M. CHAMBERS and MIHRIBAN WHITMORE *In its* Kansas Aviation Review p 14-20 1991
Avail: NTIS HC/MF A03

Using the cockpit of the Learjet 15 Flight Simulator, nine computerized cognitive performance tests were administered to thirty volunteer subjects who monitored selected flight instruments during laboratory controlled conditions. The primary objective of this research was to measure and assess cognitive performance abilities of subjects as they monitored cockpit instruments while exposed to variations in work load, engine noise, and instrument conditions. Cognitive performance profiles were obtained for subjective judgements and physiological response. Cognitive performance profiles were reported for the following tests: logical relations; following directions; missing items; tower puzzle; word anagrams; mark numbers; information purchase; numbers and words; and route planning. Analysis of variance was conducted to assess the effects of cockpit conditions upon cognition test scores and performance profiles. Author

N91-24165# Wichita State Univ., KS.
HUMAN FACTORS COCKPIT: A SYSTEM AND HUMAN FACTORS PROGRAM TO ENHANCE SAFETY AND EFFICIENCY IN SINGLE PILOT IFR AND TERMINAL AREA OPERATIONS
RANDALL M. CHAMBERS, PAUL YORK, M. GAWAD NAGATI, and DAVID ELLIS *In its* Program Plans for Aviation Safety Research 11 p Dec. 1990
Avail: NTIS HC/MF A04

The objective is to study the interrelationships between the pilot, the aircraft, and its on-board flight control and avionics systems in an effort to determine how best to apply these new technologies. The accomplishment of this objective requires the development of the required navigation, display, and simulation system components. Author

N91-24604*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CETA TRUCK AND EVA RESTRAINT SYSTEM
DAVID C. BEALS and WAYNE R. MERSON (Lockheed Engineering and Sciences Co., Hampton, VA.) *In* JPL, The 25th Aerospace Mechanisms Symposium p 1-14 May 1991
Avail: NTIS HC/MF A15 CSCL 05/8

The Crew Equipment Translation Aid (CETA) experiment is an extravehicular activity (EVA) Space Transportation System (STS) based flight experiment which will explore various modes of transporting astronauts and light equipment for Space Station Freedom (SSF). The basic elements of CETA are: (1) two 25 foot long sections of monorail, which will be EVA assembled in the STS cargo bay to become a single 50 ft. rail called the track; (2) a wheeled baseplate called the truck which rolls along the track and can accept three cart concepts; and (3) the three carts which are designated manual, electric, and mechanical. The three carts serve as the astronaut restraint and locomotive interfaces with the track. The manual cart is powered by the astronaut grasping the track's handrail and pulling himself along. The electric cart is operated by an astronaut turning a generator which powers the electric motor and drives the cart. The mechanical cart is driven by a Bendix type transmission and is similar in concept to a man-propelled railroad cart. During launch and landing, the truck is attached to the deployable track by means of EVA removable restraint bolts and held in position by a system of retractable shims. These shims are positioned on the exterior of the rail for launch and landing and rotate out of the way for the duration of the experiment. The shims are held in position by strips of Velcro nap, which rub against the sides of the shim and exert a tailored force. The amount of force required to rotate the shims was a major EVA concern, along with operational repeatability and extreme temperature effects. The restraint system was tested in a thermal-vac and vibration environment and was shown to meet all of the initial design requirements. Using design inputs from the astronauts who will perform the EVA, CETA evolved through an iterative design process and represented a cooperative effort. Author

N91-24665# Meteorological Satellite Center, Tokyo (Japan).
ADDED INFORMATION BY MAN-MACHINE INTERACTIVE OPERATION OF THE SCIC
YOSHIHIKO ANDO *In its* Meteorological Satellite Center Technical Note, No. 21, 1990 p 33-46 Dec. 1990 In JAPANESE; ENGLISH summary
Avail: NTIS HC/MF A05

Answers were received from questionnaires on the Satellite Cloud Information Chart (SCIC) from users, and then improved to be more useful. The summary of the answers is presented, and improvements and some uses of the SCIC are explained. Author

N91-24738# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
A MOTION ACTIVATED ARTICULATING SEAT (MAAS): A DYNAMIC CONCEPT FOR COCKPIT SEAT DESIGN IN HIGH PERFORMANCE AIRCRAFT Special Report, Aug. 1987 - Aug. 1988
VANCE D. SKOWRONSKI, ROBERT ESKEN, JAMES COOPER, and ALVA KARL Nov. 1990 5 p Prepared in cooperation with Systems Research Labs., Inc., Dayton, OH
(AD-A231698; AAMRL-SR-90-508) Avail: NTIS HC/MF A01 CSCL 01/3

The motion activated articulating seat (MAAS) is a pilot aid in lifting the shoulder/upper torso while flying an aircraft. The MAAS system has the ability to respond rapidly should the pilot require a different shoulder/upper torso position in response to changing mission requirements, such as checking 6. The approach uses a high speed desk top computer, a video camera, a specialized video processing capture board, a set of specifically geometrically designed air bags (three independently functionable) with operational valving, a modified cockpit seat with a 30 degree seat back angle, a flight helmet with identifiable indicators, and an in house developed operating software program. The system has been demonstrated statistically and successfully processed head/helmet movements for generating seat motion. The video capture technique is being applied to other laboratory research efforts. GRA

N91-24739# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
FORMULATIVE EVALUATION STUDY OF A PROTOTYPE NEAR-INFRARED PROJECTION SYSTEM: NIGHT VISION GOGGLE STUDY Interim Report, Aug. - Dec. 1988
GENA M. PEDRONI and GABRIEL P. INTANO Jan. 1991

38 p
(AD-A231759; ARI-RN-91-15) Avail: NTIS HC/MF A03 CSCL 23/2

U.S. Army Aviation relies upon image intensifiers, such as night vision goggles (NVGs), for night nap-of-the-earth (NOE) flight. During initial flight training, OH-58 student pilots are expected to apply academic knowledge of NVG use in flight after limited review. To facilitate OH-58 students' transition to NVG flight, researchers projected images through a prototype near-infrared (IR) video projection system. Helicopter pilot students received hands-on experience with the AN/PVS-5A NVGs, which are compatible with the projection system's output range. Instructor pilots rated OH-58 students' flight performance throughout the night/NVG phase of instruction. A strong positive effect on students' confidence (increase) and anxiety (decrease) levels were observed. No difference in flight performance was observed between matched pairs (experimental vs. control) of students. Additional research is planned in the areas of safety of flight, terrain navigation, special operations, mission planning, and threat recognition. GRA

N91-24740# Department of Transportation, Cambridge, MA.
SHIPBOARD CREW FATIGUE, SAFETY AND REDUCED MANNING Final Report, Jan. 1989 - Nov. 1990
J. K. POLLARD, E. D. SUSSMAN, and M. STEARNS Nov. 1990 109 p Sponsored by Maritime Administration, Washington
(PB91-138099; DOT-VNTSC-MARAD-90-1; DOT-MA-RD-840-90014) Avail: NTIS HC/MF A06 CSCL 06/16

An exploratory first phase of an investigation of human stress and fatigue in the merchant marine is described. Its principle purposes were to survey the effects of fatigue on human performance in the transportation industries, describe the state of the art in measuring fatigue, investigate the causes of stress and fatigue on merchant ships, summarize the insights gained about the implications of reduced manning as well as measures to mitigate fatigue, and discuss the results of preliminary attempts to gauge fatigue during the routing voyages using survey methods. It was concluded that organization and design factors could provide opportunities under some circumstances for the design and operation of advanced merchant ships which can be sailed safely and efficiently by well-rested crews which are smaller than are common today. Dissert. Abstr.

N91-24741# California Univ., Los Angeles.
BENCHMARKING TEXT UNDERSTANDING SYSTEMS TO HUMAN PERFORMANCE: AN EXPLORATION Project Report No. 6, 1 Sep. 1989 - 30 Sep. 1990
FRANCES A. BUTLER, EVA L. BAKER, TINE FALK, HOWARD HERL, and YOUNGHEE JANG Sep. 1990 69 p
(Contract N00014-86-K-0395; NR PROJ. RR0-4206)
(AD-A233306) Avail: NTIS HC/MF A04 CSCL 05/7

This report explores the use of natural language in intelligent computer systems specifically with regard to text understanding systems. The goal of the research was to benchmark selected text understanding systems to human performance in reading comprehension. To this end a reading comprehension test was compiled which included the texts and questions from six intelligent computer systems. This test along with a criterion reading measure was administered to the subjects in the study. The computer systems' performances were then benchmarked to a scale of human performance on reading comprehension as part of the development of the Artificial Intelligence Measurement System (AIMS). GRA

N91-24742# California Univ., Los Angeles. Center for the Study of Evaluation.
HUMAN BENCHMARKING OF EXPERT SYSTEMS Interim Project Report No. 20, 1 Jul. 1989 - 30 Jan. 1990
HAROLD F. ONEIL, JR., YUJING NI, ANAT JACOBY, and KATHLEEN M. SWIGGER Sep. 1990 33 p
(Contract N00014-86-K-0395)
(AD-A233601) Avail: NTIS HC/MF A03 CSCL 12/5

This document outlines the strategy used for benchmarking expert systems to human performance. Two major alternatives for human benchmarking of expert system are proposed: computer science driven or psychological process driven. The computer science driven approach is either (1) expert system driven in which one picks an expert system which encodes an expert, derives psychological processes, and tests the processes with people, or (2) expert system shell driven in which one estimates the intelligence of the shell (parent), assumes that applied expert systems will have similar intelligence, then follows the procedures of the expert system driven approach. The psychological process driven approach involves picking a psychological process, finding an expert system that exemplifies the process, and then tailoring a test for the expert system and for people. The computer science driven approach was used to develop the expert system benchmarking methodology by relating cognitive taxonomies and expert system taxonomies. GRA

N91-24743# California Univ., Los Angeles.
HUMAN BENCHMARKING OF EXPERT SYSTEMS. LITERATURE REVIEW Interim Project Report, No. 19, 1 Jul. 1989 - 30 Jan. 1990
HAROLD F. ONEIL, JR., YUJING NI, and ANAT JACOBY Jan. 1990 48 p
(Contract N00014-86-K-0395)
(AD-A233602) Avail: NTIS HC/MF A03 CSCL 05/8

This literature review provides a context for using the human benchmarking approach with expert systems. It includes three parts: the current status of expert system evaluation; a search for cognitive instruments; and a parallel comparison of categories between expert systems and cognitive skill instruments. The review suggests that there are different approaches to expert system evaluation including evaluation criteria and evaluation procedures. The literature offers diverse environments for capturing developmental aspects of expert system evaluation. The review suggests the possibility of developing a psychometric standard for the evaluation of expert systems and documents similarities and differences between cognitive psychology and artificial intelligence, which is important for the human benchmarking approach. GRA

N91-24744*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS: NATURAL AND ARTIFICIAL ECOSYSTEMS
ROBERT D. MACELROY, ed., BRAD G. THOMPSON, ed., THEODORE W. TIBBITTS, ed., and TYLER VOLK, ed. (New York Univ., New York.) Dec. 1989 185 p The 27th COSPAR Meeting was held in Espoo, Finland, 18-29 Jul. 1988; sponsored by Subcommission F.4
(NASA-CP-10040; A-89105; NAS 1.55:10040) Avail: NTIS HC/MF A09 CSCL 06/11

The scientists supported by the NASA sponsored Controlled Ecological Life Support Systems (CELSS) program have played a major role in creating a Committee on Space Research (COSPAR) section devoted to the development of bioregenerative life support for use in space. The series of 22 papers were sponsored by Subcommission F.4. The papers deal with many of the diverse aspects of life support, and with outgrowth technologies that may have commercial applications in fields such as biotechnology and bioengineering. Papers from researchers in France, Canada, Japan and the USSR are also presented. Author

55

SPACE BIOLOGY

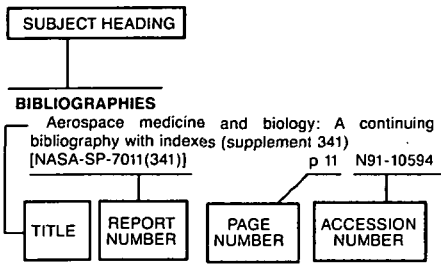
Includes exobiology; planetary biology; and extraterrestrial life.

A91-37367* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
UREY PRIZE LECTURE - PLANETARY EVOLUTION AND THE ORIGIN OF LIFE

CHRISTOPHER P. MCKAY (NASA, Ames Research Center, Moffett Field, CA) Icarus (ISSN 0019-1035), vol. 91, May 1991, p. 93-100. refs

One of the principal questions concerning planetary evolution and life's origins relates to the early-earth organic material's origination in situ, outer solar system importation, or simple irrelevance to the emergence of organisms. Additional considerations encompass the character of interstellar organic material and its relationship to outer solar system organic compounds, and the possibility of life's emergence in the early Mars. Attention is given to the essentiality of liquid water for life-forms, in the role not only of a reaction medium among molecules but that of a basis for hydrophylic and hydrophobic groups' bonding. O.C.

Typical Subject Index Listing



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

A

ABIOGENESIS
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
ABNORMALITIES
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
ACCELERATION PROTECTION
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16
p 228 A91-33375
ACCELERATION STRESSES (PHYSIOLOGY)
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles
p 211 A91-37509
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
Cardiovascular adjustments to gravitational stress
p 215 A91-39505
Gravitational force and the cardiovascular system
p 216 A91-39511
Comments on asymmetric visual loss associated with +Gz-stress p 218 A91-39547
ACCELERATION TOLERANCE
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity
p 209 A91-37482
Cardiovascular responses to sustained acceleration
p 201 A91-37504
Physiologic bases for increased G-level and G-duration tolerances p 210 A91-37505
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles
p 211 A91-37509
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
Human centrifuge onset rates p 214 A91-39399
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
ACOUSTIC IMPEDANCE
The transfer of technology to measure skin burn depth *in humans* p 222 N91-24076
ACOUSTIC PROPERTIES
Auditory-acoustic basis of consonant perception. Attachments A thru I
[AD-A233041] p 223 N91-24734
ACTUATORS
Experimental control results in a compact space robot actuator p 228 A91-38749
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
ADAPTATION
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073
Exposure to stressful environments - Strategy of *adaptive responses* p 215 A91-39507
AEROSPACE ENVIRONMENTS
Payload related crew operations: From past missions to Columbus p 230 N91-23569
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
AEROSPACE MEDICINE
International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings
p 197 A91-37456
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
Spacelab life sciences 1 - Reprints of background life sciences publications --- Book p 214 A91-39501
Heart-lung interactions in aerospace medicine
p 215 A91-39508
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
Transcranial Doppler evaluation of syncope - An application in aerospace physiology p 218 A91-39545
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
AGGREGATES
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
AIR CONDITIONING EQUIPMENT
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing
[AD-A231572] p 232 N91-23717
AIR QUALITY
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549
New research on bioregenerative air/water purification systems p 233 N91-24053
AIRCRAFT ACCIDENT INVESTIGATION
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation
p 229 A91-39550
AIRCRAFT ACCIDENTS
Individual differences underlying pilot cockpit error
[DOT/FAA/RD-91/13] p 225 N91-23710
AIRCRAFT PILOTS
New electronic anti-G valve and regulator ensemble
p 228 A91-39378
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
Superimposed perspective visual cues for helicopter *hovering above a moving ship deck* p 224 A91-39421
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
Personality types among experienced military pilots
p 224 A91-39536
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots
p 229 A91-39548
Choroidal nevi in USAF aviators
[AD-A233042] p 223 N91-24735
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739
AIRCRAFT SURVIVABILITY
Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings p 228 A91-39376
ALBUMINS
Three-dimensional structure of human serum albumin
p 222 N91-24057
ALGAE
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744
ALGORITHMS
Mechanisms of higher brain functions: A study of models of perception
[AD-A232389] p 225 N91-23712
ALTITUDE ACCLIMATIZATION
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
AMBIENT TEMPERATURE
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
AMINO ACIDS
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698
ANGIOGRAPHY
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
ANGULAR VELOCITY
The effect of the angular velocity on the muscle *composition in Japanese quail* p 199 A91-37490
ANIMALS
Multiple neuron recording in the hippocampus of freely moving animals
[AD-A232934] p 205 N91-24725
Exposure standard for fog oil
[AD-A231714] p 223 N91-24729
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096
ANTIGRAVITY
New electronic anti-G valve and regulator ensemble
p 228 A91-39378
ANTIRADIATION DRUGS
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
ARCHAEOLOGY
The Berlenga underwater survey project
p 231 N91-23577

ARMED FORCES (FOREIGN)
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720
ARMED FORCES (UNITED STATES)
Choroidal nevi in USAF aviators
[AD-A233042] p 223 N91-24735
ARTIFICIAL GRAVITY
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500
ARTIFICIAL INTELLIGENCE
The development of highly practiced skills: A starting point for driver modelling
[IZF-1990-B-16] p 232 N91-23719
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
ASTRONAUT PERFORMANCE
Payload related crew operations: From past missions to Columbus p 230 N91-23569
CETA truck and EVA restraint system
p 234 N91-24604
ASTRONAUT TRAINING
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
Subsea habitats and space simulation
p 230 N91-23567
ASTRONAUTS
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
ATROPHY
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
ATTITUDE (INCLINATION)
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474
AUDITORY PERCEPTION
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
Auditory-acoustic basis of consonant perception. Attachments A thru I
[AD-A233041] p 223 N91-24734
AUDITORY SIGNALS
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
AUDITORY TASKS
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
AUTOMATIC CONTROL VALVES
New electronic anti-G valve and regulator ensemble
p 228 A91-39378
AUTONOMIC NERVOUS SYSTEM
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt
p 213 A91-37527
AVIATION PSYCHOLOGY
Personality types among experienced military pilots
p 224 A91-39536
AVIONICS
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165

B

BACTERIA
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693
New hosts and vectors for genome cloning
[DE91-009996] p 204 N91-23696
BARORECEPTORS
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526
BATS
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
BED REST
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure
p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
BIBLIOGRAPHIES
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
BINOCULAR VISION
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539
BIOASTRONAUTICS
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
Competing antagonists to energy production in space and their effect on calcium metabolism
p 200 A91-37493
Plants and men in space - A new field in plant *physiology* *p 226 A91-37494*
Opportunity and challenge in life sciences research on Space Station Freedom p 200 A91-37495
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
Variations of the renal flow in relation with the volemia
p 212 A91-37525
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
A KO2 rebreather for EVA denitrogenation procedure
p 220 N91-23588
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
BIODEGRADATION
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699
BIODYNAMICS
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity
p 209 A91-37482
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model
p 199 A91-37487
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
BIOELECTRIC POTENTIAL
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
BIOELECTRICITY
International conference on Biophysics of Transmembrane Electric Fields
[AD-A232057] p 204 N91-24724
BIOLOGICAL EFFECTS
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722
Biological effects of electromagnetic fields
[DE91-010006] p 205 N91-24727
Identifying and controlling immunotoxic substances: Background paper
[OTA-BP-BA-75] p 223 N91-24730
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096
BIOLOGICAL EVOLUTION
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
BIOLOGICAL MODELS (MATHEMATICS)
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model
p 211 A91-37511
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations
p 227 A91-37517
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
BIOMASS
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
BIOMEDICAL DATA
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
BIOPHYSICS
International conference on Biophysics of Transmembrane Electric Fields
[AD-A232057] p 204 N91-24724
BLOOD
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508
BLOOD CIRCULATION
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184
Comments on asymmetric visual loss associated with +Gz-stress p 218 A91-39547
BLOOD FLOW
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow
p 208 A91-37476
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity
p 201 A91-37514
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep
p 218 A91-40465
Simulation of blood flow through an artificial heart
p 222 N91-24056
BLOOD PLASMA
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles
p 219 A91-40467
BLOOD PRESSURE
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt
p 213 A91-37527
Transcranial Doppler evaluation of syncope - An application in aerospace physiology p 218 A91-39545
BLOOD VOLUME
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497

The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading p 212 A91-37523

BODY COMPOSITION (BIOLOGY)
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421

BODY FLUIDS
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia p 214 A91-39102
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

BODY TEMPERATURE
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours [AD-A232787] p 233 N91-23722

BONE DEMINERALIZATION
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
Competing antagonists to energy production in space and their effect on calcium metabolism p 200 A91-37493
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222

BONE MINERAL CONTENT
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480

BOUNDARY VALUE PROBLEMS
Simulation of blood flow through an artificial heart p 222 N91-24056

BRAIN
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex p 198 A91-37464
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model p 211 A91-37511
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185
Mechanisms of higher brain functions: A study of models of perception [AD-A232389] p 225 N91-23712

BRAIN STEM
The effect of low-frequency vibration on GABA metabolism in several brain structures p 202 A91-39071

BURNS (INJURIES)
The transfer of technology to measure skin burn depth in humans p 222 N91-24076

C

CABIN ATMOSPHERES
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549

CALCIUM
The role of calcium in osteoporosis p 214 A91-39502

CALCIUM METABOLISM
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
Competing antagonists to energy production in space and their effect on calcium metabolism p 200 A91-37493

CALIBRATING
Absolute calibration in vivo measurement systems [DE91-009719] p 203 N91-23692

CANADA
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720

CAPILLARIES (ANATOMY)
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

CARBOHYDRATE METABOLISM
The effect of low-frequency vibration on GABA metabolism in several brain structures p 202 A91-39071

CARBON DIOXIDE
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles [NASA-TM-103819] p 232 N91-23718

CARBON DIOXIDE LASERS
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers [ITN-90-85022] p 222 N91-24728

CARBOXYLIC ACIDS
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation [AD-A232033] p 221 N91-23706

CARCINOGENS
Exposure standard for fog oil [AD-A231714] p 223 N91-24729

CARDIAC OUTPUT
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526

CARDIOGRAPHY
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518

CARDIOVASCULAR SYSTEM
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
Cardiovascular responses to sustained acceleration p 201 A91-37504
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading p 212 A91-37523
Cardiovascular adjustments to gravitational stress p 215 A91-39505
Gravitational force and the cardiovascular system p 216 A91-39511
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466

CAROTID SINUS BODY
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
Comments on asymmetric visual loss associated with +Gz-stress p 218 A91-39547

CAROTID SINUS REFLEX
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526

CARTS
CETA truck and EVA restraint system p 234 N91-24604

CATECHOLAMINE
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
Strategies to sustain and enhance performance in stressful environments [AD-A232698] p 225 N91-23714

CELL DIVISION
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501

CELL MEMBRANES (BIOLOGY)
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
International conference on Biophysics of Transmembrane Electric Fields [AD-A232057] p 204 N91-24724

CELLS (BIOLOGY)
Cell biology --- cell processes in microgravity environments p 215 A91-39506
Molecular studies of cytokine induction [AD-A232221] p 221 N91-23707
International conference on Biophysics of Transmembrane Electric Fields [AD-A232057] p 204 N91-24724
Identifying and controlling immunotoxic substances: Background paper [OTA-BP-BA-75] p 223 N91-24730

CENTRAL NERVOUS SYSTEM
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

CENTRIFUGING STRESS
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Asymmetric visual deficit at high sustained Gz p 218 A91-39546

CEREBRAL CORTEX
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex p 198 A91-37464

CEREBRAL VENTRICLES
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations p 227 A91-37517

CEREBROSPINAL FLUID
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model p 211 A91-37511

CEREBRUM
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465

CHEMICAL BONDS
Three-dimensional structure of human serum albumin p 222 N91-24057

CHEMICAL DEFENSE
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach p 229 A91-39397

CHEMICAL EFFECTS
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing [AD-A231572] p 232 N91-23717

CHOROID MEMBRANES
Choroidal nevi in USAF aviators [AD-A233042] p 223 N91-24735

CHROMOSOMES
Problems in understanding the organization, structure and function of chromosomes [DE91-009939] p 204 N91-23695
New hosts and vectors for genome cloning [DE91-009996] p 204 N91-23696
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697

CIRCADIAN RHYTHMS
Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
Organization of the human circadian system [AD-A233026] p 223 N91-24733

CLEAVAGE
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex [DE91-009071] p 204 N91-23698

CLOSED ECOLOGICAL SYSTEMS
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles [NASA-TM-103819] p 232 N91-23718
New research on bioregenerative air/water purification systems p 233 N91-24053
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems [NASA-CP-10040] p 235 N91-24744

CLOTHING
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720

CLOUDS (METEOROLOGY)
Added information by man-machine interactive operation of the SCIC p 234 N91-24665

COBALT ISOTOPES
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268

COCKPITS
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques [AD-A232732] p 221 N91-23709
Cognitive performance capabilities in the cockpit p 234 N91-24090
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft [AD-A231698] p 234 N91-24738

COGNITION
Individual differences underlying pilot cockpit error [DOT/FAA/RD-91/13] p 225 N91-23710
Mechanisms of higher brain functions: A study of models of perception [AD-A232389] p 225 N91-23712
Cognitive performance capabilities in the cockpit p 234 N91-24090

COGNITIVE PSYCHOLOGY
Human benchmarking of expert systems [AD-A233601] p 235 N91-24742

COLD TOLERANCE
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421

COLUMBUS SPACE STATION
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574

COMMERCIAL AIRCRAFT
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549

COMPATIBILITY
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573

COMPLEX COMPOUNDS
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex [DE91-009071] p 204 N91-23698

COMPOSITE MATERIALS
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation p 229 A91-39550

COMPUTER GRAPHICS
Quantifying improved visual performance through vision training [AD-A232799] p 226 N91-23716

COMPUTER PROGRAMS
Auditory-acoustic basis of consonant perception. Attachments A thru I [AD-A233041] p 223 N91-24734
Human benchmarking of expert systems [AD-A233601] p 235 N91-24742

COMPUTER SYSTEMS PERFORMANCE
Research and development involved in creating a quantitative EEG cartography wide band analysis system [LAAS-91002] p 221 N91-23705

COMPUTER TECHNIQUES
Tracking strategies and cognitive demands p 227 A91-38668
Benchmarking text understanding systems to human performance: An exploration [AD-A233306] p 235 N91-24741

COMPUTERIZED SIMULATION
Physical/chemical closed-loop water-recycling p 233 N91-24052
Simulation of blood flow through an artificial heart p 222 N91-24056

CONDENSATES
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles [NASA-TM-103819] p 232 N91-23718

CONFERENCES
International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings p 197 A91-37456
Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings p 228 A91-39376
International conference on Biophysics of Transmembrane Electric Fields [AD-A232057] p 204 N91-24724

CONFINEMENT
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
Subsea habitats and space simulation p 230 N91-23567
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571

CONSONANTS (SPEECH)
Auditory-acoustic basis of consonant perception. Attachments A thru I [AD-A233041] p 223 N91-24734

CONSTRAINTS
CETA truck and EVA restraint system p 234 N91-24604

CONTACT LENSES
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members p 229 A91-39544

CONTRAST
Spatiotemporal characteristics of visual localization [AD-A232734] p 225 N91-23715

CONTROL SIMULATION
The development of highly practiced skills: A starting point for driver modelling [IZF-1990-B-16] p 232 N91-23719

CONTROL SYSTEMS DESIGN
Experimental control results in a compact space robot actuator p 228 A91-38749
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060

CONTROL THEORY
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747

CONVECTIVE HEAT TRANSFER
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421

CORNEA
An evaluation of the photopic electroretinogram using lower eyelid electrodes [AD-A232988] p 223 N91-24732

CORTICOSTEROIDS
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422

COSMOS SATELLITES
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491

CREWS
Shipboard crew fatigue, safety and reduced manning [PB91-138099] p 235 N91-24740

CRITICAL EXPERIMENTS
Control of biosonar behavior by the auditory cortex [AD-A232699] p 221 N91-23708

CROP GROWTH
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060

CUES
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421

CULTURE (SOCIAL SCIENCES)
Cultural parameters of stress [AD-A232526] p 225 N91-23713

CYTOLOGY
Cell biology --- cell processes in microgravity environments p 215 A91-39506
Molecular studies of cytokine induction [AD-A232221] p 221 N91-23707

D

DATA BASES
The Berlenga underwater survey project p 231 N91-23577

DATA PROCESSING
Benchmarking text understanding systems to human performance: An exploration [AD-A233306] p 235 N91-24741

DECOMPRESSION SICKNESS
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588

DECONDITIONING
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483

DEEP SPACE
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584

DEEP WATER
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584

DEGRADATION
Quantifying performance degradation due to the human-machine interface of telemanipulators [AD-A232814] p 233 N91-23723

DENITROGENATION
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588

DEOXYRIBONUCLEIC ACID
Problems in understanding the organization, structure and function of chromosomes [DE91-009939] p 204 N91-23695
New hosts and vectors for genome cloning [DE91-009996] p 204 N91-23696
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
Isolation, cloning and expression of the genes for microbial polyurethane degradation [AD-A232108] p 204 N91-23699

DEPTH MEASUREMENT
The transfer of technology to measure skin burn depth in humans p 222 N91-24076

DESIGN ANALYSIS
How to design efficient MMI for space p 231 N91-23586

DESYNCHRONIZATION (BIOLOGY)
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570

DETECTION
Spatiotemporal characteristics of visual localization [AD-A232734] p 225 N91-23715

DIETS
Competing antagonists to energy production in space and their effect on calcium metabolism p 200 A91-37493

DIGESTING
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
DIGITAL TECHNIQUES
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705
DISPLAY DEVICES
Target tracking by a human operator
p 226 A91-36932
Evaluation of display system enhancements to assist an operator in the detection of point targets
p 229 A91-39883
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737
DIURESIS
Acute hypoxia-induced diuresis in rats
p 203 A91-39541
DIURNAL VARIATIONS
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia
p 214 A91-39102
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718
DIVING (UNDERWATER)
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
Subsea habitats and space simulation
p 230 N91-23567
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
Manned diving activities in JAMSTEC
p 220 N91-23572
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
DOCUMENTATION
Dependence of the success of flight training on the accentuation of the trainee's character
p 224 A91-39105
DURABILITY
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members
p 229 A91-39544

E

EARTH ORBITAL ENVIRONMENTS
Seeds in space experiment results
p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
ECHOES
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
ECOSYSTEMS
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744
EDEMA
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704
EDUCATION
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
EFFERENT NERVOUS SYSTEMS
Results of studies of motor functions in long-term space flights p 206 A91-37457
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
EJECTION SEATS
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots
p 229 A91-39548
ELECTRIC FIELDS
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074
International conference on Biophysics of Transmembrane Electric Fields
[AD-A232057] p 204 N91-24724
ELECTROCARDIOGRAPHY
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
ELECTRODES
An evaluation of the photopic electroretinogram using lower eyelid electrodes
[AD-A232988] p 223 N91-24732
ELECTROENCEPHALOGRAPHY
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705
ELECTROLYTE METABOLISM
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism --- head down tilt p 212 A91-37520
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
ELECTROLYTIC CELLS
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059
ELECTROMAGNETIC FIELDS
Biological effects of electromagnetic fields
[DE91-010006] p 205 N91-24727
ELECTRON PARAMAGNETIC RESONANCE
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698
ELECTRON TRANSFER
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693
ELECTRONIC EQUIPMENT
New electronic anti-G valve and regulator ensemble
p 228 A91-39378
ELECTRORETINOGRAPHY
An evaluation of the photopic electroretinogram using lower eyelid electrodes
[AD-A232988] p 223 N91-24732
END EFFECTORS
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584
ENERGY TRANSFER
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693
ENVIRONMENT EFFECTS
Exposure to stressful environments - Strategy of adaptive responses p 215 A91-39507
ENVIRONMENTAL TESTS
Seeds in space experiment results
p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
EQUATIONS OF MOTION
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
ERYTHROCYTES
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
ESCHERICHIA
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699
EVALUATION
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
EVOKED RESPONSE (PSYCHOPHYSIOLOGY)
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
EXERCISE PHYSIOLOGY
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542
EXOBIOLOGY
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats
p 202 A91-38222
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096
EXPERT SYSTEMS
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
EXPIRED AIR
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
EXTRAVEHICULAR ACTIVITY
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
EVA servicing: The Hermes capability
p 230 N91-23575
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
EVA/robotics integration for Space Station Freedom
p 231 N91-23583
A KO2 rebreather for EVA denitrogenation procedure
p 220 N91-23588
CETA truck and EVA restraint system
p 234 N91-24604
EYE DISEASES
Choroidal nevi in USAF aviators
[AD-A233042] p 223 N91-24735
EYE MOVEMENTS
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503

F

F-15 AIRCRAFT
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16
p 228 A91-39375
F-16 AIRCRAFT
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16
p 228 A91-39375
Human centrifuge onset rates p 214 A91-39399
FAILURE ANALYSIS
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation
p 229 A91-39550
FATIGUE (BIOLOGY)
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
FATTY ACIDS
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles
p 219 A91-40467
FEEDBACK CIRCUITS
Mechanisms of higher brain functions: A study of models of perception
[AD-A232389] p 225 N91-23712
FEMALES
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots
p 229 A91-39548
FIELD STRENGTH
Biological effects of electromagnetic fields
[DE91-010006] p 205 N91-24727
FIGHTER AIRCRAFT
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738
FILTRATION
New research on bioregenerative air/water purification systems p 233 N91-24053
FINITE ELEMENT METHOD
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468
FLEXIBLE SPACECRAFT
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220

FLIGHT CLOTHING
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots p 229 A91-39548
FLIGHT CONTROL
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
FLIGHT CREWS
Results of studies of motor functions in long-term space flights p 206 A91-37457
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
Nutritional assessment of cockpit crew meal p 213 A91-37717
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach p 229 A91-39397
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members p 229 A91-39544
FLIGHT FITNESS
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
FLIGHT INSTRUMENTS
Cognitive performance capabilities in the cockpit p 234 N91-24090
FLIGHT SIMULATORS
Cognitive performance capabilities in the cockpit p 234 N91-24090
FLIGHT TESTS
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
FLUID MECHANICS
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations p 227 A91-37517
FLUORINE COMPOUNDS
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation [AD-A232033] p 221 N91-23706
FOG
Exposure standard for fog oil [AD-A231714] p 223 N91-24729
FOOD PRODUCTION (IN SPACE)
Plants and men in space - A new field in plant physiology p 226 A91-37494
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
FOREARM
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
FUNGI
Isolation, cloning and expression of the genes for microbial polyurethane degradation [AD-A232108] p 204 N91-23699

G

GAS EXCHANGE
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles [NASA-TM-103819] p 232 N91-23718
GAS MIXTURES
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
GAS VALVES
New electronic anti-G valve and regulator ensemble p 228 A91-39378
GENE EXPRESSION
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
Isolation, cloning and expression of the genes for microbial polyurethane degradation [AD-A232108] p 204 N91-23699
GENES
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
GENETIC CODE
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
GENETIC ENGINEERING
New hosts and vectors for genome cloning [DE91-009996] p 204 N91-23696
Isolation, cloning and expression of the genes for microbial polyurethane degradation [AD-A232108] p 204 N91-23699
GENETICS
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
GEOCHEMISTRY
Exploratory data analysis on data generated in the DOE subsurface microbiology program [DE91-007575] p 205 N91-24726
GEOLOGY
Exploratory data analysis on data generated in the DOE subsurface microbiology program [DE91-007575] p 205 N91-24726
GEOMAGNETISM
Biological effects of electromagnetic fields [DE91-010006] p 205 N91-24727
GEOMETRIC ACCURACY
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573
GERMINATION
Seeds in space experiment results p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
GLOVES
Advanced technology application in the production of space suit gloves p 228 A91-39391
GLUTAMIC ACID
The effect of low-frequency vibration on GABA metabolism in several brain structures p 202 A91-39071
GOGGLES
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study [AD-A231759] p 234 N91-24739
GRAVIRECEPTORS
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
GRAVITATIONAL EFFECTS
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity p 207 A91-37463
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
Cardiovascular adjustments to gravitational stress p 215 A91-39505
Cell biology --- cell processes in microgravity environments p 215 A91-39506
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
Gravitational force and the cardiovascular system p 216 A91-39511
GRAVITATIONAL PHYSIOLOGY
Effect of microgravity on the respiratory system p 206 A91-36419
International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings p 197 A91-37456
Destructive and adaptive processes in human vertebral column under altered gravitational potential p 206 A91-37458
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
Opportunity and challenge in life sciences research on Space Station Freedom p 200 A91-37495
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
Physiologic bases for increased G-level and G-duration tolerances p 210 A91-37505
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles p 211 A91-37509
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model p 211 A91-37511
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527
Gravitational force and the cardiovascular system p 216 A91-39511
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058

H

HABITATS
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185
Subsea habitats and space simulation p 230 N91-23567
HEAD DOWN TILT
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus p 210 A91-37503
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism --- head down tilt p 212 A91-37520
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading p 212 A91-37523
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia p 214 A91-39102
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [NASA-TM-103847] p 221 N91-23704
HEAD-UP DISPLAYS
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421
HEALTH
Exposure standard for fog oil [AD-A231714] p 223 N91-24729

HEART
Heart-lung interactions in aerospace medicine p 215 A91-39508

HEART FUNCTION
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons p 201 A91-37512
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518

HEART RATE
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720

HEART VALVES
Simulation of blood flow through an artificial heart p 222 N91-24056

HEAT TOLERANCE
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720

HELICOPTER PERFORMANCE
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421

HELMETS
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation p 229 A91-39550

HEMODYNAMIC RESPONSES
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474

HEMODYNAMICS
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons p 201 A91-37512
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184
Cardiovascular adjustments to gravitational stress p 215 A91-39505

HERMES MANNED SPACEPLANE
EVA servicing: The Hermes capability p 230 N91-23575

HIGH GRAVITY ENVIRONMENTS
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16 p 228 A91-39375
Human centrifuge onset rates p 214 A91-39399

HIGH TEMPERATURE ENVIRONMENTS
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543

HIPPOCAMPUS
Multiple neuron recording in the hippocampus of freely moving animals
[AD-A232934] p 205 N91-24725

HISTOLOGY
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492

HOLE BURNING
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693

HOLMIUM
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728

HORMONE METABOLISMS
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia p 214 A91-39102
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103

HORMONES
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496

HOVERING
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421

HUMAN BEINGS
Robotics for recombinant DNA and human genetics research
[DE90-016440] p 204 N91-23697
The transfer of technology to measure skin burn depth in humans p 222 N91-24076
Organization of the human circadian system
[AD-A233026] p 223 N91-24733

HUMAN BODY
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185

HUMAN CENTRIFUGES
Development of an Artificial Gravity Sleeper (AGS) p 227 A91-37500
Human centrifuge onset rates p 214 A91-39399

HUMAN FACTORS ENGINEERING
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742

HUMAN PERFORMANCE
Perception of the body in space - Mechanisms p 216 A91-39515
Human Performance Assessment Methods. Addendum
[AGARD-AG-308-ADD] p 225 N91-23711
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742

HUMAN REACTIONS
The development of highly practiced skills: A starting point for driver modelling
[IZF-1990-B-16] p 232 N91-23719

HUMAN TOLERANCES
Physiologic bases for increased G-level and G-duration tolerances p 210 A91-37505
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468

HUMIDITY
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718

HYDRATION
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

HYDROLOGY
Exploratory data analysis on data generated in the DOE subsurface microbiology program
[DE91-007575] p 205 N91-24726

HYDROSTATIC PRESSURE
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP --- Lower Body Positive Pressure p 198 A91-37474

HYOSCINE
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537

HYPERBARIC CHAMBERS
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571

HYPERTHERMIA
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104

HYPOKINESIA
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia p 214 A91-39102

HYPOTENSION
Orthostatic hypotension p 215 A91-39504
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539
Acute hypoxia-induced diuresis in rats p 203 A91-39541

HYPOTHERMIA
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

HYPOVOLEMIA
Variations of the renal flow in relation with the volemia p 212 A91-37525

HYPOXEMIA
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423

HYPOXIA
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184
Acute hypoxia-induced diuresis in rats p 203 A91-39541
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466

I

ILLUMINATION
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722

IMAGE ANALYSIS
What eye model should we use for MRT testing? p 229 A91-39882
Human recognition of infrared images p 230 A91-39884

IMAGE CONTRAST
What eye model should we use for MRT testing? p 229 A91-39882
Evaluation of display system enhancements to assist an operator in the detection of point targets p 229 A91-39883

IMAGE INTENSIFIERS
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739

IMAGE PROCESSING
Absolute calibration in vivo measurement systems
[DE91-009719] p 203 N91-23692

IMAGE RESOLUTION
What eye model should we use for MRT testing? p 229 A91-39882

IMAGING TECHNIQUES
Absolute calibration in vivo measurement systems
[DE91-009719] p 203 N91-23692

IMMOBILIZATION
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072
IMMUNE SYSTEMS
Identifying and controlling immunotoxic substances: Background paper
[OTA-BP-BA-75] p 223 N91-24730
IMMUNOASSAY
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
IMMUNOLOGY
Identifying and controlling immunotoxic substances: Background paper
[OTA-BP-BA-75] p 223 N91-24730
IMPACT ACCELERATION
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
INCOMPRESSIBLE FLUIDS
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations p 227 A91-37517
INDEXES (DOCUMENTATION)
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
INDOOR AIR POLLUTION
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549
New research on bioregenerative air/water purification systems p 233 N91-24053
INFRARED IMAGERY
What eye model should we use for MRT testing? p 229 A91-39882
Evaluation of display system enhancements to assist an operator in the detection of point targets p 229 A91-39883
Human recognition of infrared images p 230 A91-39884
INFRARED SCANNERS
Evaluation of display system enhancements to assist an operator in the detection of point targets p 229 A91-39883
INGESTION (BIOLOGY)
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
INTERFACES
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
INTERNATIONAL SYSTEM OF UNITS
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573
INTRAVASCULAR SYSTEM
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
INTRAVEHICULAR ACTIVITY
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
ION CONCENTRATION
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058

J

JUDGMENTS
Spatiotemporal characteristics of visual localization
[AD-A232734] p 225 N91-23715

L

LABORATORY EQUIPMENT
Opportunity and challenge in life sciences research on Space Station Freedom p 200 A91-37495
LABYRINTH
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
LASER BEAMS
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728
LASER TARGET INTERACTIONS
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728
LAUNCHING
CETA truck and EVA restraint system p 234 N91-24604
LESIONS
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
LEUKOCYTES
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072
LIFE SCIENCES
Spacelab life sciences 1 - Reprints of background life sciences publications --- Book p 214 A91-39501
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
LIFE SUPPORT SYSTEMS
Plants and men in space - A new field in plant physiology p 226 A91-37494
Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings p 228 A91-39376
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
LIGANDS
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698
Three-dimensional structure of human serum albumin p 222 N91-24057
LIMBS (ANATOMY)
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
LIPID METABOLISM
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074
LIVER
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation
[AD-A232033] p 221 N91-23706
LONG DURATION EXPOSURE FACILITY
Seeds in space experiment results p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
LONG DURATION SPACE FLIGHT
Results of studies of motor functions in long-term space flights p 206 A91-37457
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
LOWER BODY NEGATIVE PRESSURE
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Endurance exercise training reduces orthostatic tolerance in humans p 208 A91-37477
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
LUMINOUS INTENSITY
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722
LUNGS
Heart-lung interactions in aerospace medicine p 215 A91-39508
LYSOSOMES
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072

M

MALES
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704
MAN MACHINE SYSTEMS
Target tracking by a human operator p 226 A91-36932
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576
How to design efficient MMI for space p 231 N91-23586
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
The development of highly practiced skills: A starting point for driver modelling
[IZF-1990-B-16] p 232 N91-23719
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
Added information by man-machine interactive operation of the SCIC p 234 N91-24665
MANAGEMENT
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573
MANGANESE COMPOUNDS
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698
MANIPULATORS
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
MANNED ORBITAL LABORATORIES
Payload related crew operations: From past missions to Columbus p 230 N91-23569
MANNED SPACE FLIGHT
Results of studies of motor functions in long-term space flights p 206 A91-37457
Destructive and adaptive processes in human vertebral column under altered gravitational potential p 206 A91-37458
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
MANNED SPACECRAFT
Payload related crew operations: From past missions to Columbus p 230 N91-23569
MANPOWER
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
MARINE ENVIRONMENTS
Subsea habitats and space simulation p 230 N91-23567
MARINE TRANSPORTATION
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
MATHEMATICAL MODELS
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations p 227 A91-37517
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737
MEDICAL ELECTRONICS
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705

MENSTRUATION
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots p 229 A91-39548
MENTAL PERFORMANCE
Individual differences underlying pilot cockpit error [DOT/FAA/RD-91/13] p 225 N91-23710
Human Performance Assessment Methods. Addendum [AGARD-AG-308-ADD] p 225 N91-23711
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours [AD-A232787] p 233 N91-23722
Cognitive performance capabilities in the cockpit p 234 N91-24090
METABOLISM
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation [AD-A232033] p 221 N91-23706
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720
METABOLITES
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542
MICROBIOLOGY
Exploratory data analysis on data generated in the DOE subsurface microbiology program [DE91-007575] p 205 N91-24726
MICROCLIMATOLOGY
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing [AD-A231572] p 232 N91-23717
MICROCOMPUTERS
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
MICROORGANISMS
Exploratory data analysis on data generated in the DOE subsurface microbiology program [DE91-007575] p 205 N91-24726
MILITARY AIRCRAFT
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach p 229 A91-39397
MILITARY AVIATION
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
Personality types among experienced military pilots p 224 A91-39536
MILITARY OPERATIONS
Modeling for human performance assessment [AD-A232905] p 226 N91-24736
MILITARY PSYCHOLOGY
Dependence of the success of flight training on the accentuation of the trainee's character p 224 A91-39105
MINERAL METABOLISM
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
MINERAL OILS
Exposure standard for fog oil [AD-A231714] p 223 N91-24729
MIR SPACE STATION
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
MISSION PLANNING
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft [AD-A231698] p 234 N91-24738
MODELS
Mechanisms of higher brain functions: A study of models of perception [AD-A232389] p 225 N91-23712
MOLECULAR EXCITATION
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study [DE91-010181] p 203 N91-23693
MOLECULAR STRUCTURE
Problems in understanding the organization, structure and function of chromosomes [DE91-009939] p 204 N91-23695
MONITORS
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
MOTION PERCEPTION
Reaction time to motion offset of visual stimuli p 224 A91-37280
Mechanisms of motion perception: Integration of direction, velocity, and space [AD-A233340] p 226 N91-24737
MOTION SICKNESS
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
MOTION SICKNESS DRUGS
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
MOTION SIMULATORS
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
MOTION STABILITY
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
MOTOR VEHICLES
The development of highly practiced skills: A starting point for driver modelling [IZF-1990-B-16] p 232 N91-23719
MUSCLES
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468
MUSCULAR FUNCTION
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489
MUSCULAR STRENGTH
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
MUSCULAR TONUS
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
MUSCULOSKELETAL SYSTEM
Destructive and adaptive processes in human vertebral column under altered gravitational potential p 206 A91-37458
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
MYOCARDIUM
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513

N

NATURAL LANGUAGE (COMPUTERS)
Benchmarking text understanding systems to human performance: An exploration [AD-A233306] p 235 N91-24741
NAVIGATION AIDS
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
NEODYMIUM LASERS
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers [ITN-90-85022] p 222 N91-24728
NERVOUS SYSTEM
Electrovestibulography in experimental animals p 200 A91-37502
NEURONS
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
Multiple neuron recording in the hippocampus of freely moving animals [AD-A232934] p 205 N91-24725
Organization of the human circadian system [AD-A233026] p 223 N91-24733
NEUROPHYSIOLOGY
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques [AD-A232732] p 221 N91-23709
Organization of the human circadian system [AD-A233026] p 223 N91-24733
NEUROSPORA
Isolation, cloning and expression of the genes for microbial polyurethane degradation [AD-A232108] p 204 N91-23699
NEUTRAL BUOYANCY SIMULATION
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
EVA/robotics integration for Space Station Freedom p 231 N91-23583
NIGHT
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours [AD-A232787] p 233 N91-23722
NIGHT VISION
What eye model should we use for MRT testing? p 229 A91-39882
Human recognition of infrared images p 230 A91-39884
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study [AD-A231759] p 234 N91-24739
NITROGEN
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles p 219 A91-40467
NOREPINEPHRINE
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
NUCLEAR MAGNETIC RESONANCE
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
Absolute calibration in vivo measurement systems [DE91-009719] p 203 N91-23692
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation [AD-A232033] p 221 N91-23706
NUCLEASE
Molecular studies of cytokine induction [AD-A232221] p 221 N91-23707
NUTRITIONAL REQUIREMENTS
Competing antagonists to energy production in space and their effect on calcium metabolism p 200 A91-37493
Nutritional assessment of cockpit crew meal p 213 A91-37717
NYSTAGMUS
Otolith responses in man during parabolic flight [IZF-1990-A-32] p 220 N91-23703

O

OBJECT PROGRAMS
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
OCULOMOTOR NERVES
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity p 207 A91-37463
OPERATOR PERFORMANCE
Target tracking by a human operator p 226 A91-36932
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings) p 213 A91-39073
Quantifying performance degradation due to the human-machine interface of telemanipulators [AD-A232814] p 233 N91-23723
OPTICAL TRACKING
Target tracking by a human operator p 226 A91-36932
Tracking strategies and cognitive demands p 227 A91-38668

ORBITAL ASSEMBLY
EVA/robotics integration for Space Station Freedom p 231 N91-23583

ORGANIC PEROXIDES
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074

ORTHOSTATIC TOLERANCE
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Endurance exercise training reduces orthostatic tolerance in humans p 208 A91-37477
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527
Orthostatic hypotension p 215 A91-39504

OSTEOPOROSIS
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222
The role of calcium in osteoporosis p 214 A91-39502

OTOLITH ORGANS
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus p 210 A91-37503
Otolith responses in man during parabolic flight [IZF-1990-A-32] p 220 N91-23703

OXYGEN
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex [DE91-009071] p 204 N91-23698

OXYGEN BREATHING
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588

OXYGEN PRODUCTION
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059

P

PARABOLIC FLIGHT
Otolith responses in man during parabolic flight [IZF-1990-A-32] p 220 N91-23703

PARAMECIA
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501

PARAMETERIZATION
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568

PASSENGER AIRCRAFT
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549

PATTERN RECOGNITION
Human recognition of infrared images p 230 A91-39884
Mechanisms of motion perception: Integration of direction, velocity, and space [AD-A233340] p 226 N91-24737

PAYLOADS
Payload related crew operations: From past missions to Columbus p 230 N91-23569

PERFORMANCE PREDICTION
Modeling for human performance assessment [AD-A232905] p 226 N91-24736

PERFORMANCE TESTS
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
Cognitive performance capabilities in the cockpit p 234 N91-24090

PERIODIC VARIATIONS
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings) p 213 A91-39073

PERSONALITY
Personality types among experienced military pilots p 224 A91-39536
Individual differences underlying pilot cockpit error [DOT/FAA/RD-91/13] p 225 N91-23710

PERSONALITY TESTS
Dependence of the success of flight training on the accentuation of the trainee's character p 224 A91-39105

PERSONNEL SELECTION
Subsea habitats and space simulation p 230 N91-23567

PHOTOSENSITIVITY
An evaluation of the photopic electroretinogram using lower eyelid electrodes [AD-A232988] p 223 N91-24732

PHOTOSTRESSES
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539

PHOTOSYNTHESIS
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study [DE91-010181] p 203 N91-23693

PHYSICAL EXAMINATIONS
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535

PHYSICAL EXERCISE
Results of studies of motor functions in long-term space flights p 206 A91-37457
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
Endurance exercise training reduces orthostatic tolerance in humans p 208 A91-37477
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons p 201 A91-37512

PHYSICAL FACTORS
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568

PHYSICAL FITNESS
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542

PHYSICAL WORK
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720

PHYSIOLOGICAL ACCELERATION
Asymmetric visual deficit at high sustained Gz p 218 A91-39546

PHYSIOLOGICAL DEFENSES
Identifying and controlling immunotoxic substances: Background paper [OTA-BP-BA-75] p 223 N91-24730

PHYSIOLOGICAL EFFECTS
Exposure standard for fog oil [AD-A231714] p 223 N91-24729

PHYSIOLOGICAL RESPONSES
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422
Cardiovascular responses to sustained acceleration p 201 A91-37504
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism --- head down tilt p 212 A91-37520
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526
The effect of low-frequency vibration on GABA metabolism in several brain structures p 202 A91-39071
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
A systems approach to the physiology of weightlessness p 216 A91-39514
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
Otolith responses in man during parabolic flight [IZF-1990-A-32] p 220 N91-23703
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [NASA-TM-103847] p 221 N91-23704
Strategies to sustain and enhance performance in stressful environments [AD-A232698] p 225 N91-23714

PHYSIOLOGICAL TESTS
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540

PHYSIOLOGY
Absolute calibration in vivo measurement systems [DE91-009719] p 203 N91-23692

PILOT ERROR
Individual differences underlying pilot cockpit error [DOT/FAA/RD-91/13] p 225 N91-23710

PILOT PERFORMANCE
Dependence of the success of flight training on the accentuation of the trainee's character p 224 A91-39105
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539
Strategies to sustain and enhance performance in stressful environments [AD-A232698] p 225 N91-23714
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
Choroidal nevi in USAF aviators [AD-A233042] p 223 N91-24735
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft [AD-A231698] p 234 N91-24738

PILOT TRAINING
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study [AD-A231759] p 234 N91-24739

PLANETARY EVOLUTION
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367

PLANTS (BOTANY)
Plants and men in space - A new field in plant physiology p 226 A91-37494
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study [DE91-010181] p 203 N91-23693
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096

PLATELETS
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles p 219 A91-40467

PNEUMATIC EQUIPMENT
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381

POTABLE WATER
Physical/chemical closed-loop water-recycling p 233 N91-24052

POTASSIUM OXIDES
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588

PRESSURE BREATHING
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach p 229 A91-39397

PRESSURE CHAMBERS
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104

PRESSURE EFFECTS
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568

PRESSURE SUITS
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498

PROSTHETIC DEVICES
Simulation of blood flow through an artificial heart p 222 N91-24056
PROTECTIVE CLOTHING
New electronic anti-G valve and regulator ensemble p 228 A91-39378
Advanced technology application in the production of space suit gloves p 228 A91-39391
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing [AD-A231572] p 232 N91-23717
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720
PROTEIN METABOLISM
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
PROTEIN SYNTHESIS
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
PROTEINS
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
PROTOTYPES
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study [AD-A231759] p 234 N91-24739
PSYCHOLOGICAL FACTORS
Personality types among experienced military pilots p 224 A91-39536
Individual differences underlying pilot cockpit error [DOT/FAA/RD-91/13] p 225 N91-23710
Spatiotemporal characteristics of visual localization [AD-A232734] p 225 N91-23715
PSYCHOLOGICAL TESTS
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
Human Performance Assessment Methods. Addendum [AGARD-AG-308-ADD] p 225 N91-23711
PSYCHOMETRICS
Human Performance Assessment Methods. Addendum [AGARD-AG-308-ADD] p 225 N91-23711
PSYCHOMOTOR PERFORMANCE
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
PSYCHOPHYSICS
Spatiotemporal characteristics of visual localization [AD-A232734] p 225 N91-23715
PULMONARY CIRCULATION
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
PULMONARY FUNCTIONS
Effect of microgravity on the respiratory system p 206 A91-36419

R

RADAR IMAGERY
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
RADIATION DOSAGE
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
RADIATION EFFECTS
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
RADIATION MEASUREMENT
Absolute calibration in vivo measurement systems [DE91-009719] p 203 N91-23692
RADIOACTIVE ISOTOPES
Absolute calibration in vivo measurement systems [DE91-009719] p 203 N91-23692
RADIOBIOLOGY
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
RAILS
CETA truck and EVA restraint system p 234 N91-24604
RAPID EYE MOVEMENT STATE
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465
RATS
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation [AD-A232033] p 221 N91-23706
REACTION TIME
Reaction time to motion offset of visual stimuli p 224 A91-37280
READING
Benchmarking text understanding systems to human performance: An exploration [AD-A233306] p 235 N91-24741
REAL TIME OPERATION
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
REBREATHING
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588
REDUCED GRAVITY
Effect of microgravity on the respiratory system p 206 A91-36419
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex p 198 A91-37464
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
Spacelab life sciences 1 - Reprints of background life sciences publications --- Book p 214 A91-39501
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
Payload related crew operations: From past missions to Columbus p 230 N91-23569
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [NASA-TM-103847] p 221 N91-23704
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
REGENERATION (PHYSIOLOGY)
New research on bioregenerative air/water purification systems p 233 N91-24053
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems [NASA-CP-10040] p 235 N91-24744
REGULATORY MECHANISMS (BIOLOGY)
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185
REMOTE CONTROL
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576
The Berlenga underwater survey project p 231 N91-23577
REMOTE SENSING
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
REMOTELY PILOTED VEHICLES
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576
RENAL FUNCTION
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
Variations of the renal flow in relation with the volemia p 212 A91-37525
RESEARCH AND DEVELOPMENT
Manned diving activities in JAMSTEC p 220 N91-23572
RESPIRATION
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
RESPIRATORY IMPEDANCE
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
RESPIRATORY PHYSIOLOGY
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
RESPIRATORY RATE
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
RESPIRATORY REFLEXES
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
RESPIRATORY SYSTEM
Effect of microgravity on the respiratory system p 206 A91-36419
RETRACTABLE EQUIPMENT
CETA truck and EVA restraint system p 234 N91-24604
RIBONUCLEIC ACIDS
Molecular studies of cytokine induction [AD-A232221] p 221 N91-23707
ROBOT CONTROL
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
Experimental control results in a compact space robot actuator p 228 A91-38749
ROBOT DYNAMICS
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
ROBOTICS
Experimental control results in a compact space robot actuator p 228 A91-38749
The Berlenga underwater survey project p 231 N91-23577
EVA/robotics integration for Space Station Freedom p 231 N91-23583
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697
Quantifying performance degradation due to the human-machine interface of telemanipulators [AD-A232814] p 233 N91-23723
ROLL
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
ROOT-MEAN-SQUARE ERRORS
Tracking strategies and cognitive demands p 227 A91-38668
RULES
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573

S

SAFETY
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
SAFETY FACTORS
Shipboard crew fatigue, safety and reduced manning [PB91-138099] p 235 N91-24740
SATELLITE OBSERVATION
Added information by man-machine interactive operation of the SCIC p 234 N91-24665
SEA WATER
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

SEATS
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738
SEEDS
Seeds in space experiment results
p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
SELECTION
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
SEMICIRCULAR CANALS
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503
SENSITIVITY
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
SENSORY DEPRIVATION
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422
SENSORY PERCEPTION
Macular bioaccelerometers on earth and in space
p 216 A91-39512
Perception of the body in space - Mechanisms
p 216 A91-39515
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
Multiple neuron recording in the hippocampus of freely moving animals
[AD-A232934] p 205 N91-24725
SENSORY STIMULATION
Electrovestibulography in experimental animals
p 200 A91-37502
SEPARATED FLOW
Simulation of blood flow through an artificial heart
p 222 N91-24056
SERUMS
Three-dimensional structure of human serum albumin
p 222 N91-24057
SERVICE MODULES
EVA servicing: The Hermes capability
p 230 N91-23575
SEX FACTOR
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
SHIPS
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
SHIVERING
Shivering onset, metabolic response, and convective heat transfer during cold air exposure
p 206 A91-36421
SIGNS AND SYMPTOMS
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
SINGULARITY (MATHEMATICS)
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
SITTING POSITION
Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101
SKIN (ANATOMY)
The transfer of technology to measure skin burn depth in humans p 222 N91-24076
SLEEP
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep
p 218 A91-40465
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
SLEEP DEPRIVATION
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
Strategies to sustain and enhance performance in stressful environments
[AD-A232698] p 225 N91-23714
SMOKE
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549
SOFTWARE TOOLS
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission
p 231 N91-23589
SOLAR SYSTEM EVOLUTION
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
SOLID STATE
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059
SONAR
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
SPACE ENVIRONMENT SIMULATION
Subsea habitats and space simulation
p 230 N91-23567
Long duration hyperbaric confinement: Hydra 9
p 220 N91-23571
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
SPACE FLIGHT
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex
p 198 A91-37464
SPACE FLIGHT FEEDING
Competing antagonists to energy production in space and their effect on calcium metabolism
p 200 A91-37493
SPACE FLIGHT STRESS
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
SPACE NAVIGATION
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
SPACE PERCEPTION
Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101
SPACE SHUTTLE MISSION 51-C
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
SPACE STATIONS
Opportunity and challenge in life sciences research on Space Station Freedom p 200 A91-37495
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
SPACE SUITS
Advanced technology application in the production of space suit gloves p 228 A91-39391
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
EVA/robotics integration for Space Station Freedom
p 231 N91-23583
SPACE TOOLS
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
Experimental control results in a compact space robot actuator p 228 A91-38749
SPACEBORNE EXPERIMENTS
Seeds in space experiment results
p 205 N91-25094
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096
SPACECREWS
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
SPATIAL DISTRIBUTION
Spatiotemporal characteristics of visual localization
[AD-A232734] p 225 N91-23715
SPECTROSCOPY
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation
[AD-A232033] p 221 N91-23706
SPECTRUM ANALYSIS
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705
SPEECH RECOGNITION
Auditory-acoustic basis of consonant perception. Attachments A thru I
[AD-A233041] p 223 N91-24734
SPINE
Destructive and adaptive processes in human vertebral column under altered gravitational potential
p 206 A91-37458
STANDARDS
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
STRESS (PHYSIOLOGY)
Exposure to stressful environments - Strategy of adaptive responses p 215 A91-39507
Cultural parameters of stress
[AD-A232526] p 225 N91-23713
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing
[AD-A231572] p 232 N91-23717
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
STRESS (PSYCHOLOGY)
Human Performance Assessment Methods. Addendum
[AGARD-AG-308-ADD] p 225 N91-23711
Cultural parameters of stress
[AD-A232526] p 225 N91-23713
Strategies to sustain and enhance performance in stressful environments
[AD-A232698] p 225 N91-23714
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
SUBMERGING
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
SUPERSONIC AIRCRAFT
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738
SUPINE POSITION
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions
p 207 A91-37468
SURVIVAL EQUIPMENT
Annual SAFE Symposium, 27th, New Orleans, LA, Dec. 5-8, 1989, Proceedings p 228 A91-39376
SYMPATHETIC NERVOUS SYSTEM
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
SYNCOPE
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
Transcranial Doppler evaluation of syncope - An application in aerospace physiology p 218 A91-39545
SYSTEMS ANALYSIS
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
SYSTEMS ENGINEERING
EVA servicing: The Hermes capability
p 230 N91-23575
How to design efficient MMI for space
p 231 N91-23586
SYSTOLIC PRESSURE
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471

T

TABLETS
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
TARGET ACQUISITION
Evaluation of display system enhancements to assist an operator in the detection of point targets
p 229 A91-39883
TARGET RECOGNITION
Target tracking by a human operator
p 226 A91-36932
TASKS
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
TECHNOLOGY TRANSFER
The transfer of technology to measure skin burn depth in humans p 222 N91-24076
TECHNOLOGY UTILIZATION
Advanced technology application in the production of space suit gloves p 228 A91-39391
TELEOPERATORS
EVA/robotics integration for Space Station Freedom
p 231 N91-23583
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584
TEMPERATURE EFFECTS
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718

Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720
TEMPERATURE MEASUREMENT
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
TEMPORAL DISTRIBUTION
Spatiotemporal characteristics of visual localization
[AD-A232734] p 225 N91-23715
THERMAL COMFORT
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
THERMAL CONDUCTIVITY
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
THERMOREGULATION
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
THREAT EVALUATION
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739
THREE DIMENSIONAL MODELS
Three-dimensional structure of human serum albumin p 222 N91-24057
TISSUES (BIOLOGY)
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
Biological effects of electromagnetic fields
[DE91-010006] p 205 N91-24727
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728
TOBACCO
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549
TOXIC HAZARDS
Exposure standard for fog oil
[AD-A231714] p 223 N91-24729
TOXICITY
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation
[AD-A232033] p 221 N91-23706
Identifying and controlling immunotoxic substances: Background paper
[OTA-BP-BA-75] p 223 N91-24730
TRAINING DEVICES
Manned diving activities in JAMSTEC p 220 N91-23572
TRAJECTORY OPTIMIZATION
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
TRAJECTORY PLANNING
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
TRUCKS
CETA truck and EVA restraint system p 234 N91-24604
TURBULENCE MODELS
Simulation of blood flow through an artificial heart p 222 N91-24056

U

ULTRASONIC TESTS
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
UNCONSCIOUSNESS
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
UNDERWATER PHOTOGRAPHY
The Berlenga underwater survey project p 231 N91-23577
UNDERWATER TESTS
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
URETHANES
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699
URINALYSIS
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
URINATION
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots p 229 A91-39548

V

VALSALVA EXERCISE
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527
VALVES
Simulation of blood flow through an artificial heart p 222 N91-24056
VEGETATION GROWTH
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
VESTIBULAR NYSTAGMUS
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus p 210 A91-37503
VESTIBULAR TESTS
Electrovestibulography in experimental animals p 200 A91-37502
Macular bioaccelerometers on earth and in space p 216 A91-39512
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
VIBRATION
CETA truck and EVA restraint system p 234 N91-24604
VIBRATION DAMPING
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
VIBRATION EFFECTS
The effect of low-frequency vibration on GABA metabolism in several brain structures p 202 A91-39071
VIRAL DISEASES
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
VISCOUS FLUIDS
A mathematical modeling of the cerebrovascular system --- viscous incompressible fluid flow perturbations p 227 A91-37517
VISUAL ACUITY
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539
VISUAL DISCRIMINATION
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
VISUAL FIELDS
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
VISUAL PERCEPTION
Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101
Asymmetric visual deficit at high sustained Gz p 218 A91-39546
Comments on asymmetric visual loss associated with +Gz-stress p 218 A91-39547
Human recognition of infrared images p 230 A91-39884
Mechanisms of higher brain functions: A study of models of perception
[AD-A232389] p 225 N91-23712
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737
VISUAL SIGNALS
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421
VISUAL STIMULI
Reaction time to motion offset of visual stimuli p 224 A91-37280
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
VISUAL TASKS
Target tracking by a human operator p 226 A91-36932
Tracking strategies and cognitive demands p 227 A91-38668
VOICE CONTROL
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576

W

WAKEFULNESS
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
WARNING SYSTEMS
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
WASTE TREATMENT
Physical/chemical closed-loop water-recycling p 233 N91-24052
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744
WASTE WATER
Physical/chemical closed-loop water-recycling p 233 N91-24052
New research on bioregenerative air/water purification systems p 233 N91-24053
WATER
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
WATER BALANCE
Effects of 10 days HDT on fluid and electrolyte metabolism --- head down tilt p 212 A91-37520
WATER CONSUMPTION
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
WATER IMMERSION
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
WATER QUALITY
Physical/chemical closed-loop water-recycling p 233 N91-24052
WATER RECLAMATION
Physical/chemical closed-loop water-recycling p 233 N91-24052
WATER TREATMENT
Physical/chemical closed-loop water-recycling p 233 N91-24052
New research on bioregenerative air/water purification systems p 233 N91-24053
WEATHER FORECASTING
Added information by man-machine interactive operation of the SCIC p 234 N91-24665
WEIGHTLESSNESS
Effect of microgravity on the respiratory system p 206 A91-36419
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity p 207 A91-37463
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508
Variations of the renal flow in relation with the volemia p 212 A91-37525
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
A systems approach to the physiology of weightlessness p 216 A91-39514
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058

WEIGHTLESSNESS SIMULATION

Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478

Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486

Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489

Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496

Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497

Sex differences in blood constituents of rats following tail suspension p 200 A91-37499

Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522

Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579

Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [*NASA-TM-103847*] p 221 N91-23704

WORKLOADS (PSYCHOPHYSIOLOGY)

Cognitive performance capabilities in the cockpit p 234 N91-24090

X

X RAY SPECTROSCOPY

Structural studies of manganese and halide in the photosynthetic oxygen evolving complex [DE91-009071] p 204 N91-23698

Y

YAG LASERS

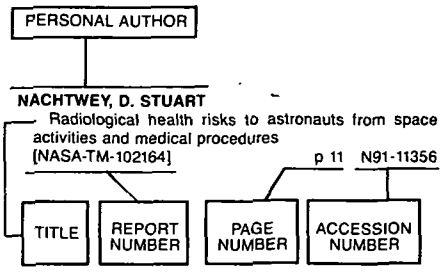
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers [ITN-90-85022] p 222 N91-24728

Z

ZIRCONIUM OXIDES

Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence.

A

ABAKUMOVA, L. V.
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072

ACCENSI, A.
EVA servicing: The Hermes capability p 230 N91-23575

AFANAS'EV, S. E.
Dependence of the success of flight training on the accentuation of the trainee's character p 224 A91-39105

AGUTTES, J. P.
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589

ALBINA, J. A.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513

ALEXANDRE, C.
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492

ALSTON, JIM A.
Seeds in space experiment results p 205 N91-25094

ANDERSON, D. E.
EVA/robotics integration for Space Station Freedom p 231 N91-23583

ANDERSON, L. E.
Biological effects of electromagnetic fields [DE91-010006] p 205 N91-24727

ANDERSON, LINDA B.
An evaluation of the photopic electroretinogram using lower eyelid electrodes [AD-A232988] p 223 N91-24732

ANDO, YOSHIHIKO
Added information by man-machine interactive operation of the SCIC p 234 N91-24665

ANDRE, M.
Plants and men in space - A new field in plant physiology p 226 A91-37494

ARAN, JEAN-MARIE
Electrovestibulography in experimental animals p 200 A91-37502

ARATOW, M.
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [NASA-TM-103847] p 221 N91-23704

ARBEILLE, P.
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498

ARBEILLE, PH.
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
Variations of the renal flow in relation with the volemia p 212 A91-37525

ARLASHCHENKO, N. I.
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268

ARNALL, DAVID
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours [AD-A232787] p 233 N91-23722

ARNAUD, C. D.
The role of calcium in osteoporosis p 214 A91-39502

ARNAUD, S. B.
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476

ARNAUD, SARA B.
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058

ARZAMAZOV, G. S.
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia p 214 A91-39102

AUSSEDAT, J.
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513

AVELLINI, BARBARA A.
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing [AD-A231572] p 232 N91-23717

B

BABIN, A. M.
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506

BAIN-UNGERSON, ORIT
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation p 229 A91-39550

BAIN, B.
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules [AD-A232653] p 232 N91-23720

BAISCH, FRIEDHELM
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527

BAKER, EVA L.
Benchmarking text understanding systems to human performance: An exploration [AD-A233306] p 235 N91-24741

BAKKEN, ANNE M.
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles p 219 A91-40467

BARANOV, V. M.
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507

BARANOVSKA, M.
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490

BARLOW, JANE F.
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots p 229 A91-39548

BARMIN, V. A.
Results of studies of motor functions in long-term space flights p 206 A91-37457

BASHAN, NAVA
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542

BAYONOVE, J.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096

BEALS, DAVID C.
CETA truck and EVA restraint system p 234 N91-24604

BEAUJEAN, R.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096

BEAUSSANT, RAYMOND
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381

BEAUVILLE, M.
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467

BECK, L.
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt p 213 A91-37527

BELICHENKO, P. V.
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460

BELL, D. G.
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421

BENTON, E. V.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096

BERGAN, T.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

BERSON, M.
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518

BEUGELSDIJK, T. J.
Robotics for recombinant DNA and human genetics research [DE90-016440] p 204 N91-23697

BLOMQVIST, C. G.
Orthostatic hypotension p 215 A91-39504

Cardiovascular adjustments to gravitational stress
p 215 A91-39505

BLOMQVIST, G.
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524

BOBROV, A. F.
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103

BODA, K.
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510

BOGOMOLOV, V. V.
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573

BORKHOFF, C.
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions
p 207 A91-37468

BORNE, M.
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491

BORREDON, P.
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515

BOUAMAR, MOHAMED
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705

BOWERS-IRONS, GAIL L.
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699

BOZNER, A.
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510

BRAAK, LAURENT
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance
p 207 A91-37465

BRADBURY, E. M.
Problems in understanding the organization, structure and function of chromosomes
[DE91-009939] p 204 N91-23695

BRAINARD, GEORGE
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722

BRINCHMANN-HANSEN, OLAF
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539

BRUNNER, B.
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584

BUCHANAN, P.
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483

BUCHANAN, PAUL
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540

BUCKEY, J.
Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524
Variations of the renal flow in relation with the volemia
p 212 A91-37525

BUCKEY, JAY C.
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading
p 212 A91-37523

BUECKER, H.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

BURBECK, CHRISTINA A.
Spatiotemporal characteristics of visual localization
[AD-A232734] p 225 N91-23715

BURSTEIN, RUTH
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542

BURTON, RUSSELL R.
Physiologic bases for increased G-level and G-duration tolerances p 210 A91-37505

BUTLER, FRANCES A.
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741

BUTLER, G. C.
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions
p 207 A91-37468

C

CADOGAN, DAVE
Advanced technology application in the production of space suit gloves p 228 A91-39391

CAINE, YEHEZKEL G.
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation
p 229 A91-39550

CAMPBELL, SCOTT
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

CANNON, R. H., JR.
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747

CANTRELL, JOHN H.
The transfer of technology to measure skin burn depth in humans p 222 N91-24076

CARDUS, DAVID
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

CARTER, DANIEL C.
Three-dimensional structure of human serum albumin
p 222 N91-24057

CASALE, ELENA
Three-dimensional structure of human serum albumin
p 222 N91-24057

CHAIKINA, L. A.
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074

CHAMBERS, RANDALL M.
Cognitive performance capabilities in the cockpit
p 234 N91-24090
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165

CHAN, J. K.
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220

CHANG, I-DEE
Simulation of blood flow through an artificial heart
p 222 N91-24056

CHAPPARD, D.
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492

CHARLET DE SAUVAGE, RENAUD
Electrovestibulography in experimental animals
p 200 A91-37502

CHARYULU, USHA
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699

CHELNAIA, N. A.
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508

CHEMLA, DENIS
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512

CHEUNG, B. S. K.
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538

CHEVALLIER, J.
EVA servicing: The Hermes capability
p 230 N91-23575

CINTRON, N. M.
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461

CLARK, DOUGLAS J.
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059

CLARK, VERNESSA R.
Cultural parameters of stress
[AD-A232526] p 225 N91-23713

CLERE, J. M.
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
New electronic anti-G valve and regulator ensemble
p 228 A91-39378

CLERE, JEAN-MICHEL
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381

CLERGUE, MICHEL
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512

COGOLI, A.
Cell biology p 215 A91-39506

COLICE, G.
Acute hypoxia-induced diuresis in rats
p 203 A91-39541

COMET, M.
Long duration hyperbaric confinement: Hydra 9
p 220 N91-23571

CONVERTINO, V. A.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469

COOPER, JAMES
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738

COTTET-EMARD, J. M.
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481

CRAMPES, F.
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure
p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467

CRAWFORD, W. A.
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549

CRENSHAW, A.
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704

CUTLER, L.
Macular bioaccelerometers on earth and in space
p 216 A91-39512

D

D'IACHKOVA, L. N.
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex
p 198 A91-37464

DAMRON, JOHN
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach
p 229 A91-39397

DAVIDSON, B.
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466

DEADWYLER, SAMUEL A.
Multiple neuron recording in the hippocampus of freely moving animals
[AD-A232934] p 205 N91-24725

DEAVERS, D. R.
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472

DECRAMER, L.
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579

DELAUZE, H. G.
Long duration hyperbaric confinement: Hydra 9
p 220 N91-23571

DELPOUX, M.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

DEMPSEY, D. T.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513

DENGLER, W.
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503

DENNIS, IAN
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669

DENNIS, RICHARD J.
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members
p 229 A91-39544

DEROSE, V. J.
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698

DESPLANCHES, D.
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486

DIAMANDIS, PETER
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

DICHGANS, J.
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503

DIDIER, MURIEL
How to design efficient MMI for space
p 231 N91-23586
DIEFFENBACH, CARL W.
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
DIETRICH, J.
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584
DIETZ, J.
Acute hypoxia-induced diuresis in rats
p 203 A91-39541
DIMITROV, G.
Reaction time to motion offset of visual stimuli
p 224 A91-37280
DINTENFASS, L.
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
DOBIE, T. G.
Ship roll stabilization and human performance
[AD-A232721] p 232 N91-23721
DOLIVET, GILLES
Electrovestibulography in experimental animals
p 200 A91-37502
DOLLINS, ANDREW B.
Strategies to sustain and enhance performance in stressful environments
[AD-A232698] p 225 N91-23714
DOSTAL, J.
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
DRESE, JOHN H.
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718
DROGOU, C.
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
DRUMMER, C.
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520
DUBOWSKY, S.
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
DUCAS, JOHN
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
DUCHARME, M. B.
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468
DUCHARME, MICHEL B.
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
DUDLEY, G. A.
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483
DUDLEY, GARY A.
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
DURNOVA, G. N.
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462

E

ECKARDT, R.
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles
p 211 A91-37509
ECKBERG, D. L.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
ECKBERG, DWAIN L.
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526
EDENS, ELEANA S.
Individual differences underlying pilot cockpit error
[DOT/FAA/RD-91/13] p 225 N91-23710
EDWORTHY, JUDY
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
EGOROV, A. D.
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
ELLENDER, R. D.
New research on bioregenerative air/water purification systems p 233 N91-24053
ELLIOTT, A. R.
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
ELLIS, DAVID
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
EMERICK, K. S.
Experimental control results in a compact space robot actuator p 228 A91-38749
ENDLER, J. L.
Ship roll stabilization and human performance
[AD-A232721] p 232 N91-23721
ENGEL, L. A.
Effect of microgravity on the respiratory system
p 206 A91-36419
ERRE, JEAN-PAUL
Electrovestibulography in experimental animals
p 200 A91-37502
ESKEN, ROBERT
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738

F

FABRE, M.
European stakes and measures permitting the management of geometric dimensions
p 230 N91-23573
FACIUS, R.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096
FALEMPIN, M.
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
FALK, BARKET
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542
FALK, TINE
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
FARHI, L. E.
Gravitational force and the cardiovascular system
p 216 A91-39511
FARHI, LEON E.
Exposure to stressful environments - Strategy of adaptive responses p 215 A91-39507
FARMER, ERIC
Human Performance Assessment Methods. Addendum
[AGARD-AG-308-ADD] p 225 N91-23711
FARSTAD, MIKAEL
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles
p 219 A91-40467
FASSBENDER, C.
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
FEDERENKO, Y. F.
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats
p 202 A91-38222
FEDORENKO, S. V.
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073
FEDOROV, A. A.
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
FETTER, M.
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503
FINE, THOMAS H.
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422
FISCHER, R. D.
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
FLANDROIS, R.
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
FRANCESCONI, RALPH P.
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
FRENCH, JONATHAN
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722
FRIBERG, LARS
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep
p 218 A91-40465
FRITSCH, J. M.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
FRITSCH, JANICE M.
Carotid baroreceptor cardiac-vagal reflex responses during 10 days of head-down tilt p 213 A91-37526
FUKASE, Y.
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471

G

GAFFIE, D.
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity
p 209 A91-37482
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model
p 211 A91-37511
A mathematical modeling of the cerebrovascular system p 227 A91-37517
GAFFNEY, F. A.
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading
p 212 A91-37523
GAIONI, STEPHEN
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
GALICHII, V. A.
Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101
GARDETTE, B.
Long duration hyperbaric confinement: Hydra 9
p 220 N91-23571
GASSET, G.
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
GAUDIN, C.
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
GAUQUELIN, G.
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
GAZO, M.
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
GEELEN, G.
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man
p 226 A91-37498
GEMBITSKA, D.
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
GERRELL, JOHN
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
GERZER, R.
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520
GHARIB, C.
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
GHARIB, CLAUDE
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance
p 207 A91-37465
GIBSON, WILLIAM
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722

GINSBURG, ARTHUR P.
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716
GLAISTER, DAVID H.
Cardiovascular responses to sustained acceleration p 201 A91-37504
GOETERS, K. M.
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
GOETTL, BARRY P.
Tracking strategies and cognitive demands p 227 A91-38668
GOLDING, JOHN F.
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
GONCHARENKO, A. M.
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity p 207 A91-37463
GOODMAN, L. S.
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
GORTAN, C.
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
GOSDEN, EDWARD
Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537
GRAY, G. W.
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
GREEN, ROBERT P., JR.
Choroidal nevi in USAF aviators
[AD-A233042] p 223 N91-24735
GRIGORIEV, A. I.
Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573
GRIGOROVA, V.
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity p 207 A91-37463
GRIGSBY, DORIS K.
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095
GRUNWALD, A. J.
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421
GU, SHIAN
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
GUBA, F.
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
GUEELL, A.
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
GUEELL, ANTONIO
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
GUELL, A.
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
GUEZENNEC, C. Y.
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
GUILLUT, J.
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
GUREVICH, A.
Reaction time to motion offset of visual stimuli p 224 A91-37280
GUTMAN, GEORGES
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
GUY, H. J. B.
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
GUY, HAROLD J. B.
Heart-lung interactions in aerospace medicine p 215 A91-39508

H

HADJ-AISSA, A.
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
HALFORD, CARL E.
Human recognition of infrared images p 230 A91-39884
HANN, A.
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus p 210 A91-37503
HANNON, PATRICK
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722
HARGENS, A. R.
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
HARGENS, ALAN R.
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704
HARTH, ERICH
Mechanisms of higher brain functions: A study of models of perception
[AD-A232389] p 225 N91-23712
HARTIKAINEN, J.
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
HE, XIAO-MIN
Three-dimensional structure of human serum albumin p 222 N91-24057
HEER, M.
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520
HEINRICH, MILTON R.
Opportunity and challenge in life sciences research on Space Station Freedom p 200 A91-37495
HEMERY, N.
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
HENRIKSEN, ERIK J.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
HERL, HOWARD
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
HERRMANN, CAL C.
Physical/chemical closed-loop water-recycling p 233 N91-24052
HICKMAN, D. P.
Absolute calibration in vivo measurement systems
[DE91-009719] p 203 N91-23692
HIDEG, J.
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
HILL, JEFFREY R.
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members p 229 A91-39544
HILLEBRECHT, A.
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading p 212 A91-37523
HIRZINGER, G.
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584
HOH, JOSEPH F. Y.
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
HOLCOMB, L. C.
Environmental tobacco smoke (ETS) in airliners - A health hazard evaluation p 218 A91-39549
HOLLARS, M. G.
Experimental control results in a compact space robot actuator p 228 A91-38749
HOLLOSZY, JOHN O.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
HOLM, SOREN
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465
HOLMSEN, HOLM
Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles p 219 A91-40467
HOLST, GERALD C.
What eye model should we use for MRT testing? p 229 A91-39882
HOLY, X.
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
HOPE, A.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
HOPPELER, H.
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
HORNECK, G.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
HORNET, D.
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
HOWARD, I. P.
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
HUGH, GREGORY
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
HUGHES, SUZANNE
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
HUGHSON, R. L.
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468

I

IAKOVINA, S. A.
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings) p 213 A91-39073
IKAWA, SACHIO
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
IL'INA-KAKUEVA, E. I.
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462
ILIUKHINA, V. A.
The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat p 214 A91-39185
IMBERT, JEAN-PIERRE
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
INTANO, GABRIEL P.
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739
ITAI, TSUTOMU
Nutritional assessment of cockpit crew meal p 213 A91-37717
ITO, NOBUO
Manned diving activities in JAMSTEC p 220 N91-23572
ITOH, K.
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
IUROV, A. IU.
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184
IVERSEN, T. H.
Cell biology p 215 A91-39506

J

JACHONTOV, B. O.
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
JACKSON, LISA
Positive pressure breathing and G (PPB&G) chemical protective system - An integrated approach p 229 A91-39397
JACOBS, I.
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421

Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720
JACOBY, ANAT
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
JAMES, DAVID E.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
JANG, YOUNGHEE
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
JANKELA, J.
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510
JEPSEN, C.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
JOHNSON, ANNE H.
New research on bioregenerative air/water purification systems p 233 N91-24053
JOHNSON, PHILIP C., JR.
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
JOHNSSON, A.
Cell biology p 215 A91-39506
JOLLETT, LEWIS D.
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16
p 228 A91-39375

K

KABESHEVA, T. A.
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
KAL'NISH, V. V.
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073
KALIAKIN, V. V.
Destructive and adaptive processes in human vertebral column under altered gravitational potential
p 206 A91-37458
KAPLANSKII, A. S.
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462
KAREMAKER, J. M.
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt
p 213 A91-37527
KARKI, T.
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT)
p 209 A91-37478
KARL, ALVA
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738
KARLYEV, K. M.
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
KASS, JAMES R.
Payload related crew operations: From past missions to Columbus p 230 N91-23569
KATUNTSEV, V. P.
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
KAYAR, S. R.
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
KAZEIKIN, V. S.
Destructive and adaptive processes in human vertebral column under altered gravitational potential
p 206 A91-37458
KEKES-SZABO, F.
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model
p 199 A91-37487
KERIMOV, S. A.
The effect of low-frequency vibration on GABA metabolism in several brain structures
p 202 A91-39071
KETCHUM, NORMA S.
The durability of hydrogel extended-wear contact lenses worn for daily wear by USAF aircrew members
p 229 A91-39544
KHARITONOV, N. M.
Results of studies of motor functions in long-term space flights p 206 A91-37457
KIRIS, CETIN
Simulation of blood flow through an artificial heart
p 222 N91-24056
KJENNERUD, EIVIND
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576
KNOTT, WILLIAM M.
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
KOENIG, E.
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus
p 210 A91-37503
KOLLANDE, G.
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles
p 211 A91-37509
KORNILOVA, L. N.
The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity
p 207 A91-37463
KOSUGI, KAZUO
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
KOTOV, A. N.
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
KOZLOVSKAIA, I. B.
Results of studies of motor functions in long-term space flights p 206 A91-37457
KRAPELS, KEITH A.
Human recognition of infrared images
p 230 A91-39884
KRASNOV, I. B.
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex
p 198 A91-37464
KRUCHTEN, D. A.
Absolute calibration in vivo measurement systems
[DE91-009719] p 203 N91-23692
KUDRIASHOV, IU. A.
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184
KURENKOV, G. I.
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
KUSHNIRENKO, E. A.
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
KWAK, DOCHAN
Simulation of blood flow through an artificial heart
p 222 N91-24056

L

LABORDE, F.
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP
p 198 A91-37474
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity
p 201 A91-37514
LAGNEAUX, D.
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
LAM, T.
Macular bioaccelerometers on earth and in space
p 216 A91-39512
LAMBERT, FRANCINE
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512
LANE, H. W.
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
LANE, LYNDA D.
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading
p 212 A91-37523
LANGERON, O.
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP
p 198 A91-37474
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity
p 201 A91-37514
LANSIMIES, E.
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT)
p 209 A91-37478
LAPSHIN, V. P.
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
LARINA, I. M.
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia
p 214 A91-39102
LASHCHINSKA, I.
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104
LEACH, C. S.
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
LEACH, CAROLYN S.
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
A systems approach to the physiology of weightlessness p 216 A91-39514
LEBOUARD, D.
Variations of the renal flow in relation with the volemia
p 212 A91-37525
LECARPENTIER, YVES
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons
p 201 A91-37512
LECLERCQ, T.
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
LECOMTE, G. V.
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
LECOMTE, J.
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
LEFTHERIOTIS, G.
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
LEGER, A.
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
LEJEUNE, D.
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
New electronic anti-G valve and regulator ensemble
p 228 A91-39378
LELEVIER, A.
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
LEONARD, JOEL
Spacelab life sciences 1 - Reprints of background life sciences publications p 214 A91-39501
LEONARD, JOEL I.
A systems approach to the physiology of weightlessness p 216 A91-39514
LEONTOVICH, T. A.
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
LEPECHON, JEAN CLAUDE
Subsea habitats and space simulation
p 230 N91-23567
A KO2 rebreather for EVA denitrogenation procedure
p 220 N91-23588
LETERME, D.
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
LEVINE, LESLIE
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
LIEBAERT, P.
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model
p 211 A91-37511
A mathematical modeling of the cerebrovascular system p 227 A91-37517
LIEBAERT, PH.
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity
p 209 A91-37482
LISCIA, P.
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515

LOBACHIK, V. I.
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506
LORENZ, B.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
LORTET, S.
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
LOUISY, F.
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
LOXLEY, SARAH
Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669
LUNINA, N. V.
Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072
LYNCH, HARRY J.
Strategies to sustain and enhance performance in stressful environments
[AD-A232698] p 225 N91-23714

M

MAASS, HARTMUT
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
MACELROY, R. D.
Plants and men in space - A new field in plant physiology p 226 A91-37494
MACELROY, ROBERT D.
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744
MACHANOV, M. A.
Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460
MACHELL, R. M.
EVA/robotics integration for Space Station Freedom p 231 N91-23583
MACK, G. W.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
MADSEN, PETER LUND
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465
MALLIAVIN, M. J.
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
MANEV, A.
The patterns of spontaneous oculomotor activity during *weightlessness and readaptation to gravity* p 207 A91-37463
MANTYSAARI, M.
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
MANZEY, D.
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565
MARCUS, J. T.
Otolith responses in man during parabolic flight
[IZF-1990-A-32] p 220 N91-23703
MAROM, GAD
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation p 229 A91-39550
MAROTTE, H.
New electronic anti-G valve and regulator ensemble p 228 A91-39378
MAROTTE, HENRI
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
MATEEV, S.
Reaction time to motion offset of visual stimuli p 224 A91-37280
MATHESON, G. O.
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
MATSON, DAVID
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
MAURICE, N.
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
MAZURIN, IU. V.
Destructive and adaptive processes in human vertebral column under altered gravitational potential p 206 A91-37458
MCKAY, CHRISTOPHER P.
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
MCKEE, TONY
Advanced technology application in the production of space suit gloves p 228 A91-39391
MCKENZIE, D. C.
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
MCLELLAN, T.
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720
MCTAGGART, WESLEY G.
Development of an Artificial Gravity Sleeper (AGS) p 227 A91-37500
MEDVEDEV, V. I.
Dependence of the success of flight training on the accentuation of the trainee's character p 224 A91-39105
MEGLEN, R. R.
Exploratory data analysis on data generated in the DOE subsurface microbiology program
[DE91-007575] p 205 N91-24726
MEHIER, H.
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
MEININGER, G. A.
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
MELNICK, G.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
MENON, A. S.
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
MERSON, WAYNE R.
CETA truck and EVA restraint system p 234 N91-24604
MESLAND, D.
Cell biology p 215 A91-39506
MEYER, G.
Macular bioaccelerometers on earth and in space p 216 A91-39512
MEYER, J.-U.
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
MILLER, BRUCE J.
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
MILLER, JAMES D.
Auditory-acoustic basis of consonant perception. Attachments A thru I
[AD-A233041] p 223 N91-24734
MODI, V. J.
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
MOISEEV, I. B.
Destructive and adaptive processes in human vertebral column under altered gravitational potential p 206 A91-37458
MONDON, CARL E.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
MONEY, K. E.
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
MOORE, ROBERT Y.
Organization of the human circadian system
[AD-A233026] p 223 N91-24733
MOREY-HOLTON, EMILY
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
MORRISON, T. R.
Ship roll stabilization and human performance
[AD-A232721] p 232 N91-23721
MOUNIER, Y.
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489
MUSACCHIA, X. J.
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472
MYHRE, KJELL
Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539

N

NADEL, E. R.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
NAGANO, J.
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
NAGANO, JUNKO
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
NAGATI, M. GAWAD
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
NAKAYA, MASAYUKI
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499
NAQVI, S. S. J.
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
NATH, C.
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
NEGRIN, M.
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421
NEUFER, P. DARRELL
Fluid replacement during sustained activity in the heat - *Nutrient solution vs. water* p 217 A91-39543
NI, YUJING
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
NIKULINA, N. S.
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
NJEMANZE, PHILIP C.
Transcranial Doppler evaluation of syncope - An application in aerospace physiology p 218 A91-39545
NOGUES, C.
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
NOVARA, M.
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571
NOVIKOV, V. E.
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
NUNNELEY, S.
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
NURMATOV, A. A.
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

O

OCSOVSZKI, I.
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
OHNO, MAKOTO
Nutritional assessment of cockpit crew meal p 213 A91-37717
OLSZOWKA, A. J.
Gravitational force and the cardiovascular system p 216 A91-39511
ONEIL, HAROLD F., JR.
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742

Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743
OPARINA, D. IA.
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
OPPERT, J. M.
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
OSER, H.
Cell biology p 215 A91-39506
OSSARD, G.
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
OU, L.-C.
Acute hypoxia-induced diuresis in rats p 203 A91-39541

P

PAILLARD, F.
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP p 198 A91-37474
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
PALMER, WINIFRED G.
Exposure standard for fog oil
[AD-A231714] p 223 N91-24729
PANFEROVA, N. E.
The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507
PAPADOPOULOS, E.
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
PAPENFUSS, W.
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles p 211 A91-37509
PARANICH, A. V.
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074
PARAZYNSKI, S. E.
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704
PASI, P.
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
PATAT, F.
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Variations of the renal flow in relation with the volemia p 212 A91-37525
PAUL, MICHEL A.
Asymmetric visual deficit at high sustained Gz p 218 A91-39546
PAYEN, D.
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP p 198 A91-37474
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
PEDRONI, GENA M.
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739
PELLOUX-GERVAIS, P.
New electronic anti-G valve and regulator ensemble p 228 A91-39378
PENDERGAST, D. R.
Gravitational force and the cardiovascular system p 216 A91-39511
PEQUIGNOT, J. M.
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
PERE, A.
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
PEYRIN, L.
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
PICANO, JAMES J.
Personality types among experienced military pilots p 224 A91-39536
PIMENTAL, NANCY A.
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing
[AD-A231572] p 232 N91-23717
PLANEL, H.
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
PLATH, G.
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
PLATH, GERNOT
Effects of head down tilt for 10 days on the compliance of the lower limb p 212 A91-37521
POLLARD, J. K.
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740
POTTIER, J. M.
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Variations of the renal flow in relation with the volemia p 212 A91-37525
POZET, N.
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
POZGAJ, IRENE
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509
POZSGAI, A.
Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model p 199 A91-37487
PRAKASH, RAMESH K.
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699
PRECOURT, CHARLIE J.
Combat survival at 9G - Test results of advanced G-protection equipment on the F-15 and F-16 p 228 A91-39375
PRENDERGAST, P. R.
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
PREWITT, RICHARD M.
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
PRISK, G. K.
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
PRISK, GORDON KIM
Heart-lung interactions in aerospace medicine p 215 A91-39508
PRYOR, ROBERT
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699

Q

QUANDIEU, P.
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model p 211 A91-37511
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
A mathematical modeling of the cerebrovascular system p 227 A91-37517

R

RADZISZEWSKI, E.
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588
RAMIREZ, G.
Acute hypoxia-induced diuresis in rats p 203 A91-39541
RAMON, L. V.
EVA/robotics integration for Space Station Freedom p 231 N91-23583
RAPOPORT, I. A.
Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268
RAVEN, P. B.
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness p 198 A91-37473
RAVEN, PETER B.
Endurance exercise training reduces orthostatic tolerance in humans p 208 A91-37477
RAY, A.
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
REBUCK, A. S.
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
REEVES, R. D.
Evaluation of display system enhancements to assist an operator in the detection of point targets p 229 A91-39883
REITZ, G.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF p 205 N91-25096
REMIS, STEVEN J.
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
REO, NICHOLAS V.
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation
[AD-A232033] p 221 N91-23706
REPPERGER, DANIEL W.
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
REYNOLDS, ORR E.
International Union of Physiological Sciences Commission on Gravitational Physiology, Annual Meeting, 11th, Lyons, France, Sept. 25-27, 1989, Proceedings p 197 A91-37456
RIBEIRO, DINIS AFONSO
The Berlenga underwater survey project p 231 N91-23577
RICHARDSON, SUSAN E.
Evaluation of the Disposable Absorption Containment Trunk for female U-2 and TR-1 pilots p 229 A91-39548
RICHOILLEY, G.
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
RICHTER, BERNHARD H.
Human centrifuge onset rates p 214 A91-39399
RIVIERE, D.
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
RODNICK, KENNETH J.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
ROGERS, STUART E.
Simulation of blood flow through an artificial heart p 222 N91-24056
ROKITKA, M. A.
Gravitational force and the cardiovascular system p 216 A91-39511
ROMODANOVA, E. A.
Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074
RONCIN, A.
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
ROSE, MADELEINE S.
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543
ROSEN, A.
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421
ROSS, M. D.
Macular bioaccelerometers on earth and in space p 216 A91-39512
ROUSSEL, B.
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
ROZHKOV, A. V.
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
RUBINSTEIN, ARDON
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542
RUMMEL, JOHN A.
A systems approach to the physiology of weightlessness p 216 A91-39514

S

SAFAROV, M. I.
The effect of low-frequency vibration on GABA metabolism in several brain structures
p 202 A91-39071

SAGER, JOHN C.
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060

SAKHAROVA, Z. F.
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462

SAMOILENKO, A. V.
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

SANCHEZ, S. D.
The role of calcium in osteoporosis
p 214 A91-39502

SANDERS, JEFFREY S.
Human recognition of infrared images
p 230 A91-39884

SAUMET, J. L.
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man
p 226 A91-37498

SAVILOV, A. A.
Cardiovascular function of man exposed to LBNP tests p 210 A91-37506

SAWKA, MICHAEL N.
Fluid replacement during sustained activity in the heat - Nutrient solution vs. water p 217 A91-39543

SCHAEFFER, M.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

SCHAFHAUSER, ERICH
Payload related crew operations: From past missions to Columbus p 230 N91-23569

SCHICK, USHA
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420

SCHLEIFER, RICARDO
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728

SCHMIDT, JES F.
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep
p 218 A91-40465

SCHOTT, J. U.
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

SCHULZ, H.
The effects of a 10-day period of head-down tilt on the cardiovascular responses to intravenous saline loading
p 212 A91-37523

SEKULER, ROBERT
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737

SEMPORE, B.
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486

SEROVA, L. V.
Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508

SETTLE, R. G.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513

SHOCHAT, IGAL
The failure analysis of composite material flight helmets as an aid in aircraft accident investigation
p 229 A91-39550

SHPILBERG, OFER
The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542

SHYKOFF, B. E.
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing
p 197 A91-36423

SIFFRE, MICHEL
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570

SILVER, BURTON
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058

SKOOG, I.
EVA servicing: The Hermes capability
p 230 N91-23575

SKOWRONSKI, VANCE D.
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738

SLUTSKI, A. S.
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing
p 197 A91-36423

SMIRNOVA, T. M.
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia
p 214 A91-39102

SMITH, M. K.
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness
p 198 A91-37473

SOKOLOVSKI, E.
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104

SOURDAINE, P.
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491

SOWERS, ARTHUR E.
International conference on Biophysics of Transmembrane Electric Fields
[AD-A232057] p 204 N91-24724

SPAMPINATO, PHIL
Advanced technology application in the production of space suit gloves p 228 A91-39391

SQUIRES, W. G.
Hemodynamic responses to -6 degrees head-down rest in dogs - A model of weightlessness
p 198 A91-37473

STANNY, R. R.
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736

STEARNS, M.
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740

STEIN, T. P.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513

STEPANTSOV, V. I.
Results of studies of motor functions in long-term space flights p 206 A91-37457

STEVENS, GLEN H.
Endurance exercise training reduces orthostatic tolerance in humans p 208 A91-37477

STEVENS, L.
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles
p 199 A91-37484
Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489

STONE, H. L.
Cardiovascular adjustments to gravitational stress
p 215 A91-39505

STUPAKOV, G. P.
Destructive and adaptive processes in human vertebral column under altered gravitational potential
p 206 A91-37458

STYF, J.
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704

SUGA, NOBUO
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708

SUITOR, JERRY W.
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059

SUKHANOV, IU. V.
Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia
p 214 A91-39102

SUNDLAND, H.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

SUSSMAN, E. D.
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740

SUZUKI, YOJI
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485

SWIGGER, KATHLEEN M.
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742

SYTNIK, N. I.
Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073

T

TAHVANAINEN, K.
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT)
p 209 A91-37478

TAJIMA, NAOKO
Nutritional assessment of cockpit crew meal
p 213 A91-37717

TAKEUCHI, SHUJI
Sex differences in blood constituents of rats following tail suspension p 200 A91-37499

TANG, DE-MING
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693

TANNER, HARVEY A.
Competing antagonists to energy production in space and their effect on calcium metabolism
p 200 A91-37493

TAYLOR, ALLEN R.
What eye model should we use for MRT testing?
p 229 A91-39882

TEAL, WALTER B.
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing
[AD-A231572] p 232 N91-23717

TEN HARKEL, A. D. J.
The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt
p 213 A91-37527

TESCH, P. A.
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483

TESCH, PER A.
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540

THOMPSON, BRAD G.
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744

THOMPSON, C. A.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469

THORNTON, D. C.
Evaluation of display system enhancements to assist an operator in the detection of point targets
p 229 A91-39883

TIBBITTS, THEODORE W.
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744

TIKUISIS, P.
Shivering onset, metabolic response, and convective heat transfer during cold air exposure
p 206 A91-36421
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468

TIKUISIS, PETER
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469

TILLEY, S. W.
Experimental control results in a compact space robot actuator p 228 A91-38749

TIXADOR, R.
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501

TKACHENKO, B. I.
The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

TOGAWA, M. N.
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats
p 202 A91-38222

TOMASHEVSKA, L.
The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104

TORIKOSHI, S.
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471

TORIKOSHI, SHIGEYO
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
TOUMODGE, S. S.
Target tracking by a human operator p 226 A91-36932
TRAN, C. C.
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP p 198 A91-37474
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
TRAN, CONG C.
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
TRAN, D. C. C.
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons p 201 A91-37512
TRANSMONTANO, JOAO
Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt) p 212 A91-37522
TREDICI, THOMAS J.
Choroidal nevi in USAF aviators [AD-A233042] p 223 N91-24735
TUCKER, B.
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity [NASA-TM-103847] p 221 N91-23704
TURNER, JOHN W., JR.
Restricting environmental stimulation influences levels and variability of plasma cortisol p 206 A91-36422
TWIGG, PAMELA D.
Three-dimensional structure of human serum albumin p 222 N91-24057

U

ULLMAN, M.
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
ULLRICH, B.
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles p 211 A91-37509

V

VAERNES, R.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
VAN LEUSDEN, A. J.
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
VAN PATTEN, R. E.
Human centrifuge onset rates p 214 A91-39399
VANDIVORT, DANIEL L.
Choroidal nevi in USAF aviators [AD-A233042] p 223 N91-24735
VAZIRI, P.
Macular bioaccelerometers on earth and in space p 216 A91-39512
VERKHOTIN, M. A.
The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103
VERWEY, W. B.
The development of highly practiced skills: A starting point for driver modelling [IZF-1990-B-16] p 232 N91-23719
VERY, J. M.
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
VIBERTI, CARLO
Payload related crew operations: From past missions to Columbus p 230 N91-23569
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
VICO, L.
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
VOGT, L.
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
VOLK, TYLER
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems [NASA-CP-10040] p 235 N91-24744
VOROTNIKOVA, E. V.
Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462

W

WARNCKE, M.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566
WATKINS, PAUL J.
New research on bioregenerative air/water purification systems p 233 N91-24053
WENZEL, J.
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564
WEST, J. B.
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464
WHEELER, RAYMOND M.
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles [NASA-TM-103819] p 232 N91-23718
WHINNERY, JAMES E.
Comments on asymmetric visual loss associated with +Gz-stress p 218 A91-39547
WHITE, RONALD
Spacelab life sciences 1 - Reprints of background life sciences publications p 214 A91-39501
WHITE, RONALD J.
A systems approach to the physiology of weightlessness p 216 A91-39514
WHITMORE, MIHRIBAN
Cognitive performance capabilities in the cockpit p 234 N91-24090
WILDSCHIODTZ, GORDON
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465
WILLEMS, G. C.
Ship roll stabilization and human performance [AD-A232721] p 232 N91-23721
WIPPLER, J. L.
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
WURTMAN, RICHARD J.
Strategies to sustain and enhance performance in stressful environments [AD-A232698] p 225 N91-23714
WYDEVEN, THEODORE
Physical/chemical closed-loop water-recycling p 233 N91-24052

X

XING, H.
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468

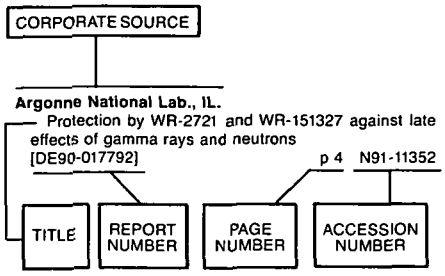
Y

YAMADA, CHIYOE
Nutritional assessment of cockpit crew meal p 213 A91-37717
YATES, J. T.
An evaluation of the photopic electroretinogram using lower eyelid electrodes [AD-A232988] p 223 N91-24732
YEN, S.
Acute hypoxia-induced diuresis in rats p 203 A91-39541
YOKOZAWA, K.
Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471
YOKOZAWA, KIKUKO
Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485
YORK, PAUL
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
YOST, WILLIAM T.
The transfer of technology to measure skin burn depth in humans p 222 N91-24076
YOUNG, LAURENCE R.
Perception of the body in space - Mechanisms p 216 A91-39515
YUZAWA, MITSUYO
Nutritional assessment of cockpit crew meal p 213 A91-37717

Z

ZAPATA, R.
New electronic anti-G valve and regulator ensemble p 228 A91-39378
ZERATH, E.
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
ZORBAS, Y. G.
Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats p 202 A91-38222

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

A

Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
Human Performance Assessment Methods. Addendum
[AGARD-AG-308-ADD] p 225 N91-23711

Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
Quantifying performance degradation due to the human-machine interface of telemanipulators
[AD-A232814] p 233 N91-23723
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738

American Red Cross, Rockville, MD.
International conference on Biophysics of Transmembrane Electric Fields
[AD-A232057] p 204 N91-24724

Ames Lab., IA.
Excited state structure, energy and electron transfer dynamics of photosynthetic reaction centers: A hole burning study
[DE91-010181] p 203 N91-23693

Army Biomedical Research and Development Lab., Fort Detrick, MD.
Exposure standard for fog oil
[AD-A231714] p 223 N91-24729

Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
Formulative evaluation study of a prototype near-infrared projection system: Night vision goggle study
[AD-A231759] p 234 N91-24739

B

Baylor Coll. of Medicine, Houston, TX.
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

Bionetics Corp., Cocoa Beach, FL.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540

Brandeis Univ., Waltham, MA.
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737

C

California Inst. of Biological Research, La Jolla.
New hosts and vectors for genome cloning
[DE91-009996] p 204 N91-23696

California Univ., Berkeley. Lawrence Berkeley Lab.
Structural studies of manganese and halide in the photosynthetic oxygen evolving complex
[DE91-009071] p 204 N91-23698

California Univ., La Jolla.
Maximum expiratory flow-volume curves during short periods of microgravity p 218 A91-40464

California Univ., Los Angeles.
Benchmarking text understanding systems to human performance: An exploration
[AD-A233306] p 235 N91-24741
Human benchmarking of expert systems
[AD-A233601] p 235 N91-24742
Human benchmarking of expert systems. Literature review
[AD-A233602] p 235 N91-24743

Center for Industrial Research, Oslo (Norway).
Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576

Central Inst. for the Deaf, Saint Louis, MO.
Auditory-acoustic basis of consonant perception. Attachments A thru I
[AD-A233041] p 223 N91-24734

Centre d'Etudes et de Recherches de Chronobiologie Humaine, Nice (France).
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570

Colorado Univ., Denver.
Exploratory data analysis on data generated in the DOE subsurface microbiology program
[DE91-007575] p 205 N91-24726

Commissariat a l'Energie Atomique, Saint-Paul-les-Durance (France).
Plants and men in space - A new field in plant physiology p 226 A91-37494

Compagnie Maritime d'Expertises, Marseille (France).
Long duration hyperbaric confinement: Hydra 9
p 220 N91-23571
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579

Companhia Espacial Portuguesa Ltd., Lisbon.
The Berlenga underwater survey project
p 231 N91-23577

D

Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720

Department of Transportation, Cambridge, MA.
Shipboard crew fatigue, safety and reduced manning
[PB91-138099] p 235 N91-24740

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.).
First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.).
The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564

Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Hamburg (Germany, F.R.).
Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565

Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.).
Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584

Direction des Constructions et Armes Navales, Toulon (France).
A KO2 rebreather for EVA denitrogenation procedure
p 220 N91-23588

E

European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EVA servicing: The Hermes capability
p 230 N91-23575
How to design efficient MMI for space
p 231 N91-23586

F

Federal Aviation Administration, Washington, DC.
Individual differences underlying pilot cockpit error
[DOT/FAA/RD-91/13] p 225 N91-23710

I

Institute for Circadian Physiology, Boston, MA.
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

Institute for Perception RVO-TNO, Soesterberg (Netherlands).
Otolith responses in man during parabolic flight
[IZF-1990-A-32] p 220 N91-23703
The development of highly practiced skills: A starting point for driver modelling
[IZF-1990-B-16] p 232 N91-23719

International Space Univ., Inc., Boston, MA.
Development of an Artificial Gravity Sleeper (AGS)
p 227 A91-37500

J

Japan Marine Science and Technology Center, Tokyo.
Manned diving activities in JAMSTEC
p 220 N91-23572

JCLP Hyperbarie, Paris (France).
Subsea habitats and space simulation
p 230 N91-23567

Jet Propulsion Lab., California Inst. of Tech., Pasadena.
Oxygen production using solid-state zirconia electrolyte technology p 233 N91-24059

John B. Pierce Foundation of Connecticut, New Haven.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469

K

Karolinska Inst., Stockholm (Sweden).
An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540

SOURCE

L

Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705
Lawrence Livermore National Lab., CA.
Absolute calibration in vivo measurement systems
[DE91-009719] p 203 N91-23692
Problems in understanding the organization, structure and function of chromosomes
[DE91-009939] p 204 N91-23695
Lockheed Engineering and Sciences Co., Washington, DC.
Spacelab life sciences 1 - Reprints of background life sciences publications p 214 A91-39501
Los Alamos National Lab., NM.
Robotics for recombinant DNA and human genetics research
[DE90-016440] p 204 N91-23697
Louisville Univ., KY.
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472

M

Management and Technical Services Co., Houston, TX.
A systems approach to the physiology of weightlessness p 216 A91-39514
Massachusetts Inst. of Tech., Cambridge.
On the dynamic singularities in the control of free-floating space manipulators p 227 A91-38748
Strategies to sustain and enhance performance in stressful environments
[AD-A232698] p 225 N91-23714
McDonnell-Douglas Space Systems Co., Houston, TX.
EVA/robotics integration for Space Station Freedom p 231 N91-23583
Medical Coll. of Virginia, Richmond.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Medicine and Dentistry Univ. of New Jersey, Camden.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
Meteorological Satellite Center, Tokyo (Japan).
Added information by man-machine interactive operation of the SCIC p 234 N91-24665
Morehouse Coll., Atlanta, GA.
Cultural parameters of stress
[AD-A232526] p 225 N91-23713

N

National Aeronautics and Space Administration, Washington, DC.
Spacelab life sciences 1 - Reprints of background life sciences publications p 214 A91-39501
Space life sciences: A status report
[NASA-NP-120] p 203 N91-23694
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 346)
[NASA-SP-7011(346)] p 220 N91-23700
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 347)
[NASA-SP-7011(347)] p 220 N91-23701
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 348)
[NASA-SP-7011(348)] p 220 N91-23702
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 349)
[NASA-SP-7011(349)] p 223 N91-24731
National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
Urey Prize Lecture - Planetary evolution and the origin of life p 235 A91-37367
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow p 208 A91-37476
Gravity, calcium, and bone - Update, 1989 p 209 A91-37480
Plants and men in space - A new field in plant physiology p 226 A91-37494
Macular bioaccelerometers on earth and in space p 216 A91-39512
Transcapillary fluid shifts in head and neck tissues during and after simulated microgravity
[NASA-TM-103847] p 221 N91-23704
Physical/chemical closed-loop water-recycling p 233 N91-24052
Simulation of blood flow through an artificial heart p 222 N91-24056
A non-invasive measure of minerals and electrolytes in tissue p 222 N91-24058
Controlled Ecological Life Support Systems: Natural and Artificial Ecosystems
[NASA-CP-10040] p 235 N91-24744
National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, MS.
New research on bioregenerative air/water purification systems p 233 N91-24053
National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
An approach to counteracting long-term microgravity-induced muscle atrophy p 209 A91-37483
Importance of eccentric actions in performance adaptations to resistance training p 217 A91-39540
Atmospheric leakage and condensate production in NASA's biomass production chamber. Effect of diurnal temperature cycles
[NASA-TM-103819] p 232 N91-23718
Monitoring and control technologies for bioregenerative life support systems/CELSS p 233 N91-24060
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
Metabolic consequences of fluid shifts induced by microgravity p 207 A91-37461
Effects of weightlessness on human fluid and electrolyte physiology p 215 A91-39510
A systems approach to the physiology of weightlessness p 216 A91-39514
National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
The transfer of technology to measure skin burn depth in humans p 222 N91-24076
CETA truck and EVA restraint system p 234 N91-24604
National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
Three-dimensional structure of human serum albumin p 222 N91-24057
Naval Aerospace Medical Research Lab., Pensacola, FL.
Modeling for human performance assessment
[AD-A232905] p 226 N91-24736
Naval Biodynamics Lab., New Orleans, LA.
Human short-latency somatosensory evoked potentials in impact acceleration research: Equipment, procedures, and techniques
[AD-A232732] p 221 N91-23709
Ship roll stabilization and human performance
[AD-A232721] p 232 N91-23721
Navy Clothing and Textile Research Facility, Natick, MA.
Effectiveness of a prototype microclimate cooling system for use with chemical protective clothing
[AD-A231572] p 232 N91-23717
Northwestern Univ., Evanston, IL.
Mechanisms of motion perception: Integration of direction, velocity, and space
[AD-A233340] p 226 N91-24737
Norwegian Underwater Technology Center Ltd., Laksevaag.
Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

O

Office of Technology Assessment, Washington, DC.
Identifying and controlling immunotoxic substances: Background paper
[OTA-BP-BA-75] p 223 N91-24730
OHB-System G.m.b.H., Bremen (Germany, F.R.).
Payload related crew operations: From past missions to Columbus p 230 N91-23569
Oklahoma State Univ., Stillwater.
Space Exposed Experiment Developed for Students (SEEDS) P-0004-2 p 205 N91-25095

P

Pacific Northwest Lab., Richland, WA.
Biological effects of electromagnetic fields
[DE91-010006] p 205 N91-24727
Park (George W.) Seed Co., Inc., Greenwood, SC.
Seeds in space experiment results p 205 N91-25094
Pennsylvania Univ., Philadelphia.
Metabolism of nonessential N-15-labeled amino acids and the measurement of human whole-body protein synthesis rates p 216 A91-39513
Pittsburgh Univ., PA.
Organization of the human circadian system
[AD-A233026] p 223 N91-24733

S

School of Aerospace Medicine, Brooks AFB, TX.
An evaluation of the photopic electroretinogram using lower eyelid electrodes
[AD-A232988] p 223 N91-24732
Choroidal nevi in USAF aviators
[AD-A233042] p 223 N91-24735
Societe d'Architectures en Milieux Extremes, Paris (France).
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573
Societe d'Etudes des Systemes d'Automation, Toulouse (France).
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
Soviet-French Joint Venture, Moscow (USSR).
Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568
SRI International Corp., Menlo Park, CA.
Spatiotemporal characteristics of visual localization
[AD-A232734] p 225 N91-23715
Stanford Univ., CA.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Experiments in global navigation and control of a free-flying space robot p 227 A91-38747
State Univ. of New York, Buffalo.
Exposure to stressful environments - Strategy of adaptive responses p 215 A91-39507
Gravitational force and the cardiovascular system p 216 A91-39511
Sterling Federal Systems, Inc., Palo Alto, CA.
Macular bioaccelerometers on earth and in space p 216 A91-39512
Syracuse Univ., NY.
Mechanisms of higher brain functions: A study of models of perception
[AD-A232389] p 225 N91-23712
Systems Research Labs., Inc., Dayton, OH.
A Motion Activated Articulating Seat (MAAS): A dynamic concept for cockpit seat design in high performance aircraft
[AD-A231698] p 234 N91-24738

T

Technical Research Associates, Salt Lake City, UT.
Isolation, cloning and expression of the genes for microbial polyurethane degradation
[AD-A232108] p 204 N91-23699
Tel-Aviv Univ. (Israel).
Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728
Texas A&M Univ., College Station.
Fluid/electrolyte balance and cardiovascular responses - Head-down tilted rats p 198 A91-37472

U

Uniformed Services Univ. of the Health Sciences, Bethesda, MD.
Molecular studies of cytokine induction
[AD-A232221] p 221 N91-23707
University of Northern Arizona, Flagstaff.
Effects of bright illumination on oral temperature and cognitive performance in humans during nighttime hours
[AD-A232787] p 233 N91-23722

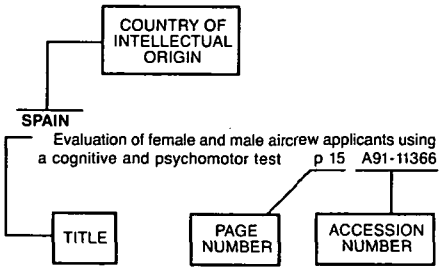
V

Veterans Administration Hospital, Palo Alto, CA.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Veterans Administration Hospital, Richmond, VA.
Baroreflex responses and LBNP tolerance following exercise training p 208 A91-37469
Vision Sciences Research Corp., San Ramon, CA.
Quantifying improved visual performance through vision training
[AD-A232799] p 226 N91-23716

W

Wake Forest Univ., Winston-Salem, NC.
Multiple neuron recording in the hippocampus of freely moving animals
[AD-A232934] p 205 N91-24725
Washington Univ., Saint Louis, MO.
Effect of denervation or unweighting on GLUT-4 protein in rat soleus muscle p 197 A91-36424
Control of biosonar behavior by the auditory cortex
[AD-A232699] p 221 N91-23708
Wichita State Univ., KS.
Cognitive performance capabilities in the cockpit
p 234 N91-24090
Human factors cockpit: A system and human factors program to enhance safety and efficiency in single pilot IFR and terminal area operations p 234 N91-24165
Wright State Univ., Dayton, OH.
Hepatic metabolism of perfluorinated carboxylic acids: A nuclear magnetic resonance investigation
[AD-A232033] p 221 N91-23706

Typical Foreign Technology Index Listing



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

A

AUSTRALIA
Effect of microgravity on the respiratory system p 206 A91-36419
Red cell membrane under zero gravity - Interpretation of ARC experiment on STS51-C p 202 A91-38965
Three hierarchies in skeletal muscle fibre classification - Allotype, isotype and phenotype p 215 A91-39509

B

BELGIUM
Orthosympathetic activity during head-out water immersion and during floating p 208 A91-37470
BULGARIA
Reaction time to motion offset of visual stimuli p 224 A91-37280

C

CANADA
Effects of left atrial pressure on the pulmonary vascular response to hypoxic ventilation p 197 A91-36420
Shivering onset, metabolic response, and convective heat transfer during cold air exposure p 206 A91-36421
Phrenic neural output during hypoxia in dogs - Constant-flow ventilation vs. spontaneous breathing p 197 A91-36423
Cardiorespiratory responses to maximal and submaximal exercise in supine and upright positions p 207 A91-37468
A closed-form dynamical analysis of an orbiting flexible manipulator p 227 A91-38220
Permanent grounding and flying restrictions in Canadian Forces pilots - A 10-year review p 216 A91-39535
Visually-induced sickness in normal and bilaterally labyrinthine-defective subjects p 217 A91-39538
Asymmetric visual deficit at high sustained Gz p 218 A91-39546
Evaluation of display system enhancements to assist an operator in the detection of point targets p 229 A91-39883
Cardiovascular adaptations in Andean natives after 6 wk of exposure to sea level p 218 A91-40466
Finite-element solution of thermal conductivity of muscle during cold water immersion p 219 A91-40468
In vivo thermal conductivity of the human forearm tissues p 219 A91-40469
Heat strain and work tolerance times with varying levels of Canadian Forces NBC protective clothing, ambient temperature, physical work intensity, and work/rest schedules
[AD-A232653] p 232 N91-23720
CZECHOSLOVAKIA
The effect of the angular velocity on the muscle composition in Japanese quail p 199 A91-37490
The effects of hypergravitation, hypodyamy and their combination on the ultrastructure of the heart muscle of Japanese quail p 201 A91-37510

D

DENMARK
Cerebral O2 metabolism and cerebral blood flow in humans during deep and rapid-eye-movement sleep p 218 A91-40465

F

FINLAND
Microcomputer-based monitoring of cardiovascular responses to microgravity simulation (-7 degrees HDT) p 209 A91-37478
FRANCE
Bone cellular effects after weightlessness exposure - An hypothesis p 197 A91-37459
Cardiovascular deconditioning during weightlessness simulation and the use of lower body negative pressure as a countermeasure to orthostatic intolerance p 207 A91-37465
Physical fitness before and after one month head-down bedrest, with and without lower body negative pressure p 207 A91-37466
Effects of lower body negative pressure on cardiovascular adaptation to one month head-down bedrest p 207 A91-37467
Comparative study of cardiovascular responses in primates exposed to tilt test and LBPP p 198 A91-37474
Effects of lower body positive pressure on forearm vasculature p 208 A91-37475
The effect of LBNP (lower body negative pressure) on lower limb capacitance vessels during a 30 day -6 deg head-down bedrest p 209 A91-37479
Catecholamines during short- and long-term head-down bedrest p 209 A91-37481
Toward an univocous interpretation of cardiovascular biomechanics in hyper and microgravity p 209 A91-37482
Compared effects of a 13 day spaceflight on the contractile proteins of soleus and plantaris rat muscles p 199 A91-37484
Effect of simulated microgravity on the ultrastructural composition of rat soleus muscle p 199 A91-37486
Time-course of soleus muscle-change in and recovery from disuse atrophy p 199 A91-37488
Evidences for slow to fast changes in the contractile proteins of rat soleus muscle after hindlimb suspension - Studies on skinned fibers p 199 A91-37489
Bone effects of 13 days of weightlessness on rat and monkey - Some results of Biocosmos 1887 and ground simulations p 200 A91-37491
Effects of a 40 day tail-suspension on rat weight-bearing bones p 200 A91-37492
Plants and men in space - A new field in plant physiology p 226 A91-37494
Relationship between hormones and brain water content measured by 1H magnetic resonance spectroscopy during simulated weightlessness in man p 210 A91-37496
Mechanisms of lower body positive pressure-induced natriuresis p 210 A91-37497
Hemodynamic, plasma renin activity and norepinephrine changes induced by anti-G suit inflation in man p 226 A91-37498
Influence of short and long duration exposure to hypergravity in a single-cell organism, paramecium tetraurelia p 200 A91-37501
Electrovestibulography in experimental animals p 200 A91-37502
Stresses in the brain mass and in the peripheral fluids under Gz acceleration - Study of a simple model p 211 A91-37511
Mechanics of contraction and relaxation in papillary muscles of healthy and centrifugated baboons p 201 A91-37512
31P-NMR spectroscopy studies of myocardium submitted to hypergravitation p 201 A91-37513
Study of aortic and carotid blood flow by pulsed Doppler with implantable microprobes in hypergravity p 201 A91-37514
Effects of high sustained hypergravity on plasma catecholamines p 202 A91-37515
G-induced loss of consciousness detection limits with transcranial Doppler monitoring p 211 A91-37516
A mathematical modeling of the cerebrovascular system p 227 A91-37517
Ultrasound technology and space cardio-vascular medicine p 211 A91-37518
Variations of the renal flow in relation with the volemia p 212 A91-37525
New electronic anti-G valve and regulator ensemble p 228 A91-39378
Modern pneumatic technology and the challenges of physiological protection for the pilot of advanced fighter aircraft p 228 A91-39381
Subsea habitats and space simulation p 230 N91-23567
Some problems of desynchronisation of sleep-wakefulness and circadian rhythms for long duration spaceflights p 219 N91-23570
Long duration hyperbaric confinement: Hydra 9 p 220 N91-23571
European stakes and measures permitting the management of geometric dimensions p 230 N91-23573
Comparisons between underwater and space working environments for on board activities optimization (Columbus space programme) p 230 N91-23574
Neutral buoyancy and microgravity: Extravehicular activities with a humid water suit p 231 N91-23579
A KO2 rebreather for EVA denitrogenation procedure p 220 N91-23588
Object oriented programming in MMI: A software tool for analysis and planification of a radar imaging mission p 231 N91-23589
Research and development involved in creating a quantitative EEG cartography wide band analysis system
[LAAS-91002] p 221 N91-23705
Human Performance Assessment Methods. Addendum
[AGARD-AG-308-ADD] p 225 N91-23711

G

GERMANY,FEDERAL REPUBLIC OF
Otolith versus vertical semicircular canal input in the inhibition of horizontal postrotatory nystagmus p 210 A91-37503
Results of examinations of the +Gz acceleration tolerance using different acceleration profiles p 211 A91-37509
Effects of a 10-day period of 6 degree head down tilt (HDT) p 211 A91-37519
Effects of 10 days HDT on fluid and electrolyte metabolism p 212 A91-37520

FOREIGN

Responses of adrenergic receptors to simulated weightlessness (6 deg head down tilt)
p 212 A91-37522

Effect of a 10-day HDT on the hemodynamic response to LBNP p 212 A91-37524

The diving laboratory as a simulation environment for manned spaceflight p 224 N91-23564

Psychological selection of astronauts: Recent developments at the DLR testing centre in Hamburg (Fed. Republic of Germany) p 224 N91-23565

Payload related crew operations: From past missions to Columbus p 230 N91-23569

Multisensory telerobotic concepts for space and underwater applications p 231 N91-23584

First biological and dosimetric results of the free flyer biostack experiment AO015 on LDEF
p 205 N91-25096

H

HUNGARY

Biomechanical characteristics of m. soleus and m. gastrocnemius of rats in Musacchia's model
p 199 A91-37487

I

ISRAEL

Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 224 A91-39421

The effect of prolonged intermittent exercise, combined with food deprivation, on plasma metabolite concentration p 217 A91-39542

The failure analysis of composite material flight helmets as an aid in aircraft accident investigation
p 229 A91-39550

Interaction between laser beam and biological tissue: A comparison between CO2, Nd:YAG and Ho:YAG lasers
[ITN-90-85022] p 222 N91-24728

J

JAPAN

Cardiovascular responses to moderate exercise during water immersion in woman p 208 A91-37471

Water intake at post-exercise comparing between head-up and -down tilting in woman p 210 A91-37485

Sex differences in blood constituents of rats following tail suspension p 200 A91-37499

Nutritional assessment of cockpit crew meal
p 213 A91-37717

Effect of fluid and salt supplements in preventing the development of 'osteopenia' in hypokinetic rats
p 202 A91-38222

Manned diving activities in JAMSTEC
p 220 N91-23572

Added information by man-machine interactive operation of the SCIC p 234 N91-24665

N

NETHERLANDS

The autonomic nervous system in blood pressure regulation during 10 days 6 deg head down tilt
p 213 A91-37527

EVA servicing: The Hermes capability
p 230 N91-23575

How to design efficient MMI for space
p 231 N91-23586

Otolith responses in man during parabolic flight
[IZF-1990-A-32] p 220 N91-23703

The development of highly practiced skills: A starting point for driver modelling
[IZF-1990-B-16] p 232 N91-23719

NIGERIA

Transcranial Doppler evaluation of syncope - An application in aerospace physiology p 218 A91-39545

NORWAY

Prolonged photostress macular recovery after reduced blood pressure p 217 A91-39539

Fatty acids in human platelets and plasma - Fish oils decrease sensitivity toward N2 microbubbles
p 219 A91-40467

Effects of weightlessness (sea water immersion) on body fluid balance and CNS functions p 219 N91-23566

Man-machine interactions and multimedia applied to ROV operations p 230 N91-23576

P

POLAND

The characteristics of adaptation to a moderate altitude hypoxia and a hyperthermia in humans engaged in physical activity p 214 A91-39104

PORTUGAL

The Berlenga underwater survey project
p 231 N91-23577

S

SWEDEN

An approach to counteracting long-term microgravity-induced muscle atrophy
p 209 A91-37483

U

U.S.S.R.

Increasing the physical endurance of animals treated with para-aminobenzoic acid p 197 A91-37268

Results of studies of motor functions in long-term space flights p 206 A91-37457

Destructive and adaptive processes in human vertebral column under altered gravitational potential
p 206 A91-37458

Effects of space flight on dendrites of the neurons of the rat's brain p 198 A91-37460

Histomorphometric analysis of bones of Cosmos-1887 rats p 198 A91-37462

The patterns of spontaneous oculomotor activity during weightlessness and readaptation to gravity
p 207 A91-37463

The effect of space flight on the ultrastructure of the rat cerebellar and hemisphere cortex
p 198 A91-37464

Cardiovascular function of man exposed to LBNP tests p 210 A91-37506

The effect of external inspiratory resistance to breathing on man's orthostatic tolerance p 211 A91-37507

Comparative analysis of hypergravity (2G) and weightlessness effect on the blood-forming system of male and female mammals p 201 A91-37508

Medical support of long-term missions aboard 'Mir' orbital complex p 213 A91-37573

The effect of low-frequency vibration on GABA metabolism in several brain structures
p 202 A91-39071

Age characteristics of the response of the lysosome system of neutrophilic leukocytes in rabbits' peripheral blood to immobilization p 202 A91-39072

Characteristics of adaptive system reactions in operators working shifts (According to omegometric findings)
p 213 A91-39073

Adaptive changes in lipid peroxidation under the chronic effect of an electrostatic field p 203 A91-39074

Biorhythmological approach to studies of functional asymmetry in systems regulating equilibrium and orientation in space p 213 A91-39101

Diurnal dynamics or hormonal regulation of the water-salt exchange in humans under prolonged hypokinesia
p 214 A91-39102

The effect of cooling in water on the hormonal state of the human organism p 214 A91-39103

Dependence of the success of flight training on the accentuation of the trainee's character
p 224 A91-39105

The macro- and microhemodynamics of an organ and the systemic circulation under combined effects of hypoxia and hypothermia p 203 A91-39184

The functional states of a human organism from the standpoint of dielectic harmony between the waveform processes of the brain, the organism, and the habitat
p 214 A91-39185

Real time analysis systems of the physical parameters of the environment and the state of a human organism for a long term exposure at different gas mixtures and pressure up to 100 bar p 219 N91-23568

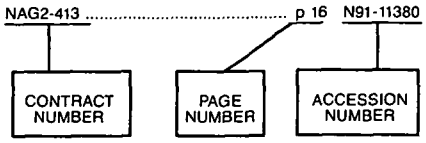
UNITED KINGDOM

Cardiovascular responses to sustained acceleration
p 201 A91-37504

Improving auditory warning design - Relationship between warning sound parameters and perceived urgency p 224 A91-38669

Scopolamine blood levels following buccal versus ingested tablets p 216 A91-39537

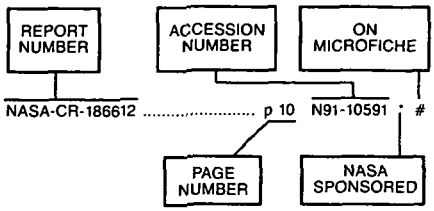
Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under the contract are shown. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

AF PROJ. 2312 ..... p 221 N91-23706
p 225 N91-23714
p 233 N91-23722
p 223 N91-24733
AF PROJ. 2313 ..... p 221 N91-23708
p 223 N91-24734
p 226 N91-24737
AF PROJ. 3484 ..... p 205 N91-24725
AF PROJ. 7231 ..... p 233 N91-23723
AF-AFOSR-0092-90 ..... p 205 N91-24725
AF-AFOSR-0097-90 ..... p 223 N91-24733
AF-AFOSR-0125-90 ..... p 225 N91-23714
AF-AFOSR-0148-90 ..... p 221 N91-23706
AF-AFOSR-0243-89 ..... p 226 N91-24737
AF-AFOSR-0250-87 ..... p 221 N91-23708
AF-AFOSR-0305-90 ..... p 233 N91-23722
AF-AFOSR-0335-86 ..... p 223 N91-24734
A88/M/318 ..... p 220 N91-23703
DA PROJ. 3M2-63002-D-995 ..... p 226 N91-24736
DAAL03-86-D-0001 ..... p 225 N91-23713
DAAL03-87-K-0034 ..... p 225 N91-23712
DE-AC03-76SF-00098 ..... p 204 N91-23698
DE-AC06-76RL-01830 ..... p 205 N91-24727
DE-FG02-87ER-60557 ..... p 205 N91-24726
DE-FG03-88ER-60673 ..... p 204 N91-23695
DE-FG03-90ER-60997 ..... p 204 N91-23696
DRET-87-040 ..... p 200 A91-37492
F33615-83-D-0602 ..... p 198 A91-37473
F33615-84-R-0514 ..... p 198 A91-37473
F49620-82-C-0035 ..... p 198 A91-37473
F49620-88-K-0008 ..... p 225 N91-23715
F49620-90-C-0063 ..... p 226 N91-23716
MDA905-89-C-0014 ..... p 221 N91-23707
MINISTRY OF DEFENCE-SUPPORTED ..... p 224 A91-38669
NAGW-1691 ..... p 227 A91-37500
NAG1-489 ..... p 227 A91-38748
NAG2-386 ..... p 198 A91-37472
NAG9-271 ..... p 218 A91-40464
NAS10-10285 ..... p 209 A91-37483
p 217 A91-39540
NAS10-11624 ..... p 217 A91-39540
p 232 N91-23718
NAS9-15487 ..... p 216 A91-39514
NAS9-16037 ..... p 218 A91-40464
NAS9-16042 ..... p 215 A91-39507
p 216 A91-39511
NAS9-16328 ..... p 216 A91-39514
NAS9-16874 ..... p 216 A91-39513
NCC2-333 ..... p 227 A91-38747
NIH-AG-00425 ..... p 197 A91-36424
NIH-AM-33431 ..... p 216 A91-39513
NIH-DK-42503 ..... p 197 A91-36424
NR PROJ. RR0-4206 ..... p 235 N91-24741
NSERC-5-80029 ..... p 227 A91-38220
NSG-2191 ..... p 198 A91-37472
NSG-2325 ..... p 198 A91-37472
N00014-86-K-0395 ..... p 235 N91-24741
p 235 N91-24742
p 235 N91-24743
N00014-90-C-0182 ..... p 204 N91-23699
N00014-90-J-1562 ..... p 204 N91-24724
W-7405-ENG-36 ..... p 204 N91-23695
p 204 N91-23697
W-7405-ENG-48 ..... p 203 N91-23692
W-7405-ENG-82 ..... p 203 N91-23693
199-14-12-04 ..... p 221 N91-23704
199-61-12 ..... p 235 N91-24744
674-23-08-17 ..... p 222 N91-24057

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-89105 ..... p 235 N91-24744 * #
A-91096 ..... p 221 N91-23704 * #

AAMRL-SR-90-508 ..... p 234 N91-24738 #
AAMRL-SR-90-510 ..... p 233 N91-23723 #

AD-A231572 ..... p 232 N91-23717 #
AD-A231698 ..... p 234 N91-24738 #
AD-A231714 ..... p 223 N91-24729 #
AD-A231759 ..... p 234 N91-24739 #
AD-A232033 ..... p 221 N91-23706 #
AD-A232057 ..... p 204 N91-24724 #
AD-A232108 ..... p 204 N91-23699 #
AD-A232221 ..... p 221 N91-23707 #
AD-A232389 ..... p 225 N91-23712 #
AD-A232526 ..... p 225 N91-23713 #
AD-A232653 ..... p 232 N91-23720 #
AD-A232698 ..... p 225 N91-23714 #
AD-A232699 ..... p 221 N91-23708 #
AD-A232721 ..... p 232 N91-23721 #
AD-A232732 ..... p 221 N91-23709 #
AD-A232734 ..... p 225 N91-23715 #
AD-A232787 ..... p 233 N91-23722 #
AD-A232799 ..... p 226 N91-23716 #
AD-A232814 ..... p 233 N91-23723 #
AD-A232905 ..... p 226 N91-24736 #
AD-A232934 ..... p 205 N91-24725 #
AD-A232988 ..... p 223 N91-24732 #
AD-A233026 ..... p 223 N91-24733 #
AD-A233041 ..... p 223 N91-24734 #
AD-A233042 ..... p 223 N91-24735 #
AD-A233306 ..... p 235 N91-24741 #
AD-A233340 ..... p 226 N91-24737 #
AD-A233601 ..... p 235 N91-24742 #
AD-A233602 ..... p 235 N91-24743 #

AD-B150721L ..... p 220 N91-23703

AFOSR-91-0021TR ..... p 221 N91-23706 #
AFOSR-91-0053TR ..... p 225 N91-23715 #
AFOSR-91-0064TR ..... p 233 N91-23722 #
AFOSR-91-0110TR ..... p 225 N91-23714 #
AFOSR-91-0112TR ..... p 205 N91-24725 #
AFOSR-91-0130TR ..... p 223 N91-24734 #
AFOSR-91-0145TR ..... p 221 N91-23708 #
AFOSR-91-0188TR ..... p 226 N91-23716 #
AFOSR-91-0189TR ..... p 226 N91-24737 #
AFOSR-91-0190TR ..... p 223 N91-24733 #

AGARD-AG-308-ADD ..... p 225 N91-23711 #

ARI-RN-91-15 ..... p 234 N91-24739 #
ARI-RN-91-29 ..... p 225 N91-23713 #

ARO-24111.10-LS ..... p 225 N91-23712 #

CONF-9005329-1 ..... p 204 N91-23695 #
CONF-9103152-1 ..... p 205 N91-24727 #
CONF-910637-1 ..... p 204 N91-23697 #

DCIEM-90-51 ..... p 232 N91-23720 #

DE90-016440 ..... p 204 N91-23697 #
DE91-007575 ..... p 205 N91-24726 #
DE91-009071 ..... p 204 N91-23698 #
DE91-009719 ..... p 203 N91-23692 #
DE91-009939 ..... p 204 N91-23695 #
DE91-009996 ..... p 204 N91-23696 #
DE91-010006 ..... p 205 N91-24727 #
DE91-010181 ..... p 203 N91-23693 #

DOE/ER-60557/1 ..... p 205 N91-24726 #
DOE/ER-60997/T1 ..... p 204 N91-23696 #

DOT-MA-RD-840-90014 ..... p 235 N91-24740 #

DOT-VNTSC-MARAD-90-1 ..... p 235 N91-24740 #

DOT/FAA/RD-91/13 ..... p 225 N91-23710 #

ETN-91-99098 ..... p 220 N91-23703
ETN-91-99099 ..... p 232 N91-23719
ETN-91-99240 ..... p 221 N91-23705 #

IS-T-1490 ..... p 203 N91-23693 #

ISBN-92-835-0600-6 ..... p 225 N91-23711 #

ITN-90-85022 ..... p 222 N91-24728

IZF-1990-A-32 ..... p 220 N91-23703
IZF-1990-B-16 ..... p 232 N91-23719

LA-UR-90-2884 ..... p 204 N91-23697 #
LA-UR-91-732 ..... p 204 N91-23695 #

LAAS-91002 ..... p 221 N91-23705 #

LBL-30077 ..... p 204 N91-23698 #

NAS 1.15:103819 ..... p 232 N91-23718 * #
NAS 1.15:103847 ..... p 221 N91-23704 * #
NAS 1.21:7011(346) ..... p 220 N91-23700 *
NAS 1.21:7011(347) ..... p 220 N91-23701 *
NAS 1.21:7011(348) ..... p 220 N91-23702 *
NAS 1.21:7011(349) ..... p 223 N91-24731 *
NAS 1.55:10040 ..... p 235 N91-24744 * #
NAS 1.83:120 ..... p 203 N91-23694 * #

NASA-CP-10040 ..... p 235 N91-24744 * #

NASA-NP-120 ..... p 203 N91-23694 * #

NASA-SP-7011(346) ..... p 220 N91-23700 *
NASA-SP-7011(347) ..... p 220 N91-23701 *
NASA-SP-7011(348) ..... p 220 N91-23702 *
NASA-SP-7011(349) ..... p 223 N91-24731 *

NASA-TM-103819 ..... p 232 N91-23718 * #
NASA-TM-103847 ..... p 221 N91-23704 * #

NBDL-89R001 ..... p 221 N91-23709 #
NBDL-90R007 ..... p 232 N91-23721 #

NCTRF-180 ..... p 232 N91-23717 #

OTA-BP-BA-75 ..... p 223 N91-24730 #

PB91-138099 ..... p 235 N91-24740 #

PNL-SA-18947 ..... p 205 N91-24727 #

TD-90-3407 ..... p 220 N91-23703
TD-90-3409 ..... p 232 N91-23719

UCRL-ID-106311 ..... p 203 N91-23692 #

USABRDL-TR-9010 ..... p 223 N91-24729 #

USAFSAM-TP-89-11 ..... p 223 N91-24735 #
USAFSAM-TP-90-23 ..... p 223 N91-24732 #

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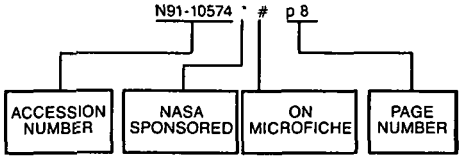

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A91-36419 p 206
A91-36420 p 197
A91-36421 p 206
A91-36422 p 206
A91-36423 p 197
A91-36424 * p 197
A91-36932 p 226
A91-37268 p 197
A91-37280 p 224
A91-37367 * p 235
A91-37456 * p 197
A91-37457 # p 206
A91-37458 # p 206
A91-37459 # p 197
A91-37460 # p 198
A91-37461 *# p 207
A91-37462 # p 198
A91-37463 # p 207
A91-37464 # p 198
A91-37465 # p 207
A91-37466 # p 207
A91-37467 # p 207
A91-37468 # p 207
A91-37469 *# p 208
A91-37470 # p 208
A91-37471 # p 208
A91-37472 *# p 198
A91-37473 # p 198
A91-37474 # p 198
A91-37475 # p 208
A91-37476 *# p 208
A91-37477 # p 208
A91-37478 # p 209
A91-37479 # p 209
A91-37480 *# p 209
A91-37481 # p 209
A91-37482 # p 209
A91-37483 *# p 209
A91-37484 # p 199
A91-37485 # p 210
A91-37486 # p 199
A91-37487 # p 199
A91-37488 # p 199
A91-37489 # p 199
A91-37490 # p 199
A91-37491 # p 200
A91-37492 # p 200
A91-37493 # p 200
A91-37494 *# p 226
A91-37495 # p 200
A91-37496 # p 210
A91-37497 # p 210
A91-37498 # p 226
A91-37499 # p 200
A91-37500 *# p 227
A91-37501 # p 200
A91-37502 # p 200
A91-37503 # p 210
A91-37504 # p 201
A91-37505 # p 210
A91-37506 # p 210
A91-37507 # p 211
A91-37508 # p 201
A91-37509 # p 211
A91-37510 # p 201
A91-37511 # p 211
A91-37512 # p 201
A91-37513 # p 201
A91-37514 # p 201
A91-37515 # p 202
A91-37516 # p 211
A91-37517 # p 227
A91-37518 # p 211
A91-37519 # p 211
A91-37520 # p 212
A91-37521 # p 212
A91-37522 # p 212
A91-37523 # p 212
A91-37524 # p 212
A91-37525 # p 212
A91-37526 # p 213
A91-37527 # p 213
A91-37573 # p 213
A91-37717 # p 213
A91-38220 p 227
A91-38222 p 202
A91-38668 p 227
A91-38669 p 224
A91-38747 * p 227
A91-38748 * p 227
A91-38749 p 228
A91-38965 # p 202
A91-39071 p 202
A91-39072 p 202
A91-39073 p 213
A91-39074 p 203
A91-39101 p 213
A91-39102 p 214
A91-39103 p 214
A91-39104 p 214
A91-39105 p 224
A91-39184 p 203
A91-39185 p 214
A91-39375 p 228
A91-39376 p 228
A91-39378 p 228
A91-39381 p 228
A91-39391 p 228
A91-39397 p 229
A91-39399 p 214
A91-39421 # p 224
A91-39501 * p 214
A91-39502 p 214
A91-39504 p 215
A91-39505 p 215
A91-39506 p 215
A91-39507 * p 215
A91-39508 p 215
A91-39509 p 215
A91-39510 * p 215
A91-39511 * p 216
A91-39512 * p 216
A91-39513 * p 216
A91-39514 * p 216
A91-39515 p 216
A91-39535 p 216
A91-39536 p 224
A91-39537 p 216
A91-39538 p 217
A91-39539 p 217
A91-39540 * p 217
A91-39541 p 203
A91-39542 p 217
A91-39543 p 217
A91-39544 p 229
A91-39545 p 218
A91-39546 p 218
A91-39547 p 218
A91-39548 p 229
A91-39549 p 218
A91-39550 p 229
A91-39882 p 229
A91-39883 p 229
A91-39884 p 230
A91-40464 * p 218
A91-40465 p 218
A91-40466 p 218
A91-40467 p 219
A91-40468 p 219
A91-40469 p 219
N91-23564 # p 224
N91-23565 # p 224
N91-23566 # p 219
N91-23567 # p 230
N91-23568 # p 219
N91-23569 # p 230
N91-23570 # p 219
N91-23571 # p 220
N91-23572 # p 220
N91-23573 # p 230
N91-23574 # p 230
N91-23575 # p 230
N91-23576 # p 230
N91-23577 # p 231
N91-23579 # p 231
N91-23583 # p 231
N91-23584 # p 231
N91-23586 # p 231
N91-23588 # p 220
N91-23589 # p 231
N91-23692 # p 203
N91-23693 # p 203
N91-23694 *# p 203
N91-23695 # p 204
N91-23696 # p 204
N91-23697 # p 204
N91-23698 # p 204
N91-23699 # p 204
N91-23700 * p 220
N91-23701 * p 220
N91-23702 * p 220
N91-23703 p 220
N91-23704 *# p 221
N91-23705 # p 221
N91-23706 # p 221
N91-23707 # p 221
N91-23708 # p 221
N91-23709 # p 221
N91-23710 # p 225
N91-23711 # p 225
N91-23712 # p 225
N91-23713 # p 225
N91-23714 # p 225
N91-23715 # p 225
N91-23716 # p 226
N91-23717 # p 232
N91-23718 *# p 232
N91-23719 p 232
N91-23720 # p 232
N91-23721 # p 232
N91-23722 # p 233
N91-23723 # p 233
N91-24052 *# p 233
N91-24053 *# p 233
N91-24056 *# p 222
N91-24057 *# p 222
N91-24058 *# p 222
N91-24059 *# p 233
N91-24060 *# p 233
N91-24076 *# p 222
N91-24090 # p 234
N91-24165 # p 234
N91-24604 *# p 234
N91-24665 # p 234
N91-24724 # p 204
N91-24725 # p 205
N91-24726 # p 205
N91-24727 # p 205
N91-24728 p 222
N91-24729 # p 223
N91-24730 # p 223
N91-24731 * p 223
N91-24732 # p 223
N91-24733 # p 223
N91-24734 # p 223
N91-24735 # p 223
N91-24736 # p 226
N91-24737 # p 226
N91-24738 # p 234
N91-24739 # p 234
N91-24740 # p 235
N91-24741 # p 235
N91-24742 # p 235
N91-24743 # p 235
N91-24744 *# p 235
N91-25094 *# p 205
N91-25095 *# p 205
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106 Old Gym Bldg.
University, MS 38677
(601) 232-5857 FAX: (601) 232-5453

MISSOURI

UNIV. OF MISSOURI - COLUMBIA
Ellis Library
Govt. Documents
Columbia, MO 65201
(314) 882-6733 FAX: (314) 882-8044

MONTANA

UNIV. OF MONTANA
Maureen & Mike Mansfield Library
Documents Div.
Missoula, MT 59812-1195
(406) 243-6700 FAX: (406) 243-2060

NEBRASKA

UNIV. OF NEBRASKA - LINCOLN
D.L. Love Memorial Library
Documents Dept.
Lincoln, NE 68588
(402) 472-2562

NEVADA

UNIV. OF NEVADA
Reno Library
Govt. Publications Dept.
Reno, NV 89557
(702) 784-6579 FAX: (702) 784-1751

NEW JERSEY

NEWARK PUBLIC LIBRARY
U.S. Documents Div.
5 Washington Street - P.O. Box 630
Newark, NJ 07101-0630
(201) 733-7812 FAX: (201) 733-5648

NEW MEXICO

UNIV. OF NEW MEXICO
General Library
Govt. Publications Dept.
Albuquerque, NM 87131-1466
(505) 277-5441 FAX: (505) 277-6019

NEW MEXICO STATE LIBRARY
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826 FAX: (505) 827-3820

NEW YORK

NEW YORK STATE LIBRARY
Documents/Gift & Exchange Section
Federal Depository Program
Cultural Education Center
Albany, NY 12230
(518) 474-5563 FAX: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA - CHAPEL HILL
CB#3912, Davis Library
BA/SS Dept.—Documents
Chapel Hill, NC 27599
(919) 962-1151 FAX: (919) 962-0484

NORTH DAKOTA

NORTH DAKOTA STATE UNIV. LIBRARY
Documents Office
Fargo, ND 58105
(701) 237-8886 FAX: (701) 237-7138
In cooperation with Univ. of North Dakota, Chester Fritz Library
Grand Forks

OHIO

STATE LIBRARY OF OHIO
Documents Dept.
65 South Front Street
Columbus, OH 43266
(614) 644-7051 FAX: (614) 752-9178

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES
U.S. Govt. Information Div.
200 NE 18th Street
Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 252, 253
FAX: (405) 525-7804

OKLAHOMA STATE UNIV.
Edmon Low Library
Documents Dept.
Stillwater, OK 74078
(405) 744-6546 FAX: (405) 744-5183

OREGON

PORTLAND STATE UNIV.
Millar Library
934 SW Harrison - P.O. Box 1151
Portland, OR 97207
(503) 725-3673 FAX: (503) 725-4527

PENNSYLVANIA

STATE LIBRARY OF PENN.
Govt. Publications Section
Walnut St. & Commonwealth Ave. - P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

SOUTH CAROLINA

CLEMSON UNIV.
Cooper Library
Public Documents Unit
Clemson, SC 29634-3001
(803) 656-5174 FAX: (803) 656-3025
In cooperation with Univ. of South Carolina, Thomas Cooper Library, Columbia

TENNESSEE

MEMPHIS STATE UNIV. LIBRARIES
Govt. Documents
Memphis, TN 38152
(901) 678-2586 FAX: (901) 678-2511

TEXAS

TEXAS STATE LIBRARY
United States Documents
P.O. Box 12927 - 1201 Brazos
Austin, TX 78711
(512) 463-5455 FAX: (512) 463-5436

TEXAS TECH. UNIV. LIBRARY
Documents Dept.
Lubbock, TX 79409
(806) 742-2268 FAX: (806) 742-1920

UTAH

UTAH STATE UNIV.
Merrill Library & Learning Resources Center, UMC-3000
Documents Dept.
Logan, UT 84322-3000
(801) 750-2684 FAX: (801) 750-2677

VIRGINIA

UNIV. OF VIRGINIA
Alderman Library
Govt. Documents
Charlottesville, VA 22903-2498
(804) 924-3133 FAX: (804) 924-4337

WASHINGTON

WASHINGTON STATE LIBRARY
Document Section
MS AJ-11
Olympia, WA 98504-0111
(206) 753-4027 FAX: (206) 753-3546

WEST VIRGINIA

WEST VIRGINIA UNIV. LIBRARY
Govt. Documents Section
P.O. Box 6069
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

ST. HIST. SOC. OF WISCONSIN LIBRARY
Govt. Publications Section
816 State Street
Madison, WI 53706
(608) 262-2781 FAX: (608) 262-4711
In cooperation with Univ. of Wisconsin-Madison, Memorial Library

MILWAUKEE PUBLIC LIBRARY
Documents Div.
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-2167 FAX: (414) 278-2137

WYOMING

WYOMING STATE LIBRARY
Supreme Court & Library Bldg.
Govt. Publications
Cheyenne, WY 82002
(307) 777-5920 FAX: (307) 777-6289

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