NASA SP-7011 (417)
July 8, 1996

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

National Aeronautics and
Space Administration

**Scientific and Technical
Information Office**

The NASA STI Office ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Office plays a key part in helping NASA maintain this important role.

The NASA STI Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Office is also NASA's institutional mechanism for disseminating the results of its research and development activities.

Specialized services that help round out the STI Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results ... even providing videos.

For more information about the NASA STI Office, you can:

Phone the NASA Access Help Desk at (301) 621-0390

Fax your question to the NASA Access Help Desk at (301) 621-0134

E-mail your question via the **Internet** to help@sti.nasa.gov

Write to: NASA Access Help Desk
NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

This publication was prepared by the NASA Center for AeroSpace Information,
800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934

Introduction

This issue of *Aerospace Medicine and Biology, A Continuing Bibliography with Indexes* (NASA SP-7011) lists 101 reports, articles, and other documents recently announced in the NASA STI Database.

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.

Two indexes—subject and author are included.

The NASA CASI price code table, addresses of organizations, and document availability information are located at the back of this issue.

SCAN Goes Electronic!

If you have electronic mail or if you can access the Internet, you can view biweekly issues of *SCAN* from your desktop absolutely free!

Electronic SCAN takes advantage of computer technology to inform you of the latest worldwide, aerospace-related, scientific and technical information that has been published.

No more waiting while the paper copy is printed and mailed to you. You can view *Electronic SCAN* the same day it is released—up to 191 topics to browse at your leisure. When you locate a publication of interest, you can print the announcement. You can also go back to the *Electronic SCAN* home page and follow the ordering instructions to quickly receive the full document.

Start your access to *Electronic SCAN* today. Over 1,000 announcements of new reports, books, conference proceedings, journal articles...and more—available to your computer every two weeks.

Timely
Flexible
Complete
FREE!

For Internet access to *E-SCAN*, use any of the following addresses:

http://www.sti.nasa.gov
ftp.sti.nasa.gov
gopher.sti.nasa.gov

To receive a free subscription, send e-mail for complete information about the service first. Enter **scan@sti.nasa.gov** on the address line. Leave the subject and message areas blank and send. You will receive a reply in minutes.

Then simply determine the SCAN topics you wish to receive and send a second e-mail to **listserve@sti.nasa.gov**. Leave the subject line blank and enter a subscribe command in the message area formatted as follows:

Subscribe <desired list> <Your name>

For additional information, e-mail a message to **help@sti.nasa.gov**.

Phone: (301) 621-0390

Fax: (301) 621-0134

Write: NASA Access Help Desk
NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

Looking just for *Aerospace Medicine and Biology* reports?

Although hard copy distribution has been discontinued, you can still receive these vital announcements through your *E-SCAN* subscription. Just **subscribe SCAN-AEROMED** in the message area of your e-mail to **listserve@sti.nasa.gov**.

New Feature!
subscribe SCAN-AEROMED

Table of Contents

Records are arranged in categories 51 through 55, the Life Sciences division of *STAR*. Selecting a category will link you to the collection of records cited in this issue pertaining to that category.

51 Life Sciences (General) 1

52 Aerospace Medicine 12

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

53 Behavioral Sciences 25

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

54 Man/System Technology and Life Support 27

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

55 Space Biology N.A.

Includes exobiology; planetary biology; and extraterrestrial life.

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.

Subject Term Index ST-1

Author Index PA-1

Selecting an index above will link you to that comprehensive listing.

Appendix

Select **Appendix** for important information about NASA Scientific and Technical Information (STI) Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

Typical Report Citation and Abstract

ACCESSION NUMBER ↓

DOCUMENT ID NUMBER → **19960021053;** 96N24540 NASA Langley Research Center, Hampton, VA USA. ← CORPORATE SOURCE

TITLE → **An Extended Compact Tension Specimen for Fatigue Crack Propagation and Fracture**

AUTHORS → Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; ← AUTHORS' AFFILIATION

PUBLICATION DATE → Mar. 1996, pp. 16; In English

CONTRACTS/GRANTS → Contract(s)/Grant(s): RTOP 538–02–10–01

REPORT NO.(S) → Report No.(s): NASA–TM–110243; NAS 1.15:110243; No Copyright; Avail: CASI A03, Hardcopy; A01, Microfiche ← AVAILABILITY AND PRICE CODE

ABSTRACT → An extended compact tension specimen, EC(T) has been developed for fatigue and fracture testing. Documented herein are stress-intensity factor and compliance expressions for the EC(T) specimen.

ABSTRACT AUTHOR → Author

SUBJECT TERMS → *Crack Propagation; Stress Intensity Factors; Fatigue (Materials)*

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 417)

JULY 8, 1996

51
LIFE SCIENCES (GENERAL)

19960021016; 96N24508 NASA Ames Research Center, Moffett Field, CA USA

Publications from Biomedical Research Conducted in the NASA Ames Research Center Human Research Facility: 1972-1995

Greenleaf, J. E., NASA Ames Research Center, USA; DeRoshia, C. W., NASA Ames Research Center, USA; Reyna, V. L., NASA Ames Research Center, USA; Oswald, K. A., NASA Ames Research Center, USA; Apr. 1996, pp. 56; In English

Contract(s)/Grant(s): RTOP 199-18-12-07

Report No.(s): NASA-TM-110391; A-961428; NAS 1.15: 110391; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Publications (abstracts, papers, and review articles) resulting from prolonged (greater than 24 hour) bed-rest projects and short-term (less than 24 hour) head-down tilt or bed rest studies conducted on men and women in the Human Research Facility, Life Science Division at Ames Research Center, from 1972 to 1995 are presented herein. These publications report findings from (a) basic research into the mechanism(s) of human short-term adaptation and deconditioning during exposure to short- and long-term bed rest; (b) evaluation of countermeasures for the deleterious effects of both shifted timing of sleep-wake schedules and deconditioning utilizing bed rest as a simulation for spaceflight; and (c) development and evaluation of biomedical equipment and instrumentation for application to astronauts, general clinical medicine, and research.

Author

Bed Rest; Human Tolerances; Physiological Responses; Life Sciences

19960021674; 96N24949 International Society for Gravitational Physiology, Washington, DC USA

Journal of Gravitational Physiology, Volume 2, No. 1

Youmans, Julian R., Editor, International Society for Gravitational Physiology, USA; Smith, Arthur H., Editor, International Society for Gravitational Physiology, USA; Fuller, Charles A., Editor, International Society for Gravitational Physiology, USA; 1995; ISSN 1077-9248, pp. 183; In English; 16th Annual International Gravitational Physiology Meeting, 19-24 Mar. 1995, Reno, NV, USA; Also announced as 1996008550; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This Journal encompasses the proceedings from the 16th Annual International Gravitational Physiology Meeting, held in Reno, Nevada in March 1995. The wide scientific span of the Journal rests on physiology as its keystone. Gravitational physiology is considered to include the effects on cells and physiological organs and systems of human, animals, and plants of changes in the magnitude and directions of the gravitational force environment. The effects of weightlessness during space flight, high sustained G forces and chronic acceleration, vibration, impact, and the various forms of simulated weightlessness are also included, as well as is consideration of the evolutionary consequences of gravity and the role of gravity in the manifestation of scale effects in animals and plants. This Journal contained papers and articles in the following areas of gravitational physiology: current concepts in gravitational physiology; gravitational physiology of the cardiovascular system; gravitational physiology of endocrine mechanisms and fluid homeostasis; animal and human skeletal muscle plasticity in response to weightlessness; gravitational physiology of regulatory mechanisms and exercise; gravitational physiology of muscle; biomedical effects of impact and vibration; gravitational physiology of perception and performance; gravitational physiology of bone; gravitational influences on cells and blood chemistry; fluid and electrolyte regulation during changes in gravity; respiratory physiology and biological research in space; and gravitational physiology of plants.

Derived from text

Gravitational Physiology; Conferences; Weightlessness; Respiratory Physiology; Musculoskeletal System; Endocrinology; Cardiovascular System; Animals; Microgravity; Aerospace Medicine

19960021684; 96N24959 Institute of Space Medico, Beijing, China

The study on the mechanism of G intolerance of rabbits after simulated weightlessness

Xianyun, Shen, Institute of Space Medico, China; Yueying,

Xue, Institute of Space Medico, China; Jingrui, Meng, Institute of Space Medico, China; Qiulu, Xiang, Institute of Space Medico, China; Baoshen, Xie, Institute of Space Medico, China; Yuqing, Wang, Institute of Space Medico, China; Jianhe, Chen, Institute of Space Medico, China; Institute of Space Medico, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 23-24; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The direct consequence of cardiovascular adaptation to weightlessness (WL) is the decrease of G tolerance. In studying the mechanism of G intolerance after WL, respiration, heart rate, electrocardiogram, temporal arterial flow, loss of vision were usually used as the indices for evaluation of G tolerance. However the changes of microcirculation and blood rheological indices were seldom observed. Considering that the damage of status of blood circulation after WL may be one of the important factors causing decrease of G tolerance, the purpose of this paper is to observe the changes of microcirculation, blood rheology, and the structure and circulatory status of four organs in rabbits during -4GX after exposure to simulated weightlessness (SWL), in order to understand the cause of G intolerance after WL.

Derived from text

Weightlessness Simulation; Aerospace Medicine; Gravitational Physiology; Acceleration (Physics); Cardiovascular System; Blood Circulation; Adaptation; Orthostatic Tolerance; Head Down Tilt

19960021688; 96N24963 Physiology/Pharmacology Consulting, San Diego, CA USA

Effects of 30 day simulated microgravity and recovery on fluid homeostasis and renal function in the rat

Tucker, Bryan J., Physiology/Pharmacology Consulting, USA; Mendonca, Margarida M., Physiology/Pharmacology Consulting, USA; Physiology(Pharmacology Consulting, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 33-34; In English; Also announced as 1996008550

Contract(s)/Grant(s): NCC2-556; NAG2-659; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Transition from a normal gravitational environment to that of microgravity eventually results in decreased plasma and blood volumes, increasing with duration of exposure to microgravity. This loss of vascular fluid is presumably due to negative fluid and electrolyte balance and most likely contributes to the orthostatic intolerance associated with the return to gravity. The decrease in plasma volume is presumed to be a reflection of a concurrent decrease in extracellular fluid volume with maintenance of normal plasma-interstitial fluid balance. In addition, the specific alterations in renal function contributing to these changes in fluid and electrolyte homeostasis are potentially responding to neuro-humoral signals that are not consistent with systemic fluid volume status. We have previously demonstrated an early increase in both glomerular filtration rate and extracellular fluid volume and that this decreases towards control values by 7 days of simulated microgravity. However, longer duration studies relating these changes to plasma volume alterations and the response to return to orthostasis have not been fully addressed. Male Wistar rats were chronically cannulated, submitted to 30 days heat-down tilt (HDT) and followed for 7 days after return to orthostasis from HDT. Measurements of renal function and extracellular and blood volumes were performed in the awake rat.

Derived from text

Weightlessness Simulation; Microgravity; Homeostasis; Renal Function; Electrolytes; Body Fluids; Balance; Gravitational Physiology; Aerospace Medicine

19960021691; 96N24966 California Univ., Dept. of Physiology., Irvine, CA USA

Functional and cellular adaptations of rodent skeletal muscle to weightlessness

Caiozzo, Vincent J., California Univ., USA; Haddad, Fadia, California Univ., USA; Baker, Michael J., California Univ., USA; Baldwin, Kenneth M., California Univ., USA; California Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 39-42; In English; Also announced as 1996008550

Contract(s)/Grant(s): NAG2-555; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This paper describes the affects of microgravity upon three key cellular levels (functional, protein, and mRNA) that are linked to one another. It is clear that at each of these levels, microgravity produces rapid and substantial alterations. One of the key challenges facing the life science community is the development of effective countermeasures that prevent the loss of muscle function as described in this paper. The development of optimal countermeasures, however, awaits a clearer understanding of events occurring at the levels of transcription, translation, and degradation.

Derived from text

Gravitational Physiology; Microgravity; Physiological Effects; Muscular Function; Weightlessness; Musculoskeletal System; Cells (Biology); Aerospace Medicine; Adaptation

19960021692; 96N24967 California Univ., San Diego, Dept. of Orthopaedics., La Jolla, CA USA

Functional and cellular adaptation to weightlessness in primates

Bodine-Fowler, Sue C., California Univ., San Diego, USA; Pierotti, David J., California Univ., San Diego, USA; Talmadge, Robert J., California Univ., San Diego, USA; California Univ., San Diego, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 43-46; In English; Also announced as 1996008550

Contract(s)/Grant(s): NAG2-653; NAG2-714; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Considerable data has been collected on the response of hindlimb muscles to unloading due to both spaceflight and hindlimb suspension. One generalized response to a reduction in load is muscle fiber atrophy, although not all muscles respond the same. Our understanding of how muscles respond to microgravity, however, has come primarily from the examination of hindlimb muscles in the unrestrained rate in space. The non-human primate spaceflight paradigm differs considerably from the rodent paradigm in that the monkeys are restrained, usually in a sitting position, while in space. Recently, we examined the effects of microgravity on muscles of the Rhesus monkey by taking biopsies of selected hindlimb muscles prior to and following spaceflights of 14 and 12 day durations (Cosmos 2044 and 2229). Our results revealed that the monkey's response to microgravity differs from that of the rat. The apparent differences in the atrophic response of the hindlimb muscles of the monkey and rat to spaceflight may be attributed to the following: (1) a species difference; (2) a difference in the manner in which the animals were maintained during the flight (i.e., chair restraint or 'free-floating'); and/or (3) an ability of the monkeys to counteract the effects of spaceflight with resistive exercise.
Derived from text
Gravitational Physiology; Aerospace Medicine; Weightlessness; Muscular Function; Muscles; Monkeys; Space Flight Stress

19960021695; 96N24970 Centre National de la Recherche Scientifique, Lab. de Physiopathologie Respiratoire., Marseilles, France
Sleep-wake cycles in Rhesus monkeys during Spacelab flight simulations
Balzamo, Emmanuel, Centre National de la Recherche Scientifique, France; Centre National de la Recherche Scientifique, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 54-55; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Neurophysiological data has been obtained in orbital flight from various non-human primates. Aboard Russian satellites during both Bion and Biocosmos missions, impairments in duration and organization of the states of vigilance were observed in Rhesus monkeys during flight: an increase in nocturnal awakening; and a decrease of rapid eye movements-sleep (REM-sleep). It was assumed that weightlessness played a role in these changes. The former "Rhesus Project', a joint program between CNES and NASA, was devoted to physiological studies using the Rhesus monkey as a human model abroad Spacelab, during 14 to 16 day orbital flights. In the first stage of this project, we investigated the effect of experimental conditions as well as specific restraint and confinement on the circadian sleep-wake rhythm in a group of Rhesus monkeys. Prior to flight, our am was to determine quantitatively and qualitatively sleep-wake cycles. These control data would thus be compared with inflight data in order to assess the influence of weightlessness.
Derived from text
Activity Cycles (Biology); Sleep; Wakefulness; Gravitational Physiology; Gravitational Effects; Circadian Rhythms; Flight Simulation; Weightlessness; Aerospace Medicine; Physiological Tests; Neurophysiology

19960021697; 96N24972 California Univ., Section of Neurobiology, Physiology and Behavior., Davis, CA USA
Acute exposure to 2G phase shifts the rat circadian timing system
Hoban-Higgins, T. M., California Univ., USA; Murakami, D. M., California Univ., USA; Tandon, T., California Univ., USA; Fuller, C. A., California Univ., USA; California Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 58-59; In English; Also announced as 1996008550
Contract(s)/Grant(s): NAGw-4552; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The circadian timing system (CTS) provides internal and external temporal coordination of an animal's physiology and behavior. In mammals, the generation and coordination of these circadian rhythms is controlled by a neural pacemaker, the suprachiasmatic nucleus (SCN), located within the hypothalamus. The pacemaker is synchronized to the 24 hour day by time cures (zeitgebers) such as the light/dark cycle. When an animal is exposed to an environment without time cues, the circadian rhythms maintain internal temporal coordination, but exhibit a 'free-running' condition in which the period length is determined by the internal pacemaker. Maintenance of internal and external temporal coordination are critical for normal physiological and psychological function in human and non-human primates. Exposure to altered gravitational environments has been shown to affect the amplitude, mean, and timing of circadian rhythms in species ranging from unicellular organisms to man. However, it has not been determined whether altered gravitational fields have a direct effect on the neural pacemaker, or affect peripheral parameters. In previous studies, the ability of a stimulus to phase shift circadian rhythms was used to determine whether a stimulus has a direct effect on the neural pacemaker. The present experiment was performed in order to determine whether acute exposure to a hyperdynamic field could phase shift circadian rhythms.
Derived from text
Circadian Rhythms; Biocontrol Systems; Regulatory Mechanisms (Biology); Gravitational Physiology; Physiological Responses; Aerospace Medicine; Acceleration (Physics); Acceleration Stresses (Physiology); Cues

19960021699; 96N24974 Arizona Univ., Exercise and Sport Science., Tucson, AZ USA
Influence of simulated microgravity on the exercise performance of Fischer 344 rats
Tipton, C. M., Arizona Univ., USA; Sebastian, L. A., Arizona

Univ., USA; Edwards, P. K., Arizona Univ., USA; Moran, M. M., Arizona Univ., USA; Arizona Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 62-63; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Measurements from mission specialists after space flights or from subjects subjected to head down tilt experiments have demonstrated a decrease in exercise performance. Similar decreases have been reported for rats that have participated in simulated microgravity studies using the head down-tail suspended method of Morey-Holton (HDS). Because it is unclear whether older animal populations would exhibit similar responses, we undertook a HDS study with Fischer 244 male rats.

Derived from text

Physical Exercise; Microgravity; Head Down Tilt; Exercise Physiology; Gravitational Physiology; Aerospace Medicine; Weightlessness Simulation; Physiological Tests

19960021702; 96N24977 Houghten Pharmaceuticals, Inc., San Diego, CA USA

Effect of spaceflight on oxidative and antioxidant enzyme activity in rat diaphragm and intercostal muscles

Lee, Mona D., Houghten Pharmaceuticals, Inc., USA; Tuttle, Ronald, Houghten Pharmaceuticals, Inc., USA; Girten, Beverly, Houghten Pharmaceuticals, Inc., USA; Houghten Pharmaceuticals, Inc., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 68-69; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

There are limited data regarding changes in oxidative and antioxidant enzymes induced by simulated or actual weightlessness, and any additional information would provide insight into potential mechanisms involving other changes observed in muscles from animals previously flown in space. Thus, the NASA Biospecimen Sharing Program was an opportunity to collect valuable information. Oxidative and antioxidant enzyme levels, as well as lipid peroxidation, were measured in respiratory muscles from rates flown on board Space Shuttle mission STS-54. The results indicated that there was an increasing trend in citrate synthase activity in the flight diaphragm when compared to ground based controls, and there were no significant changes observed in the intercostal muscles for any of the parameters. However, the lipid peroxidation was significantly (p less than 0.05) decreased in the flight diaphragm. These results indicate that 6 day exposure to microgravity may have a different effect on oxidative and antioxidant activity in rat respiratory muscles when compared to data from previous 14 day hindlimb suspension studies.

Derived from text

Space Flight Stress; Antioxidants; Oxidation; Enzyme Activity; Weightlessness Simulation; Microgravity; Gravitational Physiology; Aerospace Medicine; Physiological Tests; Physiological Effects

19960021707; 96N24982 Academy of Sciences (USSR), Saint Petersburg, USSR

Motor reactions and vestibular reflexes in cats and monkey in weightlessness

Grigorian, Roman A., Academy of Sciences (USSR), USSR; Aizikov, Gregory S., Institute of Biomedical Problems, USSR; Kreidich, Jury V., Institute of Biomedical Problems, USSR; Academy of Sciences (USSR), Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 80-81; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Close morpho-functional relationships of the cerebellum and vestibular system at all stages of phylogenesis of vertebrates suggest that the cerebellum can be regarded as an important center of gravireceptive function. Direct examination of electrical activity of the labyrinth in cats during a transient (1-2 sec) state of weightlessness produced by free fall has shown that there was an almost two fold increase in both the rate and amplitude of electrical activity in the vestibular ganglion. It is commonly accepted at present time that the conditions of orbital flight around Earth closely connect with weightlessness that usually manifests itself as undesirable factor of flight. It is known that vestibular, proprioceptive, visual, and other sensory modalities are converted on the cerebellum, which would indicate that this information is used for motor coordination and spatial orientation. Undoubtedly, origin of may vestibulo-motor disturbances during flight and in postflight period to a considerable degree depends on weightlessness. On the whole the visual illusions, motor discoordination, and space sickness, including vomiting are refereed to the 'space adaptation syndrome'. But the nature of these disturbances is still not well understood. This investigation was concerned with the study of vestibular and motor reactions in cats and monkeys in short-term microgravity.

Derived from text

Weightlessness Simulation; Microgravity; Space Adaptation Syndrome; Cerebellum; Vestibules; Proprioception; Gravitational Physiology; Aerospace Medicine; Gravitational Effects

19960021720; 96N24995 NASA Ames Research Center, Moffett Field, CA USA

Mineral distribution in rat skeletons after exposure to a microgravity model

Arnaud, Sara B., NASA Ames Research Center, USA; Harper, Jennifer S., NASA Ames Research Center, USA; Navidi, Meena, NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 115-116; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Exposure to space flight models induces changes in the distribution of bone mineral in the human skeleton that has the features of a gravitational gradient. Regional bone mineral measurements with dual energy x-ray absorptiometry (DEXA) in male adults exposed to head-down tilt bed rest for 30 days shown non-significant decrements in the pelvis and legs with 10% increases in the head region. Horizontal bed rest for 17 weeks reveals losses of bone mineral ranging from 2.2 to 10.4% from the lumbar spine to the calcaneus and an increase of 3.4% in the skull. Investigation of this phenomena would be most definitively carried out in an animal model. One candidate is the flight simulation model in the rat which removes body weight from the hind limbs and induces a cephalad fluid shift by suspending the animal by the tail. Weanling rats exposed to this model showed bone mineral to be lower in the hind limbs and higher in the skull after 3 weeks. These finds are similar in older 200 g animals after 2 weeks tail suspension. The purpose of this study was to determine the effect of age on the distribution of skeletal mineral in this model.

Derived from text

Aerospace Medicine; Microgravity; Musculoskeletal System; Bone Mineral Content; Weightlessness Simulation; Head Down Tilt; Physiological Tests; Suspending (Hanging); Gravitational Physiology

19960021722; 96N24997 Houghten Pharmaceuticals, Inc., San Diego, CA USA

Effectiveness of a Cytokine Restraining Agent (CRA (TM)) in attenuating disuse deconditioning induced by hindlimb unloading in rats

Girten, Beverly, Houghten Pharmaceuticals, Inc., USA; McPherson, Scott, Houghten Pharmaceuticals, Inc., USA; Lee, Mona, Houghten Pharmaceuticals, Inc., USA; Grethe, Nadine, Houghten Pharmaceuticals, Inc., USA; McDowell, Raquel, Houghten Pharmaceuticals, Inc., USA; McPherson, Laurie, Houghten Pharmaceuticals, Inc., USA; Tuttle, Ronald R., Houghten Pharmaceuticals, Inc., USA; Houghten Pharmaceuticals, Inc., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 121-122; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Spaceflight alters many immune responses and among the regulatory components of an organisms response system that have been shown to be affected by spaceflight is the cytokine network. Spaceflight, as well as ground-based model systems of spaceflight, have been shown to affect the production and activation of various cytokines including interleukins (IL) and tumor necrosis factor (TNF). Levels of urinary IL-2 are elevated on the first day of spaceflight and again after returning from space. Most results from ground-based studies in rodents indicate either no alterations in cytokines or decreased levels. Results from this experiment indicate that HP 228, a potent cytokine restraining agent (CRA(TM)) was effective in attenuating many of the disuse deconditioning changes induced by the ground-based hindlimb suspension model that simulates weightlessness in rats. HP 228 is a novel heptapeptide with unnatural amino acids and can effectively restrain lipopolysaccharide (LPS)-induced increased levels of several key cytokines, including plasma TNF alpha, IL-1 beta and IL-6. HP 228 has also been shown to be effective in several rodent models of pain, inflammation and LPS-induced lethality, as well as in reducing inducible nitric oxide synthase.

Derived from text

Regulatory Mechanisms (Biology); Cytology; Physiological Responses; Space Flight Stress; Environment Effects; Aerospace Environments; Aerospace Medicine; Weightlessness Simulation; Gravitational Physiology; Enzymes; Physiological Tests

19960021723; 96N24998 Waterloo Univ., Dept. of Kinesiology., Ontario Canada

Variability and cardiovascular homeostasis

Hughson, Richard L., Waterloo Univ., Canada; Gharib, Claude, Waterloo Univ., Canada; Waterloo Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 123-126; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The inability to maintain the upright posture due to a failure in the arterial blood pressure regulatory mechanisms on return from space travel or after a period of head down tilt bed rest (HDBR) is the ultimate sign of cardiovascular deconditioning. Yet, the final response of syncope is potentially heralded by a series of precursor events that can be quantified and analyzed in new, more insightful ways to attempt to understand the integrative nature of autonomic control of the cardiovascular system.

Derived from text

Cardiovascular System; Head Down Tilt; Weightlessness; Microgravity; Gravitational Physiology; Aerospace Medicine; Homeostasis; Variability; Deconditioning

19960021726; 96N25001 NASA Ames Research Center, Moffett Field, CA USA

Effects of chronic elevated levels of CO2 on the concentration of blood cellular elements and plasma corticosterone in the male rat

Alexander, R. A., Bionetics Corp., USA; Lang, C. K., Bionetics Corp., USA; Steele, M. K., Martin Marietta Corp., USA; Corbin, B. J., NASA Ames Research Center, USA; Wade, C. E., NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 134-135; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The mean CO2 concentration on the Space Shuttle is 0.3% and has reached 0.7%, for extended periods of time. Fol-

lowing space flight, it has been shown that both humans and animals have significant changes in red blood cell counts (RBC) and white blood cell counts (WBC). In other studies, where no significant change did occur in the total WBC, a significant change did occur in the distribution of WBC. WBC are affected by circulating levels of glucocorticoids, which often increase when animals or humans are exposed to adverse and/or novel stimuli (e.g. elevated CO2 levels or weightlessness). The purpose of this study was to determine if elevations in CO2 concentration produce changes in total WBC and/or their distribution.
Derived from text
Carbon Dioxide Concentration; Weightlessness; Density Distribution; Leukocytes; Blood Plasma; Gravitational Physiology; Corticosteroids; Aerospace Medicine; Weightlessness Simulation; Space Flight Stress

19960021727; 96N25002 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Regional volume changes in canine lungs suspended in air
Abbrecht, Peter H., Uniformed Services Univ. of the Health Sciences, USA; Kyle, Richard R., Uniformed Services Univ. of the Health Sciences, USA; Bryant, Howard J., Uniformed Services Univ. of the Health Sciences, USA; Feuerstein, Irwin, Uniformed Services Univ. of the Health Sciences, USA; Uniformed Services Univ. of the Health Sciences, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 136-137; In English; Also announced as 1996008550
Contract(s)/Grant(s): NAG9-636; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The purpose of this study was to determine the effect of the absence of a pleural pressure gradient (simulating the presumed condition found in microgravity) upon regional expansion of the lung. We attempted to produce a uniform pressure over the surface of the lung by suspending excised lungs in air. Such studies should help determine whether or not the absence of a pleural pressure gradient leads to uniform ventilation. A preparation in which there is no pleural pressure gradient should also be useful in studying non-gravitational effects on ventilation distribution.
Derived from text
Lungs; Pressure Gradients; Ventilation; Gravitational Effects; Weightlessness Simulation; Gravitational Physiology; Aerospace Medicine; Respiratory Physiology

19960021728; 96N25003 Centre National de la Recherche Scientifique, Lab. de Neurobiologies des Regulations., Paris, France
Animal research in microgravity and flight environment: Lessons from the past for the future
Demaria-Pesce, Victor H., Centre National de la Recherche Scientifique, France; Centre National de la Recherche Scientifique, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 138-139; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The use of animals, and more particularly the use of non-human primates, takes on importance when studying the physiological responses involved in the adaptation to changes in gravitational loading. The 'Rhesus project', now canceled, was a joint program between CNES and NASA designed to carry out simultaneous experiments of various physiological disciplines using the Rhesus monkey as a human surrogate. The choice of this species was supported by several strong arguments such as the possibility of studying several physiological systems without over-instrumenting, as well as the morphological and phylogenetical closeness with man. Within this framework, building the inflight animal facilities necessary to achieve the ambitious scientific program that was established, required state of the art design and technology. Spacelab flight simulations were conducted with the goal both to obtain baseline data and to evaluate the impact of the cabin environment on the circadian timekeeping system which is involved in the regulation of almost all physiological functions and behavior. Even if this project would never fly, the results from these experiments have been a source of thoughts and lessons for the future animal research in microgravity.
Derived from text
Flight Simulation; Monkeys; Circadian Rhythms; Weightlessness Simulation; Adaptation; Gravitational Physiology; Aerospace Medicine; Regulatory Mechanisms (Biology); Physiological Responses; Research And Development

19960021729; 96N25004 NASA Ames Research Center, Moffett Field, CA USA
Effects of housing density on mouse physiology and behavior in the NASA animal enclosure module simulators
Naidu, S., NASA Ames Research Center, USA; Winget, C. M., NASA Ames Research Center, USA; Jenner, J. W., NASA Ames Research Center, USA; Mele, G., NASA Ames Research Center, USA; Holley, D. C., NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 140; In English; Also announced as 1996008550
Contract(s)/Grant(s): NCC2-779; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Space flight studies using the Animal Enclosure Module (AEM) make it possible to investigate the role of microgravity on animal physiology and behavior. In this study, we compared the health and well-being of mice housed at different densities in AEM simulators (AEMS), to vivarium shoebox (control) cages (VSBC). A stress assessment battery (SAB) of measures was developed to evaluate mouse health and well-being, and to determine if any of the population sizes resulted in a stressful environment. The SAB was based, in part, on recommendations of a NASA Workshop on Rodent

Cage Sizing. It includes: General assessment of appearance; Behavioral assessment (video); Food and water consumption; Body weight changes; Thymus, adrenal, spleen, heart and kidney weights; Plasma corticosterone concentration; Total plasma protein concentration; Total blood leukocyte count; Differential leukocyte count: neutrophil/lymphocyte count, and eosinophil count; and Gastric histology.
Derived from text
Aerospace Medicine; Environment Effects; Density (Number/Volume); Density Distribution; Mice; Physiological Effects; Populations; Assessments; Environment Simulators; Gravitational Physiology

19960021730; 96N25005 NASA Ames Research Center, Moffett Field, CA USA
Developmental testing of the advanced animal habitat to determine compatibility with rats and mice
Corbin, Barbara J., NASA Ames Research Center, USA; Baer, Lisa A., Bionetics Corp., USA; Grindeland, Richard E., NASA Ames Research Center, USA; Vasques, Marilyn, NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 141-142; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Research Animal Holding Facility (RAHF) and the Animal Enclosure Module (AEM) have housed rats during Space Shuttle Flights since the 1980s, but the operational constraints of the hardware have limited the scientific return from these Shuttle flights. The RAHF provides environmental control and monitoring for 24 rats with in-flight animal access, but it must be flown in the Spacelab. Due to the infrequent availability of Spacelab flights, rodent experiments rely heavily on the AEM. Unfortunately, the AEM supports only six rats, has no environmental control and provides no animal access in flight. The Advanced Animal Habitat (AAH) is being developed to support up to 12 adult rats or 30 adult mice for up to 30 days, provide active temperature control, animal telemetry, and on-orbit video, record environmental parameters in the animal access in the Middeck, the Spacelab, or the Space Station. To ensure that the AAH can meet these requirements, animal testing is being conducted with rats and mice in every step of development. Testing began with the cage configuration.
Derived from text
Environmental Control; Habitats; Compatibility; Temperature Control; Rodents; Gravitational Physiology; Aerospace Medicine; Spaceborne Experiments; Active Control

19960021731; 96N25006 Biotime, Inc. Berkeley, CA USA
Low temperature preservation and space medicine
Segall, Paul E., Biotime, USA; Sternberg, Hal, Biotime, USA; Waitz, Harold D., Biotime, USA; Biotime, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 143-144; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Cold maintenance may be an option for compromised space-borne astronauts. Contemporary aneurysm surgery can involve cooling below 20 C for nearly one hour. Dogs and baboons have survived blood-substituted hypothermia for 1-3 hours. Hamsters have recovered from partial-freezing below -1 C, and supercooling at -5 C. Laboratory frogs have survived partial-freezing from -9 C, while in nature, frogs may overwinter in these states. While some invertebrates can tolerate freezing to cryogenic temperatures, no vertebrate has survived complete freezing. The following studies were conducted to explore low temperature preservation of rodents, dogs, and baboons.
Derived from text
Aerospace Medicine; Cryogenic Temperature; Cryogenic Cooling; Gravitational Physiology; Environment Effects; Hypothermia; Aerospace Environments

19960021733; 96N25008 Academy of Sciences of the Ukraine, Inst. of Botany., Kiev, Ukraine
Calcium balance changes in tip growing plant cells under clinorotation
Kordyum, Elizabeth L., Academy of Sciences of the Ukraine, Ukraine; Danevich, Larisa A., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 147-148; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Calcium is known to play an important role in the regulation of cellular processes as a secondary messenger in signal transduction to a specific response in all eucaryotic cells. Its messenger role is realized by transient changes in the Ca(2+) cytosolic concentration induced by a variety of external stimuli, such as, light, hormones, and gravity. Recent findings claim that modifications in the calcium balance in plant cells in microgravity and under clinorotation partially reproduce this microgravity effect. Based on these data, a hypothesis is proposed which states that the Ca(2+) level changes can trigger rearrangements in cell metabolism occurring in these conditions of altered gravity. However, the methods used in previous works permit only the determination of the relative quantity of intracellular membrane-bound calcium and the observation of the localization of the free Ca(2+). Therefore, it is of essential interest to be able to measure the concentration of free calcium ions ((Ca(2+))i) in plant cells under an influence of altered gravity. In this paper, the results from measurements of (Ca(2+))i in plant cells under clinorotation will be reviewed and discussed in an effort to examine their effectiveness, causes, and consequences.
Derived from text
Calcium; Positive Ions; Gravitational Effects; Gravitational Physiology; Aerospace Medicine; Cells (Biology); Cytology;

Plants (Botany); Rotating Environments; Concentration (Composition)

19960021734; 96N25009 Kansas State Univ., Div. of Biology., Manhattan, KS USA

Clinorotation affects soybean seedling morphology

Hilaire, Emmanuel, Kansas State Univ., USA; Guikema, James A., Kansas State Univ., USA; Brown, Christopher S., Dynamac Corp., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 149-150; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Although spaceflight does not appear to significantly affect seed germination, it can influence subsequent plant growth. On STS-3 and SL-2, decreased growth (measured as plant length, fresh weight, and dry weight) was noted for pine, oat, and mung bean. In the CHROMEX-01 and 02 experiments with Haplopappus and in the CHROMEX-03 experiment with Arabidopsis, enhanced root growth was noted in the space-grown plants. In the CHROMEX-04 experiments with wheat, both leaf fresh weight and leaf area were diminished in the space-grown plants but there was no difference in total plant height (CS Brown, HG Levine, and AD Krikorian, unpublished data). These data suggest that microgravity impacts growth by whole plant partitioning of the assimilates. The objective of the present study was to determine the influence of clinorotation on the growth and the morphology of soybean seedlings grown in the Biological Research In Canister (BRIC) flight hardware. This experiment provided baseline data for a spaceflight experiment (BRIC-3) flown on STS-63 (February 3-11, 1995).

Derived from text

Gravitational Physiology; Rotating Environments; Aerospace Medicine; Soybeans; Seeds; Morphology; Microgravity; Gravitational Effects; Space Flight Stress; Physiological Responses

19960021735; 96N25010 Kansas State Univ., Div. of Biology., Manhattan, KS USA

Effects of stress ethylene inhibitors on sweet clover (Melilotus Alba L.) seedling growth in microgravity

Gallegos, Gregory L., Kansas State Univ., USA; Peterson, Barbara V., Dynamac Corp., USA; Brown, Christopher S., Dynamac Corp., USA; Guikema, James A., Kansas State Univ., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 151-152; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Previous experiments from our lab have shown that seeds of sweet clover, when germinated and grown within the Fluid Processing Apparatus (FPA) on a slow rotating clinostat produce significantly greater levels of the volatile stress hormone, ethylene, when compared to seeds treated the same but without clinorotation. In both conditions, carbon dioxide levels reached high levels and seedling growth was inhibited. However, clinorotation inhibited growth to a greater extent. To help determine to what extent microgravity influences stress ethylene production and to what extent ethylene inhibits seedling growth, we have extended the above experiments by growing sweet clover in the presence of aminooxyacetic acid (AOA) and silver nitrate (AgNO3), inhibitors of stress ethylene biosynthesis and action, respectively. Seeds of sweet clover were germinated and grown for five days in the FPA under two gravity conditions: under stationary conditions on Earth and in microgravity onboard the space shuttle, Discovery (STS-63), which launched Feb. 3, 1995. Upon recovery, gas samples were aspirated from the growth chambers and carbon dioxide and ethylene concentrations were measured using a gas chromatograph. Then the tissue was weighed, photographed and fixed, and is current undergoing further morphological and microscopic characterization.

Derived from text

Space Flight Stress; Environment Effects; Physiological Responses; Gravitational Physiology; Aerospace Medicine; Microgravity; Rotating Environments; Ethylene; Seeds; Vegetation Growth; Spaceborne Experiments; Inhibitors; Leguminous Plants

19960021736; 96N25011 Kansas State Univ., Div. of Biology., Manhattan, KS USA

Effects of microgravity and clinorotation on stress ethylene production in two starchless mutants of Arabidopsis thaliana

Gallegos, Gregory L., Kansas State Univ., USA; Hilaire, Emmanuel M., Kansas State Univ., USA; Peterson, Barbara V., Dynamac Corp., USA; Brown, Christopher S., Dynamac Corp., USA; Guikema, James A., Kansas State Univ., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 153-154; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Starch filled plastids termed amyloplasts, contained within columella cells of the root caps of higher plant roots, are believed to play a statolith-like role in the gravitropic response of roots. Plants having amyloplasts containing less starch exhibit a corresponding reduction in gravitropic response. We have observed enhanced ethylene production by sweet clover (Melilotus alba L.) seedlings grown in the altered gravity condition of a slow rotating clinostat, and have suggested that this is a stress response resulting from continuous gravistimulation rather than as a result of the simulation of a microgravity condition. If so, we expect that plants deficient in starch accumulation in amyloplasts may produce less stress ethylene when grown on a clinostat. Therefore, we have grown Arabidopsis thaliana in the small, closed environment of the Fluid Processing Apparatus (FPA). In this preliminary report we compare stationary plants with clinorotated and those grown in microgravity aboard Discovery during the

STS-63 flight in February 1995. In addition to wildtype, two mutants deficient in starch biosynthesis, mutants TC7 and TL25, which are, respectively, deficient in the activity of amyloplast phosphoglucomutase and ADP-glucose pyrophosphorylase, were grown for three days before being fixed within the FPA. Gas samples were aspirated from the growth chambers and carbon dioxide and ethylene concentations were measured using a gas chromatograph. The fixed tissue is currently undergoing further morphologic and microscopic characterization.
Derived from text
Plants (Botany); Phytotrons; Closed Ecological Systems; Microgravity; Rotating Environments; Gravitational Physiology; Aerospace Medicine; Gas Analysis; Spaceborne Experiments; Gravitational Effects; Space Flight Stress; Biosynthesis

19960021737; 96N25012 Kansas State Univ., Div. of Biology., Manhattan, KS USA
Effect of microgravity on stress ethylene and carbon dioxide production in sweet clover (Melilotus alba L.)
Gallegos, Gregory L., Kansas State Univ., USA; Odom, William R., Kansas State Univ., USA; Guikema, James A., Kansas State Univ., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 155-156; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The study of higher plant growth and development in the microgravity (micro-g) environment continues to be a challenge. This is in part a result of the available flight qualified hardware with restrictive closed gas environments. This point is underscored by considering that gas exchange of seedlings grown in microgravity may be further limited owing to a thicker layer of water wicked onto the roots and to the absence of convective mixing. We hypothesized that seedlings grown under such conditions will experience greater hypoxia in microgravity than at Earth gravity, and thus produce greater stress ethylene. We compared flight and ground samples of sweet clover seedlings grown in the Fluid Processing Apparatus (FPA) during STS-57 and found them to contain extremely high levels of carbon dioxide (CO2) and stress ethylene. There were time dependent increases for both gases, and seedling growth was greatly inhibited. We repeated these experiments aboard STS-60 using modified chambers which increased, by fifty fold, the air available to the developing seedlings. Sweet clover seed germination and subsequent seedling growth to eight days within the FPA modified with a gas permeable membrane is not compromised by the microgravity environment.
Derived from text
Microgravity; Gravitational Effects; Ethylene; Gas Evolution; Gravitational Physiology; Aerospace Medicine; Carbon Dioxide; Leguminous Plants; Vegetation Growth; Closed Ecological Systems; Phytotrons

19960021738; 96N25013 Academy of Sciences of the Ukraine, Inst. of Botany., Kiev, Ukraine
Root-hair response to vector-free gravity: Role of Ca(2+) ions
Belyavskaya, N. A., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 157-158; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In plants, apical growth is demonstrated by a variety of cells, including root hairs, (RH) which are tubular outgrowths of root epidermal cells. They are likely to be involved in uptake of nutrients and water, anchorage of plants maintenance of contact between roots and soil, and root exudation. Over the last years, it has become clear that calcium is involved in various processes which result in tip growth. Previous studies from our laboratory have demonstrated an increase in calcium levels in roots cells of pea seedlings grown under conditions of space flight and clinorotation. On the basis of these data, we have suggested that such effects of microgravity and clinorotation might be due to the enhancement of Ca(2+) influx into hyaloplasm evidently through Ca(2+) channel blockers (verapamil and nifedipine) on orientation and structure of growing RH that might be an appropriate model system being sensitive to calcium for studying the gravitational effects at cellular level.
Derived from text
Gravitational Effects; Microgravity; Calcium; Positive Ions; Plant Roots; Grasses; Vegetation Growth; Gravitational Physiology; Aerospace Medicine; Rotating Environments

19960021739; 96N25014 Academy of Sciences of the Ukraine, Inst. of Botany., Kiev, Ukraine
Plastid ultrastructure, fractional composition and activity of amylases in chlorella cells in microgravity
Popova, A. F., Academy of Sciences of the Ukraine, Ukraine; Kordyum, E. L., Academy of Sciences of the Ukraine, Ukraine; Shnyukova, E. I., Academy of Sciences of the Ukraine, Ukraine; Sytnik, K. M., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 159-160; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Microgravity causes biological effects, which are manifested in changes of the submicroscopic organization in some of the Chlorella cell organelles, such as chloroplasts. It has been proven that the number and the size of the starch grains in the Chlorella cells grown in space flight and clinorotation conditions decreased up to the complete disappearance of the polysaccharides, including the area surrounding the pyrenoid, at the end of the logarithmic growth state. Since enzymes, mainly amylases, are able to hydrolyze reserve polyglucans, they may play a role in this process. We suggest that in

microgravity the hydrolytic processes intensify, due in the first place to the enhanced amylase activity, that leads to the utilization of the reserve polysaccharides. To confirm our hypothesis on the hydrolytic process intensification under clinorotation and space flight, we studied a specific activity of the amylases and a fractional composition of their multiple molecular forms (MMF) were carried out simultaneously with an investigation of the chloroplast ultrastructure and the determination of the relative volume of starch grains in the plastids.
Derived from text
Chlorella; Aerospace Medicine; Microgravity; Chloroplasts; Gravitational Physiology; Rotating Environments; Enzymes; Structural Analysis; Chemical Composition; Chemical Fractionation; Biological Effects

19960021740; 96N25015 Kansas State Univ., Div. of Biology., Manhattan, KS USA
Plasmid acquisition in microgravity
Juergensmeyer, Margaret A., Kansas State Univ., USA; Juergensmeyer, Elizabeth A., Judson Coll., USA; Guikema, James A., Kansas State Univ., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 161-162; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In microgravity, bacteria often show an increased resistance to antibiotics. Bacteria can develop resistance to an antibiotic after transformation, the acquisition of DNA, usually in the form of a plasmid containing a gene for resistance to one or more antibiotics. In order to study the capacity of bacteria to become resistant to antibiotics in microgravity, we have modified the standard protocol for transformation of Escherichia coli for use in the NASA-flight-certified hardware package, The Fluid Processing Apparatus (FPA). Here we report on the ability of E. coli to remain competent for long periods of time at temperatures that are readily available on the Space Shuttle, and present some preliminary flight results.
Derived from text
Bacteria; Antibiotics; Escherichia; Microgravity; Gravitational Physiology; Aerospace Medicine; Organelles; Immunity; Bacteriology; Colonies

19960021741; 96N25016 Academy of Sciences of the Ukraine, Inst. of Botany., Kiev, Ukraine
Effects of microgravity on the structure of leaves cells involved in water transport
Nedukha, Elena M., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 163-164; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The oppression of plant cells growth and the acceleration of their aging processes and cell structural changes take place during the growth of the plants in conditions of long duration space flight or in clinorotation. Such changes reflect the alterations of the gravity-sensitive links in plant cell metabolism, of the plant polarity, and of the water balance of plants during weightlessness. The aim of our investigation was the study of plant cell ultrastructural changes concerned with water transport while under microgravity influences.
Derived from text
Grasses; Vegetation Growth; Microgravity; Water Balance; Weightlessness; Transport Properties; Water Circulation; Gravitational Physiology; Aerospace Medicine; Dynamic Structural Analysis; Gravitational Effects; Physiological Effects

19960021742; 96N25017 Kansas State Univ., Div. of Biology., Manhattan, KS USA
The fluid processing apparatus: From flight hardware to electron micrographs
Hilaire, Emmanuel, Kansas State Univ., USA; Brown, Christopher S., Dynamac Corp., USA; Guikema, James A., Kansas State Univ., USA; Kansas State Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 165-166; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Since the early years of space biology, a major drawback in spaceflight plant experiments has been the inability to fix specimens in microgravity, relying instead on fixation after return to Earth. As there, it is of a growing interest to look at the effect of microgravity on the structure and the developmental polarity of root graviperceptive cells, or columella cells, and so, it is important to use flight hardware which allows specimen fixation in space therefore avoiding the confounding effects of rapid readaptation to gravity after landing. As part of the Bioserve Space Technologies, a Center for the Commercial Development of Space (CCDS), we now have experiment flight opportunities through the Commercial Generic Bioprocessing Apparatus (CGBA) payload. In this study the Fluid Processing Apparatus (FPA) was used to grow seedlings for a limited period of time prior to fixation of the tissue in a microgravity environment. Upon return to Earth, the samples were processed for electron microscopy. This report describes the microscopic data obtained from the two space flights (STS-54 and STS-60). In both cases, the electron micrographs of the columella cells revealed well preserved cell structure, well defined microtubules, and the presence of calcium precipitates formed by a antimonate precipitation method.
Derived from text
Microgravity; Cells (Biology); Leguminous Plants; Vegetation Growth; Gravitational Effects; Gravitational Physiology; Aerospace Medicine; Bioprocessing; Phytotrons; Electron Microscopy

19960021745; 96N25020 NASA Johnson Space Center, Houston, TX USA

Determination of the Residence Time of Food Particles During Aseptic Sterilization

Carl, J. R., Lockheed Engineering and Sciences Co., USA; Arndt, G. D., NASA Johnson Space Center, USA; Nguyen, T. X., NASA Johnson Space Center, USA; Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 7-14; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The paper describes a non-invasive method to measure the time an individual particle takes to move through a length of stainless steel pipe. The food product is in two phase flow (liquids and solids) and passes through a pipe with pressures of approximately 60 psig and temperatures of 270-285 F. The proposed problem solution is based on the detection of transitory amplitude and/or phase changes in a microwave transmission path caused by the passage of the particles of interest. The particles are enhanced in some way, as will be discussed later, such that they will provide transitory changes that are distinctive enough not to be mistaken for normal variations in the received signal (caused by the non-homogeneous nature of the medium). Two detectors (transmission paths across the pipe) will be required and place at a known separation. A minimum transit time calculation is made from which the maximum velocity can be determined. This provides the minimum residence time. Also average velocity and statistical variations can be computed so that the amount of 'overcooking' can be determined.

Author

Microwave Transmission; Sterilization; Antiseptics; Food Processing; Time Measurement; Two Phase Flow; Nonintrusive Measurement

19960021793; 96N25068 Wisconsin Univ., College of Agrocultural and Life Sciences, Poultry Science Dept., Madison, WI USA

Fecundity of Quail in Spacelab Microgravity *Progress Report*

Wentworth, B. C., Wisconsin Univ., USA; Wentworth, A. L., Wisconsin Univ., USA; Apr. 1996, pp. 16; In English

Contract(s)/Grant(s): NAG2-1009

Report No.(s): NASA-CR-200956; NAS 1.26:200956; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight experiments in which fertilized Japanese quail eggs were allowed to develop to various ages in space, and the results of the following laboratory tests are described. Laboratory-based experiments concerned with the embryonic development of Japanese quail in gravity using simulated vibrations and G-force are reported. Effect of turning and ambient temperature at various days of incubation on the development of Japanese quail, and method to feed and water adult and newly hatched Japanese quail in microgravity using a gelatin-based diet as a solid water supply, are also described.

CASI

Spacelab; Microgravity; Eggs; Embryos; Gravitational Effects; Reproduction (Biology); Vibration Effects

19960022715; 96N25617 International Centre for Theoretical Physics, Trieste, Italy

First steps in eukaryogenesis: Physical phenomena in the origin and evolution of chromosome structure

Chela Fores, J., International Centre for Theoretical Physics, Italy; Aug. 1995, pp. 14; In English

Report No.(s): IC-95/251; DE96-607012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Our present understanding of the origin and evolution of chromosomes differs considerably from current understanding of the origin and evolution of the cell itself. Chromosome origins have been less prominent in research, as the emphasis has not shifted so far appreciably from the phenomenon of primeval nucleic acid encapsulation to that of the origin of gene organization, expression, and regulation. In this work we discuss some reasons why preliminary steps in this direction are being taken. We have been led to examine properties that have contributed to raise the ancestral prokaryotic programmes to a level where we can appreciate in eukaryotes a clear departure from earlier themes in the evolution of cell from the last common ancestor. We shift our point of view from evolution of cell morphology to the point of view of the genes. In particular we focus attention on possible physical bases for the way transmission of information has evolved in eukaryotes, namely, the inactivation of whole chromosomes. The special case of the inactivation of the X chromosome in mammals is discussed, paying particular attention to the physical process of the spread of X inactivation in monotremes (platypus and echidna). When experimental data is unavailable some theoretical analysis is possible based on the idea that in certain cases collective phenomena in genetics, rather than chemical detail, are better correlates of complex chemical processes.

DOE

Biological Evolution; Chromosomes; Genes; Gene Expression; Data Transmission; Plants (Botany); Deoxyribonucleic Acid

19960022795; 96N25688 Oak Ridge National Lab., TN USA

A fast look-up algorithm for detecting repetitive DNA sequences

Guan, X., Oak Ridge National Lab., USA; Uberbacher, E. C., Oak Ridge National Lab., USA; 1996, pp. 13; In English; 1st Pacific Symposium on Biocomputing, 3 - 6 Jan. 1996, Kona, HI, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-960150-1; DE96-003052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have presented a fast linear time algorithm for recognizing tandem repeats. Our algorithm is a one pass algorithm. No information about the periodicity of tandem repeats is needed. The use of the indices calculated from non-continuous and overlapping kappa-tuples allow tandem repeats with insertions and deletions to be recognized.

DOE

Deoxyribonucleic Acid; Algorithms; Genetics; Genes; Pattern Recognition

19960022802; 96N25692 Georgia Univ., Research Foundation., Athens, GA USA

Environmental stress-mediated changes in transcriptional and translational regulation of protein synthesis in crop plants *Final Report*

1996, pp. 11; In English

Contract(s)/Grant(s): DE-FG09-86ER-13602

Report No.(s): DOE/ER/13602-8; DE96-002998; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The research described in this final report focused on the influence of stress agents on protein synthesis in crop plants (primarily soybean). Investigations into the 'heat shock' (HS) stress mediated changes in transcriptional and translocational regulation of protein synthesis coupled with studies on anaerobic water deficit and other stress mediated alterations in protein synthesis in plants provided the basis of the research. Understanding of the HS gene expression and function(s) of the HSPs may clarify regulatory mechanisms operative in development. Since the reproductive systems of plants if often very temperature sensitive, it may be that the system could be manipulated to provide greater thermotolerance.

DOE

Environment Effects; Farm Crops; Protein Synthesis; Thermal Shock; Biological Effects; Stress (Biology)

52
AEROSPACE MEDICINE

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

19960021608; 96N24932 Yamaguchi Univ., Faculty of Engineering., Ube, Japan

Analysis and Modeling of Na Current in Cardiac Muscles

Sada, Hideaki, Yamaguchi Univ., Japan; Tanaka, Kotaro, Yamaguchi Univ., Japan; Ebina, Yoshio, Yamaguchi Univ., Japan; Ban, Takashi, Yamaguchi Univ., Japan; Memoirs of the Faculty of Engineering, Yamaguchi University, volume 44, no. 1; Oct. 1993, pp. 151-158; In Japanese; Also announced as 1996040155; Copyright; Avail: Issuing Activity (Faculty of Engineering, Yamaguchi Univ., Tokiwadai, Ube, Japan), Hardcopy, Microfiche

The Na(+) channel plays essential roles in initiation and conduction of action potential in a variety of excitable tissues including nerves, hearts and muscles. Na channels undergo activation and inactivation depending on the membrane voltage and time. Hodgkin & Huxley (H-H), early in 1950s, proposed a mathematical model to describe Na channel properties of the squid axonal membrane, based on voltage-clamp (V-C) study. For the next 3 decades since then, direct recording of the Na current by V-C method and hence the study of Na channel property have been hampered largely by a complicated geometry of the tissue. Recent electrophysiological studies using V-C method with patch-pipettes on dispersed single heart cells have demonstrated that the gating-kinetics of Na channels is much more complicated than that of the H-H model. To establish a new model which enables describing Na channel events in heart, we conducted V-C study in embryonic chick heart cells. In this preparation, we found pronounced differences in the inactivation and re-inactivation mechanisms from those in the axon, suggesting a presence of one conductive and two inactivated states among which voltage-dependent transitions were permitted (a cyclic reaction model). According to the model, we experimentally determined rate-constants of the reaction. We also found a delay in onset of inactivation as well as activation in voltage-clamped heart cells, and derived empirical equations for such delays in onset. Taken above into consideration, we could faithfully reproduce the Na channel currents observed in heart cells under V-C conditions.

Author

Myocardium; Electrophysiology; Sodium; Bioelectricity; Bioelectric Potential; Cell Membranes (Biology)

19960021675; 96N24950 Florida Univ., Dept. of Zoology., Gainesville, FL USA

Evolution of cardiovascular adaptation to gravity

Lillywhite, Harvey B., Florida Univ., USA; Florida Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 1-4; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Gravitational force is a pervasive environmental parameter that affects, directly or indirectly, virtually all living organisms in the Earth's biosphere. Experimental research has demonstrated clearly that living systems respond and adapt to gravity on cellular and molecular levels, with the result being the presence of gravireceptors and graviresponding systems in smaller as well as in larger organisms. Aquatic organisms, inhabiting the larger part of the Earth's biosphere and representing long evolutionary histories, are affected by gravity largely indirectly by means of depth-dependent hydrostatic pressure. Evolutionary radiations of organisms into terrestrial environments subjected them to increasing gravitational disturbance of body fluids and necessitated dramatic modifications of musculoskeletal systems related to support and locomotion in the less dense medium. These 'larger scale'

effects of gravity on fluid distribution and musculoskeletal support became increasingly important with the evolution of larger body size. The present paper considers the evolutionary responses of vertebrates to gravitational stressors acting on the cardiovascular system. Inasmuch as the range of published studies addressing gravity's effects on cardiovascular function is limited to relatively few taxa, the perspective developed here is based largely on studies of snakes and a few mammals. A brief review and synthesis of the available data suggest several generalizations concerning the evolutionary responses of form and function to gravity's stress on blood circulation.
Derived from text
Cardiovascular System; Adaptation; Gravitational Effects; Earth Gravitation; Aerospace Medicine; Vertebrates; Blood Circulation; Evolution (Development)

19960021676; 96N24951 Fourth Military Medical Univ., Dept. of Aerospace Physiology., Xi'an, China
Functional alterations in cardiac muscle after medium- or long-term simulated weightlessness and related cellular mechanisms
Zhang, Li-Fan, Fourth Military Medical Univ., China; Yu, Zhi-Bin, Fourth Military Medical Univ., China; Ma, Jin, Fourth Military Medical Univ., China; Fourth Military Medical Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 5-8; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Cardiac and skeletal muscles are very similar with respect to sarcomere organization, contractile protein, and gene organization. The structure and function of both cardiac and skeletal muscles can be modified and adapt to new functional requirements. Though data accumulated have provided convincing evidence of atrophy of skeletal muscle in space, there is simply too little information to characterize the primary effects of microgravity on the function and structure of the cardiac muscle. A serial work on effects of simulated weightlessness on function and structure of cardiac muscle was started in our laboratory several years ago. In our previous papers, a long-term tail-suspension rat model modified by us, and its validity as a simulation of microgravity effects on the cardiovascular system have been reported. In the present paper, we will focus primarily on the nature, time course, and mechanism of functional alterations in rat cardiac muscle during both 4 weeks of tail-suspension by our technique and 2 weeks of recovery. Besides, some findings concerning changes after 13 weeks of tail-suspension and the regression during recovery for 3 weeks are also included.
Derived from text
Cardiovascular System; Weightlessness Simulation; Gravitational Physiology; Aerospace Medicine; Microgravity; Physiological Responses; Muscles; Muscular Function; Cells (Biology)

19960021677; 96N24952 Centre Hospitalier Univ., Unite Medical and Physiology Spatiale., Tours, France
Influence of the THIGH CUFFS countermeasure on the CARDIOVASCULAR ADAPTATION to 0.g (14 and 21 day Mir spaceflights)
Arbeille, Ph., Centre Hospitalier Univ., France; Fomina, G., Institute of Biomedical Problems, USSR; Pottier, J. M., Centre Hospitalier Univ., France; Achaibou, F., Centre Hospitalier Univ., France; Kotovskaya, A., Institute of Biomedical Problems, USSR; Centre Hospitalier Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 9-10; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objectives and methods used in these physiological tests were to assess the 0.g induced cardiac and vascular changes at rest on two cosmonauts by using thigh cuffs on one from flight days 1 to 8 (Mir 14d flight) and not using thigh cuffs on the second cosmonaut (Mir 21d flight). Both did not use any other intensive countermeasure. An ultrasound device onboard the Mir with echo, doppler, and TM modes was used. The measurements taken at rest were the left ventricle and strokes volumes, cardiac output, CVP, renal, mesenteric and splanchnic vascular resistances, and cerebral and femoral flow volumes and resistances. Preflight, inflight, and postflight measurement sessions were scheduled.
Derived from text
Cardiovascular System; Cosmonauts; Countermeasures; Adaptation; Space Flight Stress; Gravitational Physiology; Physiological Responses; Aerospace Medicine; Blood Circulation; Physiological Tests; Cuffs; Thigh

19960021678; 96N24953 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Aerospace Medicine., Cologne, Germany
Forehead skin microcirculation during tilt table testing and lower body negative pressure
Drescher, Juergen, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Diedrich, Andre, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Lebedev, Arthur N., Cosmonaut Training Center, Russia; Spatenko, Juri A., Cosmonaut Training Center, Russia; Rome, Jean-Luc, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Grueber, Wilhelm, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 11-12; Also announced as 1996008550
Contract(s)/Grant(s): DARA-FK-50-WB-9331; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Noninvasive skin microcirculation measurements based on a new Near Infrared sensor technique (NIR/Fa.Silicon Sensor GmbH; Berlin) were embedded in a tilt table experiment for simulation of acute effects of weightlessness (HDT-6

deg) and active standing with the Russian Tschibis-LBNP device. The phenomenon of orthostatic intolerance depends on complex interactions among functional characteristics of central and peripheral cardiovascular control. The purpose of this study was to assess the blood volume and flow motion changes as well as pulsatile spectral pattern during orthostatic and antiorthostatic stress.

Derived from text

Lower Body Negative Pressure; Head Down Tilt; Weightlessness Simulation; Orthostatic Tolerance; Cardiovascular System; Forehead; Skin (Anatomy); Blood Circulation; Stress (Physiology); Aerospace Medicine; Gravitational Physiology

19960021679; 96N24954 International Society for Gravitational Physiology, Inst. of Aerospace Medicine., Washington, DC USA

Heart rate variability during head down tilt and lower body negative pressure in the Russian Tschibis

Diedrich, Andre, International Society for Gravitational Physiology, USA; Drescher, Juergen, International Society for Gravitational Physiology, USA; Nalishitij, Vladimir, Cosmonaut Training Center, Russia; Spatenko, Juri A., Cosmonaut Training Center, Russia; Rome, Jean-Luc, International Society for Gravitational Physiology, USA; Grueber, Wilhelm, International Society for Gravitational Physiology, USA; Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 13-14; In English; Also announced as 1996008550

Contract(s)/Grant(s): DARA-FK-50-WB-9331; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The cardiovascular function in space seems to be normal. However, abnormalities of cardiovascular responses have been found during lower body negative pressure suction in space. The etiology of the cardiovascular deconditioning in space is still unknown. A previous study showed that short periods of head down tilt (HDT-6 deg) induce changes in the spectral pattern of heart rate variability (HRV) and an increase in the sympathethic activation caused by orthostatic stress. The aim of this study was to test the following hypotheses: (1) The dynamics of heart rate variability is different in the head down tilt and supine positions; (2) The application of lower body negative pressure (LBNP) during head down tilt induces similar heart rate variability patterns like the standing position; and (3) After short term head down tilt the cardiovascular response to the lower body negative pressure stressor is altered.

Derived from text

Head Down Tilt; Lower Body Negative Pressure; Heart Rate; Variability; Cardiovascular System; Gravitational Physiology; Physiological Tests; Aerospace Medicine; Russian Space Program

19960021680; 96N24955 Service de Sante des Armees, Inst. de Medecine Aerospatiale., Bretigny sur Orge, France

Venous distensibility and venous emptying in the legs during a 42- day -6 deg head-down bedrest

Louisy, Francis, Service de Sante des Armees, France; Schroiff, Philippe, Service de Sante des Armees, France; Guezennec, Charles-Yannick, Service de Sante des Armees, France; Guell, Antonio, Service de Sante des Armees, France; Service de Sante des Armees, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 15-16; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Exposure to actual or simulated microgravity is known to result in changes in lower limb venous compliance or distensibility which may play a role in post-bedrest or postflight orthostatic intolerance. Venous deconditioning has only been described in terms of changes in vascular compliance or distensibility. But a complete understanding of changes in venous hemodynamics and cardiovascular regulation occurring under these conditions has to take into account changes in emptying capacities of the veins which influence venous return, cardiac filling, and cardiac output regulation. Moreover, few data are available about the course of changes in venous hemodynamics for periods of simulated microgravity longer than 4 weeks. The purpose of this investigation was to measure parameters of venous compliance and venous emptying before, during, and after a 42-day period of bedrest at -6 deg head-down tilt for a better understanding of long term venous physiological adaptation to microgravity.

Derived from text

Gravitational Physiology; Aerospace Medicine; Physiological Tests; Head Down Tilt; Bed Rest; Weightlessness Simulation; Blood Circulation; Veins; Adaptation; Hemodynamic Responses

19960021681; 96N24956 University of North Texas Health Science Center, Dept. of Physiology., Forth Worth, TX USA

Cardiovascular adaptations following detraining

Raven, Peter B., University of North Texas Health Science Center, USA; Shi, Xiangrong, University of North Texas Health Science Center, USA; University of North Texas Health Science Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 17-18; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We have recently summarized our data concerning endurance exercise training and its effect on blood pressure regulation during lower body negative pressure (LBNP). We found that endurance trained (ET) subjects were less tolerant to LBNP than their untrained (UT) counterparts. This decreased tolerance to LBNP was linked to a fitness related adaptation in cardiac compliance, an attenuated cardiopulmonary reflex regulation of peripheral vasoconstriction and an attenuated aortic-cardiac reflex. More recently we have found

that at 15 days of bed rest deconditioning (a severe form of detraining) in UT subjects resulted in a more responsive aortic-cardiac reflex. In severe detraining investigations, spaceflight and bed rest deconditioning, a reduction in total blood and plasma volume were the manifest reflex responsiveness was compensation for the blood and plasma volume losses associated with detraining. Subsequently, we hypothesized that a generalized reduction of the normal daily aerobic activities of a healthy, young adult population would produce a moderate reduction in total blood and plasma volume and an up-regulation of the reflex blood pressure regulatory mechanisms.

Derived from text

Gravitational Physiology; Aerospace Medicine; Cardiovascular System; Adaptation; Lower Body Negative Pressure; Physical Exercise; Blood Pressure; Regulatory Mechanisms (Biology); Orthostatic Tolerance; Human Tolerances; Deconditioning

19960021682; 96N24957 Graz Univ., Volume Regulations and Space Medicine Group., Austria

Is there 'cardiovascular drift' during and after simulated orthostasis in humans?

Hinghofer-Szalkay, Helmut G., Graz Univ., Austria; Laszlo, Zoltan, Graz Univ., Austria; Roessler, Andreas, Graz Univ., Austria; Graz Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 19-20; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This study investigates the time course of hemodynamic variables during and after simulated orthostasis (lower body suction at 55 mmHg for 30 min: LBNP-55). Individual strategies of blood pressure defense could be observed; LBNP-55 increased heart rate and reduced stroke volume, but was noon-hypotensive. During 20 minutes post-LBMP, heart rate was decreased as well as stroke volume index below pre-LBNP values. The reduced cardiac index together with unchanged mean arterial pressure gave a highly significant increase of peripheral resistance after LBNP. The validity of stroke volume results under the experimental conditions given needs to be clarified.

Author

Cardiovascular System; Hemodynamic Responses; Lower Body Negative Pressure; Blood Circulation; Variations; Gravitational Physiology; Aerospace Medicine; Orthostatic Tolerance

19960021683; 96N24958 NASA Ames Research Center, Moffett Field, CA USA

Calf venous compliance measured with head-up tilt equals supine calf compliance

Watenpaugh, D. E., NASA Ames Research Center, USA; Ballard, R. E., NASA Ames Research Center, USA; Breit, G. A., NASA Ames Research Center, USA; Bernauer, E. M., California Univ., USA; Blomqvist, C. G., Texas Univ., USA; Hargens, A. R., NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 21-22; In English; Also announced as 1996008550

Contract(s)/Grant(s): NAS9-16044; RTOP 199-14-12-04; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Elevated calf compliance may contribute to orthostatic intolerance following space flight and bed rest. Calf venous compliance is measured conventionally with venous occlusion plethysmography in supine subjects. With this well-established technique, subjects undergo inflation of a pressure cuff around the thigh just above the knee, which increases calf venous pressure. A plethysmograph simultaneously measures calf volume elevation. Compliance equals calf volume elevation per mm Hg thigh occlusion (calf venous) pressure in relaxed legs of the supine subjects. Compliance may also be measured during stepwise head-up tilt (HUT) as calf volume elevation per mm Hg gravitational venous pressure elevation produced by HUT. However, during HUT on a tilt table with a footplate, calf muscles activate to counteract gravity: this is an obvious and natural response to gravitational force. Such muscle activation conceivably could reduce calf compliance, yet relatively little calf muscle activation occurs during HUT and orthostasis (less than 10% of maximal voluntary levels; 4, 8, 10). Also, this activation produces minimal calf volume change (less than 0.3%; 3). Therefore, we hypothesized that calf compliance measured with HUT equals that measured with supine venous occlusion.

Derived from text

Veins; Blood Circulation; Gravitational Physiology; Space Flight Stress; Aerospace Medicine; Physiological Responses; Lower Body Negative Pressure; Orthostatic Tolerance; Weightlessness Simulation; Leg (Anatomy); Muscles

19960021685; 96N24960 Lyon-1 Univ., Lab. Physiologie de l'Environnement., Lyon, France

Hormonal regulation during a 60-day confinement (ESA-EXEMSI'92) in humans

Maillet, A., Lyon-1 Univ., France; Gunga, H. C., Freie Univ., Germany; Normand, S., Institut National de la Sante et de la Recherche Medicale, France; Allevard, A. M., Lyon-1 Univ., France; Pachiaudi, C., Institut National de la Sante et de la Recherche Medicale, France; Strollo, F., Institute for Endocrinological and Metabolic Diseases, Italy; Kirsch, K. A., Freie Univ., Germany; Gauquelin-Koch, G., Lyon-1 Univ., France; Gharib, C., Lyon-1 Univ., France; Lyon-1 Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 25-26; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

EXEMSI'92 was a 60-day isolation and confinement experiment with an international crew. During this second experiment of the European Space Agency (the first one was a 28-day confinement with 6 men: ISEMSI'90), blood vol-

ume regulating hormones and water balance were studied. During ISEMSI'90, the stress levels were elevated as shown by specific markers and we observed some interesting results which have been observed previously during bed rest experiments. Thus, our conclusion was that some of the physiological effects observed during bed rest could be the consequence of the 'confinement effect' and/or stress imposed to the subjects during such experiments. The aim of the present physiological study was to define the origin of the blood pressure increase seen during ISEMSI'90, to study the blood volume regulating hormones (ANP, renin, aldosterone) variations, and to determine the dehydration level by measuring the total body water with the doubly labeled water (DLW) method and fluid balance in general.
Derived from text
Hormones; Regulatory Mechanisms (Biology); Aerospace Environments; Environment Simulation; Isolation; Spacecrews; Physiological Effects; Blood Volume; Gravitational Physiology; Aerospace Medicine; Stress (Physiology)

19960021686; 96N24961 National Inst. of Vocational Rehabilitation, Chiba, Japan
Activated renin-angiotensin-aldosterone system and its effects on cardiovascular system during 20-days horizontal bed rest
Haruna, Yuichiro, National Inst. of Vocational Rehabilitation, Japan; Suzuki, Yoji, National Inst. of Vocational Rehabilitation, Japan; Yanagibori, Ryoko, National Inst. of Vocational Rehabilitation, Japan; Kawakubo, Kiyoshi, National Inst. of Vocational Rehabilitation, Japan; Gunji, Atsuaki, National Inst. of Vocational Rehabilitation, Japan; National Inst. of Vocational Rehabilitation, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 27-28; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The changes in circulating blood volume during bed rest has been suggested as to effect on many cardiovascular responses after bed rest, including orthostatic intolerance and exercise performance. However, there is a lack of concensus of the effect of the renin-angiotensin-aldosterone system (RAAS) on baseline heart rate and blood pressure during bed rest, although RAAS is the most potent fluid regulating system. The purpose of this study was to clarify the effects of RAAS on the changes in the baseline cardiovascular systems and with urine excretion.
Derived from text
Regulatory Mechanisms (Biology); Cardiovascular System; Gravitational Physiology; Aerospace Medicine; Weightlessness Simulation; Bed Rest; Physiological Responses; Hormones; Urine; Excretion

19960021687; 96N24962 Physiology/Pharmacology Consulting, San Diego, CA USA
Alterations in glomerular and tubular dynamics at 1 and 14 days simulated microgravity and after acute return to orthostasis
Tucker, Bryan J., Physiology/Pharmacology Consulting, USA; Mendonca, Margarida M., Physiology/Pharmacology Consulting, USA; Physiology(Pharmacology Consulting, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 31-32; In English; Also announced as 1996008550
Contract(s)/Grant(s): NCC2-556; NAG2-659; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Head-down tilt (HDT) is utilized to simulate microgravity and produces a cephalad fluid shift, which results in alterations in fluid and electrolyte balance. These changes in volume homeostasis are due, in part, to alterations in multiple volume control mechanisms in which renal function is a major participant. We have previously demonstrated that glomerular filtration rate increases early in HDT and eventually returns to values not different from non-tilt measurements. This early increase in glomerular filtration rate was also demonstrated during days 2 and 8 of the SLS-1 mission. However, urine flow and electrolyte excretion does not parallel the alternations in glomerular filtration rate and the site of this change in nephron fluid reabsorption pattern has not been previously examined. Through determination of the location of alterations in tubular fluid reabsorption within the nephron, a more detailed hypothesis can be forwarded as to which specific neuro-humoral agents participating in control or renal function in microgravity conditions. the importance of this type of examination is that measurements in circulating neuro-humoral agents and urinary excretion patterns alone are not accurate predictors of how renal functional response may alter to head-down tilt or other models of simulated weightlessness. To examine this issue, renal micropuncture techniques were utilized in Munich-Wistar rats submitted 24 hour and 14 day head-down tilt, measuring all the determinants of glomerular ultrafiltration and obtaining data regarding segmental tubular fluid reabsorption. Following these measurements, the rats were returned to an orthostatic position and after 60 minutes, the measurements were repeated.
Derived from text
Physiological Responses; Renal Function; Weightlessness Simulation; Microgravity; Body Fluids; Balance; Head Down Tilt; Gravitational Physiology; Aerospace Medicine; Electrolytes; Regulatory Mechanisms (Biology)

19960021689; 96N24964 Polish Air Force Inst. of Aviation Medicine, Warsaw, Poland
Application of multivariate statistical analysis to estimate (+)Gz tolerance based on the changes of hemodynamic parameters during Lower Body Negative Pressure (LBNP)
Turski, Bronislaw K., Polish Air Force Inst. of Aviation Medicine, Poland; Kuzak, Wlodzimierz, Polish Air Force Inst. of Aviation Medicine, Poland; Debinski, Wojciech B., Polish Air Force Inst. of Aviation Medicine, Poland; Gembicka-

Kuzak, Danuta M., Polish Air Force Inst. of Aviation Medicine, Poland; Dabrowski, Olaf B., Polish Air Force Inst. of Aviation Medicine, Poland; Polish Air Force Inst. of Aviation Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 35-36; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The application of lower body negative pressure (LBNP) is a very useful method for simulating +Gz stress and for evaluating orthostatic reactions. The different physiological changes that occur during LBNP tests and +Gz acceleration tests are similar. This present study was undertaken to evaluate the adaptation responses to LBNP stimulus at the level of -60 mmHg, the regulatory mechanisms of the circulatory system (central and peripheral), and to look at the possibility of +Gz tolerance predictions based on the changes of some of the hemodynamic parameters during LBNP.

Derived from text

Multivariate Statistical Analysis; Gravitational Physiology; Circulatory System; Lower Body Negative Pressure; Weightlessness Simulation; Aerospace Medicine; Hemodynamic Responses

19960021690; 96N24965 Polish Air Force Inst. of Aviation Medicine, Warsaw, Poland

Relationship between Atrial Natriuretic Peptide (ANP), renin (PRA), aldosterone (PAC), hemodynamic responses to Lower Body Negative Pressure (LBNP) and (+)Gz tolerance

Turski, Bronislaw K., Polish Air Force Inst. of Aviation Medicine, Poland; Gembicka-Kuzak, Danuta M., Polish Air Force Inst. of Aviation Medicine, Poland; Debinski, Wojciech B., Polish Air Force Inst. of Aviation Medicine, Poland; Kuzak, Wlodzimierz, Polish Air Force Inst. of Aviation Medicine, Poland; Polish Air Force Inst. of Aviation Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 37-38; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The redistribution of a certain thoracic blood volume to the lower parts of the body and a decrease in the venous return of blood to the heart during lower body negative pressure leads to central hypovolemia and deactivation of cardiopulmonary and arterial baroreceptors. Many compensatory mechanisms are involved during central hypovolemia, which is also reflected by the changes in the secretion of different vasoactive hormones. Due to this fact the LBNP stimulus is widely used for the investigation of regulatory (compensatory) mechanisms in the cardiovascular system, providing deeper understanding of orthostasis reactions. Recently several papers were published on the applications of this experimental model for +Gz acceleration tolerance assessment. The purpose of this study was to evaluate the possible dependency between the changes of ANP secretion, renin-angiotensin-aldosterone system activity, the changes of some hemodynamic parameters during the model of gravitational stress, i.e. LBNP exposure, and +Gz acceleration tolerance.

Derived from text

Cardiovascular System; Lower Body Negative Pressure; Secretions; Hemodynamic Responses; Acceleration Tolerance; Aldosterone; Peptides; Gravitational Physiology; Aerospace Medicine; Regulatory Mechanisms (Biology)

19960021693; 96N24968 NASA Johnson Space Center, Houston, TX USA

Adaptations of human skeletal muscle fibers to spaceflight

Day, M. Kathleen, California Univ., USA; Allen, David L., California Univ., USA; Mohajerani, Laleh, California Univ., USA; Greenisen, Michael C., NASA Johnson Space Center, USA; Roy, Roland R., California Univ., USA; Edgerton, V. Reggie, California Univ., USA; NASA Johnson Space Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 47-50; In English; Also announced as 1996008550 Contract(s)/Grant(s): NAS9-18773; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Human skeletal muscle fibers seem to share most of the same interrelationships among myosin ATPase activity, myosin heavy chain (MHC) phenotype, mitochondrial enzyme activities, glycolytic enzyme activities, and cross-sectional area (CSA) as found in rat, cat, and other species. One difference seems to be that fast fibers with high mitochrondrial content occur less frequently in humans than in the rat or cat. Recently, we have reported that the type of MHC expressed and the size of the muscle fibers in humans that have spent 11 days in space change significantly. Specifically, about 8% more fibers express fast MHCs and all phenotypes atrophy in the vastus lateralis (VL) post compared to preflight. In the present paper we examine the relationships among the population of myonuclei, MHC type, and CSA of single human muscle fibers before and after spaceflight. These are the first data that define the relationship among the types of MHC expressed, myonuclei number, and myonuclei domain of single fibers in human muscle. We then compare these data to similar measures in the cat. In addition, the maximal torque that can be generated by the knee extensors and their fatigability before and after spaceflight are examined. These data provide some indication of the potential physiologica consequences of the muscle adaptations that occur in humans in response to spaceflight.

Derived from text

Muscles; Fibers; Adaptation; Space Flight Stress; Gravitational Physiology; Aerospace Medicine; Muscular Function; Muscular Tonus; Physiological Tests; Microstructure; Microgravity

19960021694; 96N24969 California Univ., Dept. of Physiology and Biophysics., Irvine, CA USA

Future research directions in seeking countermeasures to weightlessness

Baldwin, Kenneth M., California Univ., USA; California Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 51-53; In English; Also announced as 1996008550 Contract(s)/Grant(s): NAG2-555; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this paper is to briefly review the state of knowledge concerning the adaptive properties of mammalian skeletal muscle in response to varying duration in weightlessness, to identify voids in the understanding of this adaptive process, and to provide some insight for undertaking future research on this important topic.

Derived from text

Technology Assessment; Technological Forecasting; Countermeasures; Mammals; Muscular Function; Weightlessness; Gravitational Physiology; Aerospace Medicine; Adaptation

19960021696; 96N24971 International Society for Gravitational Physiology, Lab. Physiology de l'Environnement., Washington, DC USA

Early and late renin and ANP modifications induced by bedrest

Gauquelin, G., International Society for Gravitational Physiology, USA; Maillet, A., International Society for Gravitational Physiology, USA; Allevard, A. M., International Society for Gravitational Physiology, USA; Sigaudo, D., International Society for Gravitational Physiology, USA; Gharib, C., International Society for Gravitational Physiology, USA; Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 56-57; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A number of studies have been devoted to better understanding cardiovascular adaptation to space flights. These studies included hemodynamic and hormonal studies, but few investigations of the rhythms exist in the literature. However, the importance of the modifications of rhythms in true or simulated weightlessness was underlined in some published works. Several factors are probably associated in modifying the circadian rhythms. First, these is a reduction or absence of gravity, an important environmental factor. Second, space missions or bed rest simulations are conducted under confinement conditions which may influence many psychological functions. The resulting instability of the circadian state will affect other physiological systems, because circadian variations are a fundamental feature of other biological systems (sleep, endocrine, and cardiovascular functions). The present study was undertaken to study the effect of a continuous 28 day bed rest on the rhythms of circulating PRA and ANP, and the modification of rhythmicity of systolic and diastolic blood pressure and heart rate during bed rest.

Derived from text

Circadian Rhythms; Bed Rest; Gravitational Physiology; Aerospace Medicine; Weightlessness Simulation; Hemodynamic Responses; Sleep; Physiological Tests; Gravitational Effects

19960021698; 96N24973 Waterloo Univ., Dept. of Kinesiology., Ontario Canada

Exercise with- and without gravitational gradient: Evaluation with the new Random Access Mass Spectrometer (RAMS)

Hughson, Richard L., Waterloo Univ., Canada; Shoemaker, J. Kevin, Waterloo Univ., Canada; Tshchakovsky, Michael E., Waterloo Univ., Canada; Corsale, Dominic, Marquette Electronics, Inc., USA; Dietrich, Bruce H., Marquette Electronics, Inc., USA; Waterloo Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 60-61; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Gravity adds about 40-50 mmHg perfusion pressure to the arterial supply of the quadriceps muscles in the upright posture position. This could have important implications in the supply of blood flow during exercise. Recently, we have shown that when subjects exercise in a supine position the rate of increase in VO2 is considerably slower then when an cycling exercise takes place in the upright posture position. The most probable explanation for this slower adaptation was the altered perfusion gradient. Indeed, when the perfusion gradient from the heart to the legs was restored by placing the lower part of the body of the supine subjects in a negative pressure chamber, the rate of increase in the VO2 returned to the upright values. The hypothesis advanced from these studies was that skeletal muscle blood flow was reduced at the onset of the supine exercise. Exercise in the microgravity environment of space should be similar to that in the supine posture position. The only experiments conducted in space to date that have addressed the question of cardiorespiratory adaptation to changing work rates were performed on the German D2 mission using the methodology proposed by Stegemann and colleagues. To conduct these experiments, it was necessary to utilize sensitive breath-by-breath technology. Recently, NASA and the Russian space programs have commissioned a new mass spectrometer based system as part of the GASMAP project. It was the purpose of this study to evaluate the new mass spectrometer under conditions in which the gravitational effects on the cardiorespiratory response were being challenged.

Derived from text

Gravitational Effects; Physical Exercise; Gravitational Physiology; Aerospace Medicine; Gradients; Musculoskele-

tal System; Cardiovascular System; Physiological Tests; Physiological Responses; Random Access; Mass Spectroscopy

19960021700; 96N24975 Danish Aerospace Medical Center of Research, Copenhagen, Denmark

Estimations of changes in plasma volume during simulated weightlessness

Johansen, Lars Bo, Danish Aerospace Medical Center of Research, Denmark; Norsk, Peter, Danish Aerospace Medical Center of Research, Denmark; Danish Aerospace Medical Center of Research, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 64-65; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Results of previous investigations on the effects of simulated microgravity (thermoneutral (34.5 C) head-out water immersion, WI) have indicated that plasma volume (PV) increases initially and thereafter decreases to attain values below the pre-immersion level(3). In these cases, changes in hematocrit (Hct) and hemoglobin concentration (Hgb) were used as indicators of relative changes in PV. In order to test whether changes in Hct and Hgb are accurate measures of changes in PV during simulated microgravity, direct measurements of PV were performed with a modified Evans blue dye dilution technique before, during, and after a 12 h WI experiment. Furthermore, PV was determined with the same technique before, during, and after acute 6 deg head-down tilt (HDT). Changes in PV were then compared with changes calculated from changes in Hct and Hgb.

Derived from text

Blood Plasma; Variations; Volumetric Analysis; Weightlessness Simulation; Microgravity; Physiological Responses; Water Immersion; Physiological Tests

19960021701; 96N24976 NASA Kennedy Space Center, Cocoa Beach, FL USA

Increased beta-adrenergic responsiveness induced by 14 days exposure to simulated microgravity

Convertino, V. A., NASA Kennedy Space Center, USA; Polet, J. L., NASA Kennedy Space Center, USA; Engelke, K. A., NASA Kennedy Space Center, USA; Hoffler, G. W., NASA Kennedy Space Center, USA; Lane, L. D., NASA Kennedy Space Center, USA; Blomqvist, C. G., NASA Kennedy Space Center, USA; NASA Kennedy Space Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 66-67; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Increased sensitivity of end-organ responses to neuroendocrine stimuli as a result of prolonged exposure to the relative inactivity of microgravity has recently been hypothesized. This notion is based on the inverse relationship between circulating norepinephrine and beta-adrenoreceptor sensitivity. The beta-adrenoreceptor activity is reduced in individuals who have elevated plasma norepinephrine as a result of regular exposure to upright posture and physical exercise. In contrast, adrenoreceptor hypersensitivity has been reported in patients with dysautonomias in which circulating catecholamines are absent or reduced. Taken together, these studies and the observation that circulating plasma norepinephrine has been reduced during spaceflight and in groundbased simulations of microgravity prompt the suggestion that adrenoreceptor hypersensitivity may be a consequence of the adaptation to spaceflight. We conducted an experiment designed to measure cardiovascular responses to adrenoreceptor agonists in human subjects before and after prolonged exposure to 6 deg head-down tilt (HDT) to test the hypothesis that adaptation to microgravity increases adrenoreceptor responsiveness, and that this adaptation is associated with reduced levels of circulating norepinephrine.

Derived from text

Adrenal Gland; Adrenergics; Beta Particles; Cardiovascular System; Chemoreceptors; Physiological Responses; Sympathetic Nervous System; Gravitational Physiology; Aerospace Medicine; Microgravity

19960021703; 96N24978 Baylor Coll. of Medicine, Dept. of Physical Medicine and Rehabilitation., Houston, TX USA

Electrical impedance measurements in the arm and the leg during a thirty day bed rest study

Cardus, David, Baylor Coll. of Medicine, USA; Jaweed, Mazher, Baylor Coll. of Medicine, USA; McTaggart, Wesley, Baylor Coll. of Medicine, USA; Baylor Coll. of Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 70-71; In English; Also announced as 1996008550

Contract(s)/Grant(s): RTOP 199-16-11-28; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The need to detect, follow, and understand the effects of gravity on body fluid distribution is a constant stimulus to the quest for new techniques in this area of research. One of these techniques is electrical bioimpedance spectroscopy (BIS). Although not new, this is a technique whose applications to biomedical research are fairly recent. What is new is the development of instrumentation that has made practical the use of impedance spectroscopy in the biomedical setting, particularly in studies involving human subjects. The purpose of this paper is to report impedance spectroscopy observations made on a subject who was submitted to bed rest for a period of thirty days. These observations were made as part of a study on muscle atrophy during a thirty day head down bed rest. Since bed rest studies are very costly in human and financial terms, and technically difficult to realize, we felt that even though the present study deals only with a single case it was worthy of reporting because it illustrates kinds of questions impedance spectroscopy may help to answer in microgravity research.

Derived from text

Electrical Impedance; Bed Rest; Electrical Measurement;

Weightlessness Simulation; Head Down Tilt; Microgravity; Gravitational Physiology; Aerospace Medicine; Biometrics; Physiological Tests

19960021704; 96N24979 Baylor Coll. of Medicine, Dept. of Physical Medicine and Rehabilitation., Houston, TX USA
Neuromuscular adaptations during 30 days of cast-immobilization and head-down bedrest
Jaweed, M. Mazher, Baylor Coll. of Medicine, USA; Grana, Erick A., Baylor Coll. of Medicine, USA; Glennon, Terrance P., Baylor Coll. of Medicine, USA; Monga, Trilok N., Baylor Coll. of Medicine, USA; Mirabi, Batool, Baylor Coll. of Medicine, USA; Baylor Coll. of Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 72-73; In English; Also announced as 1996008550
Contract(s)/Grant(s): RTOP 199-16-11-28; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Prolonged skeletal muscle disuse, during space flights and on Earth, produces distinct adaptive changes in the neuromuscular system of human subjects. There is a significant decline in muscle mass and strength, exercise capacity, fatigue resistance, integrated EMG (IEMG) output and time-dependent alterations in the behavior of Hoffmann (H) and deep tendon reflexes (1-2). The objective of this study was to examine the changes in excitability of segmental motoneuronal network and its influence upon gastrocnemius-soleus (G-S) function in healthy male and female subjects, who underwent either 6 deg head-down bedrest (HDB) or unilateral cast-immobilization (CIM) for a period of 30 days.
Derived from text
Neuromuscular Transmission; Adaptation; Musculoskeletal System; Gravitational Effects; Gravitational Physiology; Aerospace Medicine; Bed Rest; Immobilization; Head Down Tilt

19960021705; 96N24980 Tokyo Univ., Dept. of Health Administration., Japan
Effects of 20 days bed rest on mechanical efficiency during upright cycling and leg muscle mass in young males
Suzuki, Y., Tokyo Univ., Japan; Haruna, Y., National Inst. of Vocational Rehabilitation, Japan; Kuriyama, K., Tokyo Univ., Japan; Kawakubo, K., Tokyo Univ., Japan; Igawa, S., Nippon Coll. of Physical Education, Japan; Goto, S., Goto Coll., Japan; Makita, Y., Makita General Hospital, Japan; Gunji, A., Tokyo Univ., Japan; Tokyo Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 74-75; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Delta efficiency defined as increase in work over the corresponding increase in energy liberation (delta work/delta energy) may be used to express the efficiency of working muscles under standard conditions where work is performed with similar changes in muscle length, identical pedal revolution frequencies, and contraction-to-relaxation ratios. The Delta efficiency is probably the most valid measure of the efficiency of muscular work, so ti may be influenced by the difference in distribution and/or density of muscle fiber types in exercising muscles. It has been reported that after bed rest of 7-14 days, not only maximum oxygen uptake (VO2max) but also oxygen uptake (VO2) at 3-min submaximal upright exercise decreased. However, the decrease might be apparent, and the mechanical efficiency might be unchanged. On the other hand, muscle mass of bicycling legs was decreased after continuous horizontal bed rest of 10 days and 20 days. Because the decreased muscle mass is probably related to decrease in the density of the slow twitch muscle (ST-fiber), the decrease in submaximal VO2 during bicycle exercises after bed rest may result from a decrease in ST-fiber mass. Therefore, it could be hypothesized that the mechanical efficiency should increase during upright exercise because of the relative increase in amount of more efficient fast twitch muscle fibers (FT-fiber) than ST fibers in excercising muscles. The purpose of the present study was to investigate whether delta efficiency in working muscle is influenced by the decrease in muscle mass after 20 days horizontal bed rest in young males.
Derived from text
Bed Rest; Exercise Physiology; Gravitational Physiology; Weightlessness Simulation; Aerospace Medicine; Muscular Function; Cycles; Energy Conversion Efficiency; Work Capacity; Weight (Mass)

19960021706; 96N24981 Institute of Biomedical Problems, Moscow, USSR
Mechanical and electrical adaptation of skeletal muscle to gravitational unloading
Koryak, Yuri, Institute of Biomedical Problems, USSR; Institute of Biomedical Problems, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 76-79; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The physiological and biochemical properties of limb skeletal muscle have been show to adapt to variety of experimental conditions. Among these is the microgravity encountered with spaceflight. It is adaptations accompanying skeletal muscle disuse atrophy. Foremost among these changes is a reduction in the force-generating capacity, which is presumably a direct result of decrease in fiber number and diameter. These changes suggest a spaceflight-induced reduction in muscle work capacity. The interesting finding that the reduction of the mechanical tension is not proportional to the reduction of muscle weight, fiber diameter, and concentration of contractile protein suggested that changes of electrical activity might contribute to the reduction of the contraction force in disused muscle. The purpose of our study was to assess the effects of a 7-d 'dry' immersion on the contractile properties of the triceps surae muscle.
Derived from text
Muscles; Adaptation; Unloading; Electrical Properties;

Mechanical Properties; Gravitational Effects; Gravitational Physiology; Aerospace Medicine; Microgravity; Space Flight Stress

19960021708; 96N24983 Research Inst. of Aviation and Space Medicine, Moscow, Russia

Prognostic evaluation of spinal microlesions under exposure of longitudinal blow accelerations of prolonged action

Mazurin, Yu. V., Research Inst. of Aviation and Space Medicine, Russia; Stupakov, G. P., Research Inst. of Aviation and Space Medicine, Russia; Research Inst. of Aviation and Space Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 82-84; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

These performed experimental investigations were aimed at qualitative and approximate qualitative estimation of parameters of the cumulated microtraumatic destructions in spin, leading to its lowered bearing capabilities under prolonged loading conditions with compression exposures corresponding to high level maneuverable accelerations that exceed 5 G and onset rates of 10 G/s or more. The microlesion process of in bone tissue of vertebral bodies in this range of acceleration has not been sufficiently studied. Of practical importance with these effects is that this bears a close relationship to problems of high intensity flight maneuvering accelerations with onset rates up to 10 G/s and higher, as well as, to estimates of the impact acceleration tolerance in an ejection event with a controllable flightpath of the kicked out catapult seat. The data received in the natural experiments on spinal segments T(sub 11)-L(sub 3) with fixed acoustical emission signals (AES), suggests that a stage of minor lesions of vertebral bodies (the first degree of severity), characterized by an avalanche-like increment of acoustical emission signals and a starting point of specific cracking in the loading flow chart, which may be pertained as having a fragile character.

Derived from text

Impact Acceleration; Evaluation; Spine; Lesions; Acceleration Tolerance; Sound Waves; Gravitational Physiology; Aerospace Medicine; Destruction; Bones; Compression Waves

19960021709; 96N24984 Research Inst. of Aviation and Space Medicine, Moscow, Russia

Effect of flight accelerations on human tolerance to impact ejection overload

Moiseyev, Yu. B., Research Inst. of Aviation and Space Medicine, Russia; Research Inst. of Aviation and Space Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 85-87; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The operation of modern high performance of fourth generation aircraft and even more the forthcoming transition to fifth generation flying vehicles, which are being intensively developed at the present, make probable the emergence of flying mishaps and unavoidable ejection against a background of high-sustained +G(sub z)-forces. However, there is a lack of papers, which highlight the effect that such a powerful hypergravitational factor as flying acceleration or the corresponding axial mechanical loading will have on the dynamic strength of the spinal column in the current available literature. Investigations of the static preloading effect, which is equivalent to the action of flying at an acceleration of 8,...10 G, on the dynamic strength of the spine, were conducted in model experiments with newly excised vertebral bodies of spinal columns from the 11th thoracic down to the 2nd lumbar segments.

Derived from text

Space Flight Stress; Acceleration (Physics); Spine; Gravitational Physiology; Aerospace Medicine; Impact Loads; Impact Acceleration; Human Tolerances; Ejection Seats

19960021714; 96N24989 Academy of Sciences of the Ukraine, Inst. for Physics., Kiev, Ukraine

Piezoelectric effects in otolith structure-function relationship

Kondrachuk, Alexander V., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 102-103; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In the present report, the possible role of piezoelectric effects in the functioning of an otolith organ is discussed by comparing it with the effects found in a man-made material, polymer composite films, in which the polymer (organic) matrix contains piezoelectric inclusions (usually, piezoceramics). The theoretical grounds of this consideration consist of a piezoelectrical model of gravireception (proposed some time ago) and a description of the otolith organ as a system with distributed parameters.

Derived from text

Otolith Organs; Piezoelectric Ceramics; Piezoelectricity; Structural Analysis; Functional Analysis; Aerospace Medicine; Gravitational Physiology; Impact Acceleration

19960021715; 96N24990 Armstrong Lab., Brooks AFB, TX USA

Whole body movements in altered G environments

Constable, Roxanne, Armstrong Lab., USA; Carpenter, David, Armstrong Lab., USA; Armstrong Lab., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 104; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Davies and Rennie determined that the instantaneous peak and mean power transferred to the center-of-mass of a subject during jumping could be calculated from analyzing the ground reaction force. Since Davies and Rennie's report,

vertical jumping has been used to measure the peak and mean power transferred to the center-of-mass and to assess human performance. It has also been suggested that the external load a subject experiences effects the power production. However, it is difficult to determine if the difference in power production as defined in these studies is due to the external loading, or is an effect of changing the dynamics of the movement. In this paper, we describe a study which allows us to more clearly define the power developed during jumping under different weights, and the relationship between the power developed and jump height.
Derived from text
Center Of Mass; Human Performance; Gravitational Physiology; Aerospace Medicine; Acceleration (Physics); Physiological Acceleration; Human Body; Gravitational Effects; Physiological Tests

19960021718; 96N24993 Academy of Sciences of the Ukraine, Inst. for Physics., Kiev, Ukraine
Concept of new tool to simulate human physiological reactions in microgravity
Kondrachuk, Alexander, Academy of Sciences of the Ukraine, Ukraine; Gulyar, Serge A., Academy of Sciences of the Ukraine, Ukraine; Academy of Sciences of the Ukraine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 109-110; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The effect of microgravity on living creatures is determined by the fact that one physical reason (G = 0) causes different changes in closely coordinated physiological systems that are first involved in spatial orientation. It results in a disbalance of these systems. Because the physical realization of prolonged microgravity in Earth conditions is impossible, the commonly accepted approaches are: to outline the reactions of the main systems subjected to the hypogravity effects; to determine their weights in a generalized picture of weightlessness perception; and to try to model the most important of these reactions by using different physical methods. It may be supposed that any combination of these methods in one facility may give a more pronounced effect of microgravity modeling. To simplify the situation, we outlined the following physiological reactions caused by weightlessness: the reaction of the otolith organ (gravireceptor); the reactions of the proprioceptors; and the redistribution of body fluids, especially, the blood shift. It is known that the stimulation each of these reactions causes sensations similar to those which take place under microgravity conditions.
Derived from text
Human Reactions; Physiological Responses; Body Fluids; Blood Circulation; Otolith Organs; Gravitational Physiology; Aerospace Medicine; Microgravity; Technology Assessment

19960021721; 96N24996 Eidgenoessische Technische Hochschule, Space Biology Group., Zurich, Switzerland
Lymphocyte movement and interactions in microgravity
Cogoli-Greuter, Marianne, Eidgenoessische Technische Hochschule, Switzerland; Sciola, Luigi, Sassari Univ., Italy; Spano, Alessandra, Sassari Univ., Italy; Meloni, Maria Antonietta, Sassari Univ., Italy; Pippia, Proto, Sassari Univ., Italy; Cogoli, Augusto, Eidgenoessische Technische Hochschule, Switzerland; Eidgenoessische Technische Hochschule, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 117-118; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A dramatic depression of T lymphocyte activation in vitro by the mitogen concanavalin A (Con A) was discovered in an experiment conducted in Spacelab 1 in 1983. More sophisticated experiments followed in Spacelab D1 in 1985 and in the Spacelab SLS1 in 1991. All investigations confirmed the effect. The results suggested that the major reason of the depression was the failure of the monocytes, acting as accessory cells, to provide the second signal, interleukin 1, required for activation of the T cells. Conversely, when T lymphocytes and monocytes were attached to microcarrier beads, activation was more than doubled in microgravity, when compared to controls cultured at 1 g either in flight or on the ground. It was concluded that signal transduction is markedly changed in microgravity. Cell-cell contacts and the formation of aggregates play an important role in the mitogen induced in-vitro activation of lymphocytes. The fact that the formation of cell aggregates is only slightly reduced in microgravity suggests that cells are moving and interacting also in space. Direct evidence was obtained for the first time in an experiment performed on a sounding rocket flight, where the movements and interactions of free-floating, non activated cells could be observed in real time in microgravity. In an experiment performed on the IML-2 mission in July 1994, the movements and interactions of human lymphocytes during activation with the mitogen Con Q were studied in real time in microgravity. An evaluation of the video tapes reveals that lymphocytes resuspended in microgravity in the presence of Con A are capable of autonomous movements and formation of cell aggregates.
Derived from text
Lymphocytes; Aggregates; Activation (Biology); Immunology; Microgravity; Gravitational Physiology; Aerospace Medicine; Physiological Responses; Gravitational Effects; Locomotion

19960021724; 96N24999 Vaexjoe Hospital, Dept. of Clinical Physiology., Vaexjoe, Sweden
Transcapillary fluid transfer and plasma volume changes in response to quiet standing and LBNP
Lundvall, Jan, Vaexjoe Hospital, Sweden; Vaexjoe Hospital, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 127-130; In English; Also announced as 1996008550; No

Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Quiet standing is one of the conditions of daily life. Still, it may lead to acute circulatory failure even in normal man, a phenomenon ascribed mainly to the early large pooling of blood and secondary decrease in central blood volume. Reduction of plasma volume (PV) by filtration in dependent regions apparently contributes, but there is no indication that this process is of major importance during short periods of standing still in normal life. Hence, studies have indicated that the plasma fluid loss occurs at relatively slow rates due to the presence of protective mechanisms that prevent rapid fluid loss. However, the rate and magnitude of PV reduction might have been seriously underestimated in the past as strongly suggested by recent studies from our laboratory. The following summary was based on data obtained in tests with subjects exposed to 10 min periods of quiet standing lasting for 5, 10, and 20 min intervals. The PV alterations in relative terms were reached from analyses of the arterial hemoglobin (Hb) and hematocrit (Hct). For control, resting PV prior to standing was determined using the albumin dilution technique.

Derived from text

Posture; Human Body; Blood Volume; Blood Circulation; Lower Body Negative Pressure; Cardiovascular System; Gravitational Physiology; Aerospace Medicine; Regulatory Mechanisms (Biology)

19960021725; 96N25000 Austrian Society for Aerospace Medicine, Inst. for Adaptive and Spaceflight Physiology., Graz, Austria

Orthostasis and transcapillary fluid shifts

Hinghofer-Szalkay, Helmut G, Austrian Society for Aerospace Medicine, Austria; Austrian Society for Aerospace Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 131-133; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The basic sequence of physiological responses to postural blood volume changes that aggravate the regulatory mechanisms of arterial blood pressure and perfusion are presented in this article. The hydrostatic effects of orthostasis, i.e., blood pooling below the hydrostatic indifferent points and reduced cardiac preload, or comparable effects are noticed with extended passive standing, particularly in highly trained, dehydrated, or otherwise compromised subjects, or after long-lasting immobilization, as occurs with space flight. This paper addresses the orthostasis and transcapillary fluid shifts aspects to this problem.

CASI

Blood Volume; Diffusion; Posture; Orthostatic Tolerance; Gravitational Physiology; Aerospace Medicine; Cardiovascular System; Capillary Flow; Capillaries (Anatomy); Blood Circulation; Regulatory Mechanisms (Biology)

19960021732; 96N25007 NASA Ames Research Center, Moffett Field, CA USA

Ultrasound measurement of transcranial distance during head-down tilt

Torikoshi, S., NASA Ames Research Center, USA; Wilson, M. H., NASA Ames Research Center, USA; Ballard, R. E., NASA Ames Research Center, USA; Watenpaugh, D. E., NASA Ames Research Center, USA; Murthy, G., NASA Ames Research Center, USA; Yost, W. T., NASA Langley Research Center, USA; Cantrell, J. H., NASA Langley Research Center, USA; Chang, D. S., NASA Ames Research Center, USA; Hargens, A. R., NASA Ames Research Center, USA; NASA Ames Research Center, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 145-146; In English; Also announced as 1996008550

Contract(s)/Grant(s): RTOP 199-14-12-04; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Exposure to microgravity elevates blood pressure and flow in the head, which may increase intracranial volume (ICV) and intracranial pressure (ICP). Rhesus monkeys exposed to simulated microgravity in the form of 6 degree head-down tilt (HDT) experience elevated ICP. With humans, twenty-four hours of 6 degree HDT bed rest increases cerebral blood flow velocity relative to pre-HDT upright posture. Humans exposed to acute 6 degree HDT experiments increased ICP, measured with the tympanic membrane displacement (TMD) technique. Other studies suggest that increased ICP in humans and cats causes measurable cranial bone movement across the sagittal suture. Due to the slightly compliant nature of the cranium, elevation of the ICP will increase ICV and transcranial distance. Currently, several non-invasive approaches to monitor ICP are being investigated. Such techniques include TMD and modal analysis of the skull. TMD may not be reliable over a large range of ICP and neither method is capable of measuring the small changes in pressure. Ultrasound, however, may reliably measure small distance changes that accompany ICP fluctuations. The purpose of our study was to develop and evaluate an ultrasound technique to measure transcranial distance changes during HDT.

Derived from text

Ultrasonics; Distance Measuring Equipment; Intracranial Pressure; Gravitational Physiology; Aerospace Medicine; Head Down Tilt; Bed Rest; Weightlessness Simulation; Microgravity; Brain Circulation

19960021767; 96N25042 Lockheed Engineering and Sciences Co., Houston, TX USA

Human-Computer Interaction with Medical Decisions Support Systems

Adolf, Jurine A., Lockheed Engineering and Sciences Co., USA; Holden, Kritina L., Lockheed Engineering and Sciences Co., USA; Lockheed Engineering and Sciences Co., Dual-Use Space Technology Transfer Conference and

Exhibition; May 1994, pp. 255-262; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Decision Support Systems (DSSs) have been available to medical diagnosticians for some time, yet their acceptance and use have not increased with advances in technology and availability of DSS tools. Medical DSSs will be necessary on future long duration space missions, because access to medical resources and personnel will be limited. Human-Computer Interaction (HCI) experts at NASA's Human Factors and Ergonomics Laboratory (HFEL) have been working toward understanding how humans use DSSs, with the goal of being able to identify and solve the problems associated with these systems. Work to date consists of identification of HCI research areas, development of a decision making model, and completion of two experiments dealing with 'anchoring'. Anchoring is a phenomenon in which the decision maker latches on to a starting point and does not make sufficient adjustments when new data are presented. HFEL personnel have replicated a well-known anchoring experiment and have investigated the effects of user level of knowledge. Future work includes further experimentation on level of knowledge, confidence in the source of information and sequential decision making.

Author

Human-Computer Interface; Human Factors Laboratories; Medical Personnel; Decision Making

19960021771; 96N25046 Science Applications International Corp., Houston, TX USA

A Feasibility Study for Perioperative Ventricular Tachycardia Prognosis and Detection and Noise Detection Using a Neural Network and Predictive Linear Operators

Moebes, T. A., Science Applications International Corp., USA; Science Applications International Corp., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 295-304; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

To locate the accessory pathway(s) in preexicitation syndromes, epicardial and endocardial ventricular mapping is performed during anterograde ventricular activation via accessory pathway(s) from data originally received in signal form. As the number of channels increases, it is pertinent that more automated detection of coherent/incoherent signals is achieved as well as the prediction and prognosis of ventricular tachywardia (VT). Today's computers and computer program algorithms are not good in simple perceptual tasks such as recognizing a pattern or identifying a sound. This discrepancy, among other things, has been a major motivating factor in developing brain-based, massively parallel computing architectures. Neural net paradigms have proven to be effective at pattern recognition tasks. In signal processing, the picking of coherent/incoherent signals represents a pattern recognition task for computer systems. The picking of signals representing the onset ot VT also represents such a computer task. We attacked this problem by defining four signal attributes for each potential first maximal arrival peak and one signal attribute over the entire signal as input to a back propagation neural network. One attribute was the predicted amplitude value after the maximum amplitude over a data window. Then, by using a set of known (user selected) coherent/incoherent signals, and signals representing the onset of VT, we trained the back propagation network to recognize coherent/incoherent signals, and signals indicating the onset of VT. Since our output scheme involves a true or false decision, and since the output unit computes values between 0 and 1, we used a Fuzzy Arithmetic approach to classify data as coherent/incoherent signals. Furthermore, a Mean-Square Error Analysis was used to determine system stability. The neural net based picking coherent/incoherent signal system achieved high accuracy on picking coherent/incoherent signals on different patients. The system also achieved a high accuracy of picking signals which represent the onset of VT, that is, VT immediately followed these signals. A special binary representation of the input and output data allowed the neural network to train very rapidly as compared to another standard decimal or normalized representations of the data.

Author

Tachycardia; Signal Processing; Neural Nets; Feasibility; Brain; Signal Detection

19960022094; 96N25140 Los Alamos National Lab., NM USA

Life Sciences Division and Center for Human Genome Studies 1994

Cram, L. Scott, Compiler, Los Alamos National Lab., USA; Stafford, Carolyn, Compiler, Los Alamos National Lab., USA; Sep. 1995, pp. 104; In English

Contract(s)/Grant(s): W-7405-eng-36

Report No.(s): LA-12937-PR; DE96-001543; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report summarizes the research and development activities of the Los Alamos National Laboratory's Life Sciences Division and the biological aspects of the Center for Human Genome Studies for the calendar year 1994. The technical portion of the report is divided into two parts: (1) selected research highlights; and (2) research projects and accomplishments. The research highlights provide a more detailed description of a select set of projects. A technical description of all projects is presented in sufficient detail so that the informed reader will be able to assess the scope and significance of each project. Summaries useful to the casual reader desiring general information have been prepared by the group leaders and appear in each group overview. Investigators on the staff of the Life Sciences Division will be pleased to provide further information.

DOE

Cells (Biology); Computer Aided Mapping; Molecular Structure; Molecular Dynamics; Molecular Biology; Human Beings; Genetic Code; Genetics; Research And Development

19960022788; 96N25681 Civil Aeromedical Inst., Oklahoma City,OK USA

Ophthalmic Requirements and Considerations for the En Route Air Traffic Control Specialist: An Ergonomic Analysis of the Visual Work Environment ***Final Report***

Nakagawara, Van B., Civil Aeromedical Inst., USA; Coffey, James D., Civil Aeromedical Inst., USA; Montgomery, Ronald W., Civil Aeromedical Inst., USA; Apr. 1996, pp. 20; In English

Report No.(s): DOT/FAA/AM-96/12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Air Surgeon requested continued investigation of visual disorders and vision corrective devices as to their relevance to the medical certification of airmen and controllers. The en route Air Traffic Control Specialist (ATCS) works with a unique radar console unit when controlling aircraft. To better understand the visual requirements of this work environment, an ergonomic study of the radar console was performed. A vertical stand with a tape measure was placed 10.2 cm (4.0 inches) from the front of the current model radar console used by en route Acts. Measurements from two eye height levels, representing the low female value (5th percentile) and the high mate value (95th percentile), to four primary components of the radar console were obtained. Accommodation, vergence, and vision demands were calculated. The accommodative range was from 0.79 D to 1.81 D and the vergence demand range from 4.61(sup delta) to 10.35(sup delta). Version demands were generally large due to the size and placement of the primary components. Of the 80 version measurements calculated, only 17 (21.25 percent) required less than 15 deg of eye movements. The accommodative and convergence demands of an en route radar console would not be expected to have a substantial clinical effect on vision for pre- and early-presbyopic controllers with normal phoria and fusional reserve capabilities. Version demands are substantial and may be visually stressful to the ATCS. Clinical ophthalmic considerations for correcting the vision at the radar console of these controllers, particularly presbyopic ATCSS, are reviewed. These data may be used by the Office of Aviation Medicine in addressing occupational and medical questions, and their associated regulatory implications.

Author

Air Traffic Control; Human Performance; Visual Accommodation; Eye Movements; Ophthalmology; Human Factors Engineering; Workstations; Physiological Tests; Radarscopes

53
BEHAVIORAL SCIENCES

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

19960021713; 96N24988 Semmelweis Univ. Medical School, First Dept. of Anatomy., Budapest, Hungary

Basic cerebellar events relating sensorimotor adaptation: Structural analysis on extracellular records of Purkinje cells

Simon, L., Semmelweis Univ. Medical School, Hungary; Laczko, L., Semmelweis Univ. Medical School, Hungary; Csotai, J., Semmelweis Univ. Medical School, Hungary; Semmelweis Univ. Medical School, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 100-101; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The heterosynaptic facilitation or suppression of synaptic efficacy between parallel fibers and the dendritic spines of Purkinje cells (PC's) in the cerebellar cortex has been for decades the basic idea of sensorimotor adaptation. Great efforts in order to get direct evidence failed, or were not accepted as direct proofs. A new facility was introduced with the structural analysis of intradendritic records of the PC. These records reveal a generally double (rarely single, triple, or quadruple) rhythmic pattern of small spikes, which are proposed to be prespikes of dendritic origin. Moreover, they may take their origin at functionally separated dendritic compartments, resulting in a nonlinear, phase-sensitive integrative process, performed by the compound spike generating mechanism of the cerebellar PC.

Derived from text

Cerebral Cortex; Neurons; Adaptation; Bioelectricity; Sensorimotor Performance; Neurophysiology; Structural Analysis; Aerospace Medicine

19960021716; 96N24991 Technische Univ., Inst. fuer Humanbiologie und Biopsychologie., Dresden, German Democratic Republic

Aspects of action regulations by payload cosmonauts

Wirth, D., Technische Univ., German Democratic Republic; Technische Univ., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 105-106; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This paper is concerned with the Action Regulation Theory and its application to the action and workload regulations of payload cosmonauts in space. The theory's conclusions and how it is applied by the cosmonauts is discussed. The working conditions and problems faced by cosmonauts are discussed and the physical effects on the cosmonauts are listed.

CASI

Cosmonauts; Regulations; Aerospace Medicine; Space

Flight Stress; Control Theory; Gravitational Physiology; Aerospace Environments; Assessments

19960021761; 96N25036 Lockheed Engineering and Sciences Co., Houston, TX USA

Advanced Video Analysis Needs for Human Performance Evaluation

Campbell, Paul D., Lockheed Engineering and Sciences Co., USA; Lockheed Engineering and Sciences Co., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 187-194; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Evaluators of human task performance in space missions make use of video as a primary source of data. Extraction of relevant human performance information from video is often a labor-intensive process requiring a large amount of time on the part of the evaluator. Based on the experiences of several human performance evaluators, needs were defined for advanced tools which could aid in the analysis of video data from space missions. Such tools should increase the efficiency with which useful information is retrieved from large quantities of raw video. They should also provide the evaluator with new analytical functions which are not present in currently used methods. Video analysis tools based on the needs defined by this study would also have uses in U.S. industry and education. Evaluation of human performance from video data can be a valuable technique in many industrial and institutional settings where humans are involved in operational systems and processes.

Author

Video Data; Space Missions; Technology Utilization; Human Factors Engineering; Human Performance

19960022269; 96N25296 NASA Ames Research Center, Moffett Field,CA USA

There is No Free Lunch: Tradeoffs in the Utility of Learned Knowledge

Kedar, Smadar T., NASA Ames Research Center, USA; McKusick, Kathleen B., NASA Ames Research Center, USA; Jun. 1992, pp. 22; In English

Report No.(s): NASA-TM-111483; FIA-92-04; NAS 1.15:111483; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the recent introduction of learning in integrated systems, there is a need to measure the utility of learned knowledge for these more complex systems. A difficulty arrises when there are multiple, possibly conflicting, utility metrics to be measured. In this paper, we present schemes which trade off conflicting utility metrics in order to achieve some global performance objectives. In particular, we present a case study of a multi-strategy machine learning system, mutual theory refinement, which refines world models for an integrated reactive system, the Entropy Reduction Engine. We provide experimental results on the utility of learned knowledge in two conflicting metrics - improved accuracy and degraded efficiency. We then demonstrate two ways to trade off these metrics. In each, some learned knowledge is either approximated or dynamically 'forgotten' so as to improve efficiency while degrading accuracy only slightly.

Author

Complex Systems; Machine Learning; Artificial Intelligence; Knowledge Based Systems

19960022276; 96N25300 National Aeronautics and Space Administration. Ames Research Center, AI Research Branch., Moffett Field, CA USA

The Extrapolation of Elementary Sequences

Laird, Philip, National Aeronautics and Space Administration. Ames Research Center, USA; Saul, Ronald, RECOM Technologies, Inc., USA; Oct. 1992, pp. 32; In English

Report No.(s): NASA-TM-111488; FIA-92-31; NAS 1.15:111488; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We study sequence extrapolation as a stream-learning problem. Input examples are a stream of data elements of the same type (integers, strings, etc.), and the problem is to construct a hypothesis that both explains the observed sequence of examples and extrapolates the rest of the stream. A primary objective -- and one that distinguishes this work from previous extrapolation algorithms -- is that the same algorithm be able to extrapolate sequences over a variety of different types, including integers, strings, and trees. We define a generous family of constructive data types, and define as our learning bias a stream language called elementary stream descriptions. We then give an algorithm that extrapolates elementary descriptions over constructive datatypes and prove that it learns correctly. For freely-generated types, we prove a polynomial time bound on descriptions of bounded complexity. An especially interesting feature of this work is the ability to provide quantitative measures of confidence in competing hypotheses, using a Bayesian model of prediction.

Author

Extrapolation; Algorithms; Machine Learning; Sequencing; Consecutive Events

19960022380; 96N25389 Istituto Superiore di Sanita, Lab. di Ingegneria Biomedica., Rome, Italy

Spatial-Temporal Parameters of Gait

Giacomozzi, Claudia, Istituto Superiore di Sanita, Italy; Macellari, Velio, Istituto Superiore di Sanita, Italy; Saggini, Raoul, Universita degli studi G. D'Annunzio, Italy; 1995; ISSN 1123-3117, pp. 66; In English

Report No.(s): ISTISAN-95/36; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viale Regina Elena, 299-00161 Rome), Hardcopy, Microfiche

A pressure platform was used with 600 people to measure their gait. The data was used to determine the normal com-

bination of gait parameters (i.e., stride, velocity, swing phase, and gait cycle). This statistical analysis was accomplished with multiple linear regression models. The reported results constitute a data base of normal spatial and temporal gait parameters. This can be used in defining ranges regarding the gait of non-pathologic subjects to detect abnormalities of gait. Definitions of the parameters are included as an appendix.
CASI
Data Bases; Statistical Analysis; Walking; Temporal Distribution; Spatial Distribution

19960022772; 96N25667 NASA Ames Research Center, Moffett Field, CA USA
Using Fuzzy Logic for Performance Evaluation in Reinforcement Learning
Berenji, Hamid R., NASA Ames Research Center, USA; Khedkar, Pratap S., California Univ., USA; [1992], pp. 17; In English
Contract(s)/Grant(s): NCC2-275
Report No.(s): NASA-TM-111486; NAS 1.15:111486; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current reinforcement learning algorithms require long training periods which generally limit their applicability to small size problems. A new architecture is described which uses fuzzy rules to initialize its two neural networks: a neural network for performance evaluation and another for action selection. This architecture is applied to control of dynamic systems and it is demonstrated that it is possible to start with an approximate prior knowledge and learn to refine it through experiments using reinforcement learning.
Author
Fuzzy Systems; Neural Nets; Machine Learning; Evaluation

19960022787; 96N25680 Civil Aeromedical Inst., Oklahoma City,OK USA
Differential Prediction of FAA Academy Performance on the Basis of Gender and Written Air Traffic Control Specialist Aptitude Test Scores *Final Report*
Young, Willie C., Civil Aeromedical Inst., USA; Broach, Dana, Civil Aeromedical Inst., USA; Farmer, William L., Civil Aeromedical Inst., USA; Apr. 1996, pp. 24; In English
Report No.(s): DOT/FAA/AM-96/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The technical fairness of the written air traffic control specialist (ATCS) aptitude test battery was investigated within the framework of the Uniform Guidelines on Employee Selection Procedures (29 CFR 1607). First, the adverse impact of using a composite score on the test battery was evaluated on an archival sample of 170,578 job applicants. Mean score differences by gender of 0.35 SD in the favor of men were found, suggesting that adverse impact on women could be expected from use of test scores in selection. Analysis of selection rates by gender found that women were classified as eligible for employment consideration on the basis of composite test scores at a lower rate (38.5 percent) than men (50.4 percent). Step-down hierarchical regression analysis (Lautenschlager & Mendoza, 1986) was used to investigate differential prediction of performance in initial ATCS training at the Federal Aviation Administration Academy in a sample of 9,552 first-time competitive entrants. Analysis based on correlations corrected for explicit and implicit restriction in range found significant differences in slopes and intercepts by gender, suggesting that separate regression equations were appropriate to predict Academy performance for the genders. The practical significance of the statistically small effect sizes is considered within the framework of current equal employment opportunity legislation and case law in the discussion of these results. The alternative explanation that these results reflect gender differences in job-related abilities, rather than test bias, is considered.
Author
Personnel Selection; Air Traffic Control; Human Performance; Psychological Tests; Regression Analysis

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19960020970; 96N24475 National Taichung Teacher's Coll., Dept. of Mathematics and Science Education., Taichung, Taiwan, Province of China
Hydraulic characteristics and startup of anaerobic rotating biological contactors
Lin, Min-Ray, National Taichung Teacher's Coll., Taiwan, Province of China; Lu, Chungsying, National Chung Hsing Univ., Taiwan, Province of China; Yeh, An-Chin, National Chung Hsing Univ., Taiwan, Province of China; National Taichung Teacher's Coll., Journal of the Chinese Institute of Engineers, Volume 18, Number 6; Nov. 1995, pp. 801-812; In English; Also announced as 1996038025; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

In this study the hydraulic characteristics and the start-up of anaerobic rotating biological contactor (AnRBC) were investigated experimentally and theoretically. Results of tracer study showed that the AnRBC reactor is a well-mixed reactor in the first and second stages. Start-up of the AnRBC reactor was successfully carried out using high strength synthetic waste-waters at hydraulic retention time of 21.6 hours, organic surface loading of 111.4 g-COD/m(exp 2)(d), organic volumetric loading of 13.33 Kg-COD/m(exp 3)(d), disk rotational speed of 12 rpm and 100% disk submergence. In the steady-state operating condition, the removal efficiencies of soluble COD and BOD could be up to 71% and 76% for the inlet COD and BOD concentrations of 12,000 and 7,267

mg/L, respectively. The microscopic observations after start-up of the AnRBC reactor showed that the acetogenic bacteria are significant in the first two stages while the methanogenic bacteria predominate in the last two stages.
Author
Biochemical Oxygen Demand; Waste Water; Water Treatment; Pollution Control

19960021710; 96N24985 Armstrong Lab., Wright-Patterson AFB, OH USA
Effect of helmet inertial properties on head and neck response during (+)Gz impact accelerations
Perry, Chris E., Armstrong Lab., USA; Buhrman, John R., Armstrong Lab., USA; Armstrong Lab., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 88-91; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Currently, the USAF is seeking to expand the mission profiles of certain military aircraft equipped with ejection seats. This would include such mission areas as airborne strike, and close air support and interdiction. To improve the pilot's performance during these scenarios, the USA Air Force within the last 5 years has placed a strong emphasis on research to investigate the use of helmet-mounted visually coupled systems. These helmet mounted systems can include integrated helmet-mounted cueing systems, helmet-mounted night vision devices, and helmet-mounted aircraft display systems that may provide improved aircraft flight control, target acquisition, and weapon delivery. By using the helmet as a platform for these systems, the helmet's inertial properties (weight, center-of-gravity, and moment of inertia) may be modified. If these helmet-mounted systems (HMS) are in use during aircraft escape with ejection seats, the potential exists for the helmet's inertial properties to increase the rate of ejection related neck injuries by increasing the forces generated in the cervical spine. These systems could not only affect ejection related neck injuries, but may also inadvertently have a negative effect on the pilot's mission performance by increasing neck fatigue. This is because posterior neck muscles are used to balance the head. The HMS likewise may affect helmet comfort and helmet fit. Tasking was initiated to evaluate the effects of altered helmet inertial properties on the biodynamic response of the human neck during aircraft ejection. Concentration was on the neck response during the catapult phase or impact acceleration phase of the ejection sequence. The task objective was to define specifications or criteria for helmet inertial properties to allow safe ejection with HMS that will not induce neck injuries, such as neck fracture or severe soft tissue damage (muscle and ligament tears), to the ejectee.
Derived from text
Physiological Responses; Helmet Mounted Displays; Ejection Seats; Spine; Biodynamics; Impact Acceleration; Acceleration Stresses (Physiology); Gravitational Physiology; Aerospace Medicine; Inertia; Gravitational Effects

19960021711; 96N24986 Armstrong Lab., Wright-Patterson AFB, OH USA
Computer simulation of human body dynamics
Obergefell, Louise, Armstrong Lab., USA; Armstrong Lab., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 92-95; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Understanding human body dynamics is important in many situations, such as automobile and aircraft crashes, aircraft ejections, falls, and other acceleration environments. The design of automobile interiors, cockpits, and safety equipment requires knowledge of the forces and accelerations encountered during an emergency. Because of the limited information available from actual events and the various constraints in testing, computer simulations are often the only means of obtaining detailed information. The Armstrong Laboratory (AL) developed the Articulated Total Body (ATB) model to predict the human body dynamics in many of these environments. This model is a three-dimensional rigid body dynamics program in which the human body is modeled as a series of segments. Forces on the body segments are calculated based on their interaction with the surroundings including seat and cockpit surfaces. The model also calculates the internal joint resistive and constraint forces. Because of this capability to predict both internal and external forces acting on the body, the ATB model can be used in investigating injuries. It is also a valuable design tool for evaluating the safety of proposed systems before prototypes are built or costly tests conducted. When testing is conducted, the model provides data that cannot be measured, such as forces within the body, and supplements test data with parameter variation simulations. To validate the model, tests such as those conducted on the AL impact sled are simulated. Test films and instrumentation data are compared with simulation graphics and quantitative output to gain confidence in the simulation results.
Derived from text
Computerized Simulation; Human Body; Biodynamics; Impact Acceleration; Gravitational Physiology; Aerospace Medicine; Three Dimensional Models; Rigid Structures

19960021712; 96N24987 Armstrong Lab., Wright-Patterson AFB, OH USA
The effects of whole-body vibration on human biodynamic response
Smith, Suzanne D., Armstrong Lab., USA; Armstrong Lab., Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 96-99; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objective of vibration research at the Armstrong Laboratory includes the expansion and improvement of the measurement, quantification, analysis, and modeling of human vibration response. The driving-point impedance and transmissibility techniques have been expanded and are rigorously applied in the research efforts. Driving-point imped-

ance is defined as the ratio between the transmitted force and input velocity at the point of load application. Transmissibility is typically defined as the ratio between the acceleration level measured at some location on the body and the input acceleration at the seat. These two ratios are used to assess the magnitude and frequency location of resonance behaviors where maximum motions occur in the body. From these data, analytical models are developed which can simulate the motions and coupling behaviors, and predict the stiffness and damping characteristics of the affected anatomical structures. The ultimate goal of the research is to provide new and improved data and modeling capability for revising exposure standards and for developing equipment design guidelines and criteria for improving tolerance and reducing physiological consequences. This paper describes the results of recent studies conducted to identify the biodynamic behavior of major anatomical structures affected by seated whole-body vibration, to develop an analytical model for simulating human vibration response, and to apply the model to evaluate the effects of seat cushion materials on the transmission/attenuation pathways.
Derived from text
Biodynamics; Impedance; Human Body; Gravitational Physiology; Physiological Responses; Aerospace Medicine; Computerized Simulation; Vibration; Mathematical Models

19960021717; 96N24992 Max-Debrueck-Center for Molecular Medicine, Berlin, Germany
Comparison of voice stress reactivity under psychological stress test and simulated MIR docking manoeuvre
Johannes, B., Max-Debrueck-Center for Molecular Medicine, Germany; Salnitzki, V. P., Institute of Biomedical Problems, USSR; Haller, H., Max-Debrueck-Center for Molecular Medicine, Germany; Wilke, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Fischer, F., Max-Debrueck-Center for Molecular Medicine, Germany; Schlykova, L., Institute of Biomedical Problems, USSR; Max-Debrueck-Center for Molecular Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 107-108; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The relationship between laboratory tests results and results from the actual professional work is a very difficult one. The same is true for the relationship between training and real performance. The pilot controlled MIR-docking maneuver is in reality a very seldom but very important one. The training for this maneuver is very special professional work and only cosmonauts are available to do it. But the objective estimation of the performance and the used objective and subjective needs is nevertheless necessary. Even for the subjective 'stress'-feelings during task solving it is often impossible to get reliable data without any physiological measurements. The use of electrodes, cables and equipments is hardly limited during real work. Sometimes, only voice is available over more or less quality communication channels. That is the case during the training and the real-pilot controlled MIR-docking maneuver. Based on findings in the literature and through our own experiments analyzing the relationship between fundamental voice frequency (FO) and subjective stress feelings, we tested the hypothesis that an on-line measurement of FO can be used for stress evaluation during the standardized training sessions of MIR-docking maneuvers.
Derived from text
Cosmonauts; Sensory Feedback; Spacecraft Docking; Space Flight Stress; On-Line Systems; Voice Communication; Hypotheses; Spacecraft Maneuvers; Aerospace Medicine

19960021719; 96N24994 Research Inst. of Aviation and Space Medicine, Moscow, Russia
The medical foundations of standardization of impact accelerations and vibrations
Stupakov, G .P., Research Inst. of Aviation and Space Medicine, Russia; Research Inst. of Aviation and Space Medicine, Journal of Gravitational Physiology, Volume 2, No. 1; 1995, pp. 111-114; In English; Also announced as 1996008550; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This report is concerned with an assessment of the current technology used in determining the permissible levels of impact accelerations and vibrations, a part of space flight stress, and the medical foundations that show that a standardization of these levels is necessary and accomplishable.
CASI
Standardization; Impact Acceleration; Vibration Perception; Human Tolerances; Gravitational Physiology; Aerospace Medicine

19960021759; 96N25034 Lockheed Engineering and Sciences Co., Houston, TX USA
Human Factors Engineering: Current and Emerging Dual-Use Applications
Chandlee, G. O., Lockheed Engineering and Sciences Co., USA; Goldsberry, B. S., Lockheed Engineering and Sciences Co., USA; Lockheed Engineering and Sciences Co., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 167-173; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Human Factors Engineering is a multidisciplinary endeavor in which information pertaining to human characteristics is used in the development of systems and machines. Six representatives considered to be experts from the public and private sectors were surveyed in an effort to identify the potential dual-use of human factors technology. Each individual was asked to provide a rating as to the dual-use of 85 identified NASA technologies. Results of the survey were as follows: nearly 75 percent of the technologies were identified at least once as high dual-use by one of the six survey respondents, and nearly 25 percent of the identified NASA technolo-

gies were identified as high dual-use technologies by a majority of the respondents. The perceived level of dual-use appeared to be independent of the technology category. Successful identification of dual-use technology requires expanded input from industry. As an adjunct, cost-benefit analysis should be conducted to identify the feasibility of the dual-use technology. Concurrent with this effort should be an examination of precedents established by other technologies in other industrial settings. Advances in human factors and systems engineering are critical to reduce risk in any workplace and to enhance industrial competitiveness.
Author
Human Factors Engineering; Technology Utilization; Technology Transfer; Ratings

19960021760; 96N25035 Lockheed Engineering and Sciences Co., Houston, TX USA
Research on Personal Protective Equipment for Dual-Use Technology and Technology Transfer
Driggers, Donald C., Lockheed Engineering and Sciences Co., USA; Lockheed Engineering and Sciences Co., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 174-185; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The National Aeronautics and Space Administration (NASA) places highest priority on the safety of its astronauts and support personnel. Because this is so, and to ensure the continuation of this safety, the agency has undertaken to thoroughly research and develop and provide personal protective equipment (PPE) and individual life support systems (LSS) in support of manned spaceflight. It is probable that technology developed for manned spaceflight in the field of PPE and individual LSS can be utilized in certain industrial/commercial endeavors. In an attempt to determine these other uses for this PPE and individual LSS, the Space Suit Systems Branch of the NASA JSC Crew Systems Division initiated a research project designed to access potential common technology that could benefit industry. Such dual-use technology transfer could eventually involve a joint effort by Government and industry. The research project took place over several months and involved discussions with various manufacturers/suppliers/users, as well as regulatory agencies and industries, of PPE and individual LSS. Research data was compiled and evaluated and a summary of significant findings is presented for identifying and establishing opportunities for future cooperation between Government and industry in the field of PPE and individual LSS.
Author
Life Support Systems; Manned Space Flight; Aerospace Safety; Accident Prevention; Technology Utilization; Technology Transfer; Human Factors Engineering

19960021762; 96N25037 Lockheed Martin Engineering and Sciences Co., Houston, TX USA
Use of Video Analysis System for Working Posture Evaluations
McKay, Timothy D., Lockheed Martin Engineering and Sciences Co., USA; Whitmore, Mihriban, Lockheed Martin Engineering and Sciences Co., USA; Lockheed Martin Engineering and Sciences Co., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 195-202; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In a work environment, it is important to identify and quantify the relationship among work activities, working posture, and workplace design. Working posture may impact the physical comfort and well-being of individuals, as well as performance. The Posture Video Analysis Tool (PVAT) is an interactive menu and button driven software prototype written in Supercard (trademark). Human Factors analysts are provided with a predefined set of options typically associated with postural assessments and human performance issues. Once options have been selected, the program is used to evaluate working posture and dynamic tasks from video footage. PVAT has been used to evaluate postures from Orbiter missions, as well as from experimental testing of prototype glove box designs. PVAT can be used for video analysis in a number of industries, with little or no modification. It can contribute to various aspects of workplace design such as training, task allocations, procedural analyses, and hardware usability evaluations. The major advantage of the video analysis approach is the ability to gather data, non-intrusively, in restricted-access environments, such as emergency and operation rooms, contaminated areas, and control rooms. Video analysis also provides the opportunity to conduct preliminary evaluations of existing work areas.
Author
Posture; Human Factors Engineering; Human Performance; Video Data; Applications Programs (Computers); Workloads (Psychophysiology); Technology Utilization

19960021764; 96N25039 NASA Johnson Space Center, Houston, TX USA
NASA's Man-Systems Integration Standards: A Human Factors Engineering Standard for Everyone in the Nineties
Booher, Cletis R., NASA Johnson Space Center, USA; Goldsberry, Betty S., Lockheed Engineering and Sciences Co., USA; Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 211-220; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

During the second half of the 1980s, a document was created by the National Aeronautics and Space Administration (NASA) to aid in the application of good human factors engineering and human interface practices to the design and

development of hardware and systems for use in all USA manned space flight programs. This comprehensive document, known as NASA-STD-3000, the Man-Systems Integration Standards (MSIS), attempts to address, from a human factors engineering/human interface standpoint, all of the various types of equipment with which manned space flight crew members must deal. Basically, all of the human interface situations addressed in the MSIS are present in terrestrially based systems also. The premise of this paper is that, starting with this already created standard, comprehensive documents addressing human factors engineering and human interface concerns could be developed to aid in the design of almost any type of equipment or system which humans interface with in any terrestrial environment. Utilizing the systems and processes currently in place in the MSIS Development Facility at the Johnson Space Center in Houston, TX, any number of MSIS volumes addressing the human factors / human interface needs of any terrestrially based (or, for that matter, airborne) system could be created.
Author
Man Machine Systems; Human Factors Engineering; Procedures

19960021765; 96N25040 NASA Johnson Space Center, Houston, TX USA
Kinetic Study of Methyl Acetate Oxidation in a Pt/Al2O3 Fixed-Bed Reactor
Hoy, Michael, NASA Johnson Space Center, USA; Li, K. Y., Lamar Univ., USA; Li, Jeffrey S., Lamar Univ., USA; Chen, S. M., Lamar Univ., USA; Yaws, C. L., Lamar Univ., USA; Chu, H. W., Lamar Univ., USA; Simon, W. E., Lamar Univ., USA; Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 226-235; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

To support technology development for future long-term missions, a metabolic simulator will be used in a closed chamber to test the functions of a Controlled Ecological Life Support System (CELSS). Methyl acetate (MA) was selected as the fuel because its metabolic respiratory quotient is near that of humans. A kinetic study of the catalytic oxidation of MA over Pt/Al203 was then conducted to support the design and operation of the simulator. Kinetic data were obtained as a conversion percentage of MA versus retention time. The reaction was studied at one atmosphere and temperatures from 220 to 340 deg. C. The inlet MA concentration was varied from 100 to 2000 ppm with retention times from 0.01 to 10 sec. A first-order rate law and a Langmuir-Hinshelwood rate equation were tested by nonlinear regression of the kinetic data to estimate rate constants in the rate law. Regression results of the L-H equation explain the kinetic data better than the results of the first-order rate law. A Taguchi experimental design was used to study the effects of temperature, retention time, and concentrations of MA, CO2, and O2 on the conversion of MA. Results indicate that temperature has greatest effect, followed by retention time, and finally MA concentration. It was further determined that the effects of CO2 and O2 concentrations, and the cross effects, are negligible.
Author
Closed Ecological Systems; Simulators; Metabolism; Ecosystems; Life Support Systems; Reaction Kinetics

19960021766; 96N25041 Rockwell International Corp., Houston, TX USA
Solid State oxygen Sensor Development
Cheung, Jeffery T., Rockwell International Corp., USA; Johnson, Scott R., Rockwell International Corp., USA; Rockwell International Corp., Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 236-241; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

To anticipate future long-duration mission needs for life support sensors, we explored the feasibility of using thin-film metal-oxide semiconductors. The objective of this task was to develop gas sensors for life support applications which would be suitable for long-duration missions. Metal oxides, such as ZnO, SnO2, and TiO2 have been shown to react with oxygen molecules. Oxygen lowers the metal oxide's electrical resistance. Critical to the performance is the application of the oxide in a thin film on an inert substrate: the thinner the film, the more readily the oxygen penetration and hence the more rapid and sensitive the sensor. Metal oxides are not limited to oxygen detection, rather, oxides offer detection and quantification applications to the complete range of gases of interest, not only for life support systems, but for propellants as well.
Author
Solid State; Oxygen; Life Support Systems; Metal Oxide Semiconductors

19960021768; 96N25043 NASA Johnson Space Center, Houston, TX USA
Development of Shelf Stable Tortillas for Space Missions
Bourland, Charles T., NASA Johnson Space Center, USA; Kloeris, Vickie L., NASA Johnson Space Center, USA; Fohey, Michael F., Lockheed Engineering and Sciences Co., USA; Glaus-Late, Kimberly D., Lockheed Engineering and Sciences Co., USA; Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 263-269; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Flour tortillas are a favorite bread item for the Shuttle astronauts and have been used on most Shuttle missions since 1985. Spoilage problems were encountered with commercial tortillas on missions longer than 7 days. A shelf stable tortilla with a shelf life of 6 months was developed by modifying the formulation to reduce the water activity (a(sub w)) below 0.90 and packaging them in a reduced oxygen atmosphere. The water activity was reduced by substituting glycerin for some

of the water in the basic tortilla formula. Reduction of the oxygen content was accomplished by packaging in a high-barrier container with a nitrogen atmosphere and including an oxygen scavenger in the package. Additional chemicals were added to the formula to lower the pH and further inhibit mold growth. The shelf life was verified by storage studies at 22 deg. C. The shelf stable tortillas have been well accepted by astronauts and have been used on eight Shuttle missions with durations beyond 7 days.
Author
Space Shuttle Missions; Packaging; Storage Stability

19960021769; 96N25044 NASA Ames Research Center, Moffett Field, CA USA
Large-Scale Numerical Simulations of Human Motion
Anderson, Frank C., Texas Univ., USA; Ziegler, James M., Texas Univ., USA; Pandy, Marcus G., Texas Univ., USA; Whalen, Robert T., NASA Ames Research Center, USA; NASA Ames Research Center, Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 270-282; In English; Also announced as 1996044133
Contract(s)/Grant(s): NAG5-2217; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper examines the feasibility of using massively-parallel and vector-processing supercomputers to solve large-scale optimal control problems for human movement. Specifically, we compare the computational expense of determining the optimal controls for the single support phase of walking using a conventional serial machine (a Silicon Graphics Personal Iris 4D25 workstation), a MIMD parallel machine (an Intel iPSC/860 comprising 128 processors), and a parallel-vector-processing machine (a Cray Y-MP 8/864). With the human body modeled as a 14 degree-of-freedom linkage actuated by 46 musculotendinous units, computation of the optimal controls for walking could take up to 3 months of CPU time on the Iris. Both the Cray Y-MP and the Intel iPSC/860 are able to reduce this time to practical levels. The optimal control solution for walking can be found with about 77 hours of CPU time on the Cray, and with about 88 hours of CPU time on the Intel. Although the overall speeds of the Cray and the Intel were found to be similar, the unique capabilities of each machine are best suited to different parts of the optimal control algorithm used. The Intel performed best in the calculation of the derivatives of the performance criterion and the constraints. In contrast, the Cray performed best during parameter optimization of the controls. These results suggest that the ideal computer architecture for solving very large-scale optimal control problems is a hybrid system in which a vector-processing machine is integrated into the communication network of a MIMD parallel machine.
Author
Cray Computers; MIMD (Computers); Human Body; Degrees Of Freedom; Digital Simulation; Walking

19960021770; 96N25045 NASA Johnson Space Center, Houston, TX USA
Advanced Life Support Systems: Opportunities for Technology Transfer
Fields, B., Lockheed Engineering and Sciences Co., USA; Henninger, D., NASA Johnson Space Center, USA; Ming, D., NASA Johnson Space Center, USA; Verostko, C. E., NASA Johnson Space Center, USA; Dual-Use Space Technology Transfer Conference and Exhibition; May 1994, pp. 283-294; In English; Also announced as 1996044133; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

NASA's future missions to explore the solar system will be of long-duration possibly lasting years at a time. Human life support systems will have to operate with very high reliability for these long periods with essentially no resupply from Earth. Such life support systems will make extensive use of higher plants, microorganisms, and physicochemical processes for recycling air and water, processing wastes, and producing food. Development of regenerative life support systems will be a pivotal capability for NASA's future human missions. A fully functional closed loop human life support system currently does not exist and thus represents a major technical challenge for space exploration. Technologies where all life support consumables are recycled have many potential terrestrial applications as well. Potential applications include providing human habitation in hostile environments such as the polar regions or the desert in such a way as to minimize energy expenditures and to minimize negative impacts on those often ecologically-sensitive areas. Other potential applications include production of food and ornamental crops without damaging the environment from fertilizers that contaminate water supplies; removal of trace gas contaminants from tightly sealed, energy-efficient buildings (the so-called sick building syndrome); and even the potential of gaining insight into the dynamics of the Earth's biosphere such that we can better manage our global environment. Two specific advanced life support technologies being developed by NASA, with potential terrestrial application, are the zeoponic plant growth system and the Hybrid Regenerative Water Recovery System (HRWRS). The potential applications for these candidate dual use technologies are quite different as are the mechanisms for transfer. In the case of zeoponics, a variety of commercial applications has been suggested which represent potentially lucrative markets. Also, the patented nature of this product offers opportunities for licensing to commercial entities. In the case of the HRWRS, commercial markets with broad applications have not been identified but some terrestrial applications are being explored where this approach has advantages over other methods of waste water processing. Although these potential applications do not appear to have the same broad attraction from the standpoint of rapid commercialization, they represent niches

where commercialization possibilities as well as social benefits could be realized.
Author
Life Support Systems; Technology Transfer; Water Reclamation; Consumables (Spacecraft)

19960022096; 96N25142 Army Research Lab., Aberdeen Proving Ground, MD USA
The Effects of Sustained Operations on Female Soldier Performance ***Annual Report***
Treadwell, Teresa A., Principal Investigator, Army Research Lab., USA; Sep. 1995, pp. 46; In English
Contract(s)/Grant(s): MIPR-95MM5591
Report No.(s): AD-A301044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This annual report for the Defense Women's Health Research Program presents the project status on the sustained operations study comparing female and male soldier performance. An overview of previous sustained operations research and a description of the study's research methodology and measures are given. Soldiers with combat support MOSs will undergo 48 hours of sustained operations in a field environment. During the study period, soldiers will complete cognitive, psychological, and physiological testing along with soldier-relevant performance modules involving record fire, road marches, common task testing, and a computer work environment. Sustained operations research has typically focused on male soldiers with combat arms MOSs. This study augments the present sustained operations database by thoroughly evaluating the performance of female and male combat support soldiers.
DTIC
Females; Psychological Tests; Circadian Rhythms; Sleep Deprivation; Performance

19960022260; 96N25290 Cincinnati Univ., Dept. of Aerospace Engineering., OH USA
Techniques for Improving the Performance of Future EVA Maneuvering Systems ***Final Report, Jul. - Dec. 1995***
Williams, Trevor W., Cincinnati Univ., USA; [Dec. 1995], pp. 48; In English
Contract(s)/Grant(s): NAG9-799
Report No.(s): NASA-CR-200882; NAS 1.26:200882; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Simplified Aid for EVA Rescue (SAFER) is a small propulsive backpack that was developed as an in-house effort at Johnson Space Center; it is a lightweight system which attaches to the underside of the Primary Life Support Subsystem (PLSS) backpack of the Extravehicular Mobility Unit (EMU). SAFER provides full six-axis control, as well as Automatic Attitude Hold (AAH), by means of a set of cold-gas nitrogen thrusters and a rate sensor-based control system. For compactness, a single hand controller is used, together with mode switching, to command all six axes. SAFER was successfully test-flown on the STS-64 mission in September 1994 as a Development Test Objective (DTO); development of an operational version is now proceeding. This version will be available for EVA self-rescue on the International Space Station and Mir, starting with the STS-86/Mir-7 mission in September 1997. The DTO SAFER was heavily instrumented, and produced in-flight data that was stored in a 12 MB computer memory on-board. This has allowed post-flight analysis to yield good estimates for the actual mass properties (moments and products of inertia and center of mass location) encountered on-orbit. By contrast, Manned Maneuvering Unit (MMU) post-flight results were generated mainly from analysis of video images, and so were not very accurate. The main goal of the research reported here was to use the detailed SAFER on-orbit mass properties data to optimize the design of future EVA maneuvering systems, with the aim being to improve flying qualities and/or reduce propellant consumption. The Automation, Robotics and Simulation Division Virtual Reality (VR) Laboratory proved to be a valuable research tool for such studies. A second objective of the grant was to generate an accurate dynamics model in support of the reflight of the DTO SAFER on STS-76/Mir-3. One complicating factor was the fact that a hand controller stowage box was added to the underside of SAFER on this flight; the position of this box was such that two of the SAFER jets plume it. A second complication was that the EVA astronaut will sometimes be transporting a massive experiment package. This will not only alter the overall mass properties significantly, but can itself also be plumed.
Author
Extravehicular Activity; Extravehicular Mobility Units; Moments Of Inertia; Propellant Consumption; Design Analysis; Plumes

19960022616; 96N25560 NASA Johnson Space Center, Automation and Robotics Div., Houston, TX USA
Object recognition and pose estimation of planar objects from range data
Pendleton, Thomas W., NASA Johnson Space Center, USA; Chien, Chiun Hong, Lockheed Engineering and Sciences Co., USA; Littlefield, Mark L., Lockheed Engineering and Sciences Co., USA; Magee, Michael, Wyoming Univ., USA; Dual-Use Space Technology Transfer Conference and Exhibition, Volume 2; May 1994, pp. 427-434; In English; Also announced as 1996043894; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Extravehicular Activity Helper/Retriever (EVAHR) is a robotic device currently under development at the NASA Johnson Space Center that is designed to fetch objects or to assist in retrieving an astronaut who may have become inadvertently de-tethered. The EVAHR will be required to exhibit a high degree of intelligent autonomous operation and will base much of its reasoning upon information obtained from one or more three-dimensional sensors that it will carry and control.

At the highest level of visual cognition and reasoning, the EVAHR will be required to detect objects, recognize them, and estimate their spatial orientation and location. The recognition phase and estimation of spatial pose will depend on the ability of the vision system to reliably extract geometric features of the objects such as whether the surface topologies observed are planar or curved and the spatial relationships between the component surfaces. In order to achieve these tasks, three-dimensional sensing of the operational environment and objects in the environment will therefore be essential. One of the sensors being considered to provide image data for object recognition and pose estimation is a phase-shift laser scanner. The characteristics of the data provided by this scanner have been studied and algorithms have been developed for segmenting range images into planar surfaces, extracting basic features such as surface area, and recognizing the object based on the characteristics of extracted features. Also, an approach has been developed for estimating the spatial orientation and location of the recognized object based on orientations of extracted planes and their intersection points. This paper presents some of the algorithms that have been developed for the purpose of recognizing and estimating the pose of objects as viewed by the laser scanner, and characterizes the desirability and utility of these algorithms within the context of the scanner itself, considering data quality and noise.

Author

Pattern Recognition; Position (Location); Optical Scanners; Laser Applications; Robot Sensors; Telerobotics

19960022629; 96N25573 NASA Johnson Space Center, Houston,TX USA

A new machine classification method applied to human peripheral blood leukocytes

Rorvig, Mark E., NASA Johnson Space Center, USA; Fitzpatrick, Steven J., Texas Univ., USA; Vitthal, Sanjay, Halliburton Services, USA; Ladoulis, Charles T., Mercy General Catholic Hospital, USA; Dual-Use Space Technology Transfer Conference and Exhibition, Volume 2; May 1994; ISSN 0306-4573, pp. 535-545; Repr. from Information Processing and Management, v. 29, no. 6, 1993 p 765-774; In English; Also announced as 1996043894; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Human beings judge images by complex mental processes, whereas computing machines extract features. By reducing scaled human judgments and machine extracted features to a common metric space and fitting them by regression, the judgments of human experts rendered on a sample of images may be imposed on an image population to provide automatic classification.

Author

Leukocytes; Computer Vision; Pattern Recognition; Medical Electronics

19960022778; 96N25671 Lockheed Idaho Technologies Co., Idaho Falls, ID USA

Human performance analysis of industrial radiography radiation exposure events

Reece, Wendy J., Lockheed Idaho Technologies Co., USA; Hill, Susan G., Lockheed Idaho Technologies Co., USA; 1995, pp. 9; In English; Human Factors and Ergonomics Society Meeting, 9 - 13 Oct. 1995, San Diego, CA, USA

Contract(s)/Grant(s): AC07-94ID13223

Report No.(s): INEL-95/00355; CONF-951092-4; DE96-002534; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A set of radiation overexposure event reports were reviewed as part of a program to examine human performance in industrial radiography for the US Nuclear Regulatory Commission. Incident records for a seven year period were retrieved from an event database. Ninety-five exposure events were initially categorized and sorted for further analysis. Descriptive models were applied to a subset of severe overexposure events. Modeling included: (1) operational sequence tables to outline the key human actions and interactions with equipment, (2) human reliability event trees, (3) an application of an information processing failures model, and (4) an extrapolated use of the error influences and effects diagram. Results of the modeling analyses provided insights into the industrial radiography task and suggested areas for further action and study to decrease overexposures.

DOE

Human Performance; Industrial Plants; Failure Analysis; Accident Prevention; Radiography; Radiation Dosage

Subject Term Index

A

ACCELERATION (PHYSICS), 2, 3, 21, 22
ACCELERATION STRESSES (PHYSIOLOGY), 3, 28
ACCELERATION TOLERANCE, 17, 21
ACCIDENT PREVENTION, 30, 34
ACTIVATION (BIOLOGY), 22
ACTIVE CONTROL, 7
ACTIVITY CYCLES (BIOLOGY), 3
ADAPTATION, 2, 6, 13, 14, 15, 17, 18, 20, 25
ADRENAL GLAND, 19
ADRENERGICS, 19
AEROSPACE ENVIRONMENTS, 5, 7, 16, 26
AEROSPACE MEDICINE, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 28, 29
AEROSPACE SAFETY, 30
AGGREGATES, 22
AIR TRAFFIC CONTROL, 25, 27
ALDOSTERONE, 17
ALGORITHMS, 12, 26
ANIMALS, 1
ANTIBIOTICS, 10
ANTIOXIDANTS, 4
ANTISEPTICS, 11
APPLICATIONS PROGRAMS (COMPUTERS), 30
ARTIFICIAL INTELLIGENCE, 26
ASSESSMENTS, 7, 26

B

BACTERIA, 10
BACTERIOLOGY, 10
BALANCE, 2, 16
BED REST, 1, 14, 16, 18, 19, 20, 23
BETA PARTICLES, 19
BIOCHEMICAL OXYGEN DEMAND, 28
BIOCONTROL SYSTEMS, 3
BIODYNAMICS, 28, 29
BIOELECTRIC POTENTIAL, 12
BIOELECTRICITY, 12, 25
BIOLOGICAL EFFECTS, 10, 12
BIOLOGICAL EVOLUTION, 11
BIOMETRICS, 20
BIOPROCESSING, 10
BIOSYNTHESIS, 9
BLOOD CIRCULATION, 2, 13, 14, 15, 22, 23
BLOOD PLASMA, 6, 19
BLOOD PRESSURE, 15
BLOOD VOLUME, 16, 23
BODY FLUIDS, 2, 16, 22
BONE MINERAL CONTENT, 5
BONES, 21
BRAIN, 24
BRAIN CIRCULATION, 23

C

CALCIUM, 7, 9
CAPILLARIES (ANATOMY), 23
CAPILLARY FLOW, 23
CARBON DIOXIDE, 9
CARBON DIOXIDE CONCENTRATION, 6
CARDIOVASCULAR SYSTEM, 1, 2, 5, 13, 14, 15, 16, 17, 19, 23
CELL MEMBRANES (BIOLOGY), 12
CELLS (BIOLOGY), 2, 7, 10, 13, 25
CENTER OF MASS, 22
CEREBELLUM, 4
CEREBRAL CORTEX, 25
CHEMICAL COMPOSITION, 10
CHEMICAL FRACTIONATION, 10
CHEMORECEPTORS, 19
CHLORELLA, 10
CHLOROPLASTS, 10
CHROMOSOMES, 11
CIRCADIAN RHYTHMS, 3, 6, 18, 33
CIRCULATORY SYSTEM, 17
CLOSED ECOLOGICAL SYSTEMS, 9, 31
COLONIES, 10
COMPATIBILITY, 7
COMPLEX SYSTEMS, 26
COMPRESSION WAVES, 21
COMPUTER AIDED MAPPING, 25
COMPUTER VISION, 34
COMPUTERIZED SIMULATION, 28, 29
CONCENTRATION (COMPOSITION), 8
CONFERENCES, 1
CONSECUTIVE EVENTS, 26
CONSUMABLES (SPACECRAFT), 33
CONTROL THEORY, 26
CORTICOSTEROIDS, 6
COSMONAUTS, 13, 25, 29
COUNTERMEASURES, 13, 18
CRAY COMPUTERS, 32
CRYOGENIC COOLING, 7
CRYOGENIC TEMPERATURE, 7
CUES, 3
CUFFS, 13
CYCLES, 20
CYTOLOGY, 5, 7

D

DATA BASES, 27
DATA TRANSMISSION, 11
DECISION MAKING, 24
DECONDITIONING, 5, 15
DEGREES OF FREEDOM, 32
DENSITY (NUMBER/VOLUME), 7
DENSITY DISTRIBUTION, 6, 7
DEOXYRIBONUCLEIC ACID, 11, 12
DESIGN ANALYSIS, 33
DESTRUCTION, 21
DIFFUSION, 23
DIGITAL SIMULATION, 32
DISTANCE MEASURING EQUIPMENT, 23
DYNAMIC STRUCTURAL ANALYSIS, 10

E

EARTH GRAVITATION, 13
ECOSYSTEMS, 31
EGGS, 11
EJECTION SEATS, 21, 28
ELECTRICAL IMPEDANCE, 19
ELECTRICAL MEASUREMENT, 19
ELECTRICAL PROPERTIES, 20
ELECTROLYTES, 2, 16
ELECTRON MICROSCOPY, 10
ELECTROPHYSIOLOGY, 12
EMBRYOS, 11
ENDOCRINOLOGY, 1
ENERGY CONVERSION EFFICIENCY, 20
ENVIRONMENT EFFECTS, 5, 7, 8, 12
ENVIRONMENT SIMULATION, 16
ENVIRONMENT SIMULATORS, 7
ENVIRONMENTAL CONTROL, 7
ENZYME ACTIVITY, 4

ENZYMES, 5, 10
ESCHERICHIA, 10
ETHYLENE, 8, 9
EVALUATION, 21, 27
EVOLUTION (DEVELOPMENT), 13
EXCRETION, 16
EXERCISE PHYSIOLOGY, 4, 20
EXTRAPOLATION, 26
EXTRAVEHICULAR ACTIVITY, 33
EXTRAVEHICULAR MOBILITY UNITS, 33
EYE MOVEMENTS, 25

F

FAILURE ANALYSIS, 34
FARM CROPS, 12
FEASIBILITY, 24
FEMALES, 33
FIBERS, 17
FLIGHT SIMULATION, 3, 6
FOOD PROCESSING, 11
FOREHEAD, 14
FUNCTIONAL ANALYSIS, 21
FUZZY SYSTEMS, 27

G

GAS ANALYSIS, 9
GAS EVOLUTION, 9
GENE EXPRESSION, 11
GENES, 11, 12
GENETIC CODE, 25
GENETICS, 12, 25
GRADIENTS, 18
GRASSES, 9, 10
GRAVITATIONAL EFFECTS, 3, 4, 6, 7, 8, 9, 10, 11, 13, 18, 20, 21, 22, 28
GRAVITATIONAL PHYSIOLOGY, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 28, 29

H

HABITATS, 7
HEAD DOWN TILT, 2, 4, 5, 14, 16, 20, 23
HEART RATE, 14
HELMET MOUNTED DISPLAYS, 28
HEMODYNAMIC RESPONSES, 14, 15, 17, 18
HOMEOSTASIS, 2, 5
HORMONES, 16
HUMAN BEINGS, 25
HUMAN BODY, 22, 23, 28, 29, 32
HUMAN FACTORS ENGINEERING, 25, 26, 30, 31
HUMAN FACTORS LABORATORIES, 24
HUMAN PERFORMANCE, 22, 25, 26, 27, 30, 34
HUMAN REACTIONS, 22
HUMAN TOLERANCES, 1, 15, 21, 29
HUMAN-COMPUTER INTERFACE, 24
HYPOTHERMIA, 7
HYPOTHESES, 29

I

IMMOBILIZATION, 20
IMMUNITY, 10
IMMUNOLOGY, 22
IMPACT ACCELERATION, 21, 28, 29
IMPACT LOADS, 21
IMPEDANCE, 29
INDUSTRIAL PLANTS, 34
INERTIA, 28
INHIBITORS, 8
INTRACRANIAL PRESSURE, 23
ISOLATION, 16

K

KNOWLEDGE BASED SYSTEMS, 26

L

LASER APPLICATIONS, 34
LEG (ANATOMY), 15
LEGUMINOUS PLANTS, 8, 9, 10
LESIONS, 21
LEUKOCYTES, 6, 34
LIFE SCIENCES, 1
LIFE SUPPORT SYSTEMS, 30, 31, 33
LOCOMOTION, 22
LOWER BODY NEGATIVE PRESSURE, 14, 15, 17, 23
LUNGS, 6
LYMPHOCYTES, 22

M

MACHINE LEARNING, 26, 27
MAMMALS, 18
MAN MACHINE SYSTEMS, 31
MANNED SPACE FLIGHT, 30
MASS SPECTROSCOPY, 19
MATHEMATICAL MODELS, 29
MECHANICAL PROPERTIES, 21
MEDICAL ELECTRONICS, 34
MEDICAL PERSONNEL, 24
METABOLISM, 31
METAL OXIDE SEMICONDUCTORS, 31
MICE, 7
MICROGRAVITY, 1, 2, 4, 5, 8, 9, 10, 11, 13, 16, 17, 19, 20, 21, 22, 23
MICROSTRUCTURE, 17
MICROWAVE TRANSMISSION, 11
MIMD (COMPUTERS), 32
MOLECULAR BIOLOGY, 25
MOLECULAR DYNAMICS, 25
MOLECULAR STRUCTURE, 25
MOMENTS OF INERTIA, 33
MONKEYS, 3, 6
MORPHOLOGY, 8
MULTIVARIATE STATISTICAL ANALYSIS, 17
MUSCLES, 3, 13, 15, 17, 20
MUSCULAR FUNCTION, 2, 3, 13, 17, 18, 20
MUSCULAR TONUS, 17
MUSCULOSKELETAL SYSTEM, 1, 2, 5, 18, 20
MYOCARDIUM, 12

N

NEURAL NETS, 24, 27
NEUROMUSCULAR TRANSMISSION, 20
NEURONS, 25
NEUROPHYSIOLOGY, 3, 25
NONINTRUSIVE MEASUREMENT, 11

O

ON-LINE SYSTEMS, 29
OPHTHALMOLOGY, 25
OPTICAL SCANNERS, 34
ORGANELLES, 10
ORTHOSTATIC TOLERANCE, 2, 14, 15, 23
OTOLITH ORGANS, 21, 22
OXIDATION, 4
OXYGEN, 31

P

PACKAGING, 32
PATTERN RECOGNITION, 12, 34
PEPTIDES, 17
PERFORMANCE, 33
PERSONNEL SELECTION, 27

PHYSICAL EXERCISE, 4, 15, 18
PHYSIOLOGICAL ACCELERATION, 22
PHYSIOLOGICAL EFFECTS, 2, 4, 7, 10, 16
PHYSIOLOGICAL RESPONSES, 1, 3, 5, 6, 8, 13, 15, 16, 19, 22, 28, 29
PHYSIOLOGICAL TESTS, 3, 4, 5, 13, 14, 17, 18, 19, 20, 22, 25
PHYTOTRONS, 9, 10
PIEZOELECTRIC CERAMICS, 21
PIEZOELECTRICITY, 21
PLANT ROOTS, 9
PLANTS (BOTANY), 8, 9, 11
PLUMES, 33
POLLUTION CONTROL, 28
POPULATIONS, 7
POSITION (LOCATION), 34
POSITIVE IONS, 7, 9
POSTURE, 23, 30
PRESSURE GRADIENTS, 6
PROCEDURES, 31
PROPELLANT CONSUMPTION, 33
PROPRIOCEPTION, 4
PROTEIN SYNTHESIS, 12
PSYCHOLOGICAL TESTS, 27, 33

R

RADARSCOPES, 25
RADIATION DOSAGE, 34
RADIOGRAPHY, 34
RANDOM ACCESS, 19
RATINGS, 30
REACTION KINETICS, 31
REGRESSION ANALYSIS, 27
REGULATIONS, 25
REGULATORY MECHANISMS (BIOLOGY), 3, 5, 6, 15, 16, 17, 23
RENAL FUNCTION, 2, 16
REPRODUCTION (BIOLOGY), 11
RESEARCH AND DEVELOPMENT, 6, 25
RESPIRATORY PHYSIOLOGY, 1, 6
RIGID STRUCTURES, 28
ROBOT SENSORS, 34
RODENTS, 7
ROTATING ENVIRONMENTS, 8, 9, 10
RUSSIAN SPACE PROGRAM, 14

S

SECRETIONS, 17
SEEDS, 8
SENSORIMOTOR PERFORMANCE, 25
SENSORY FEEDBACK, 29
SEQUENCING, 26
SIGNAL DETECTION, 24
SIGNAL PROCESSING, 24
SIMULATORS, 31
SKIN (ANATOMY), 14
SLEEP, 3, 18
SLEEP DEPRIVATION, 33
SODIUM, 12
SOLID STATE, 31
SOUND WAVES, 21
SOYBEANS, 8
SPACE ADAPTATION SYNDROME, 4
SPACE FLIGHT STRESS, 3, 4, 5, 6, 8, 9, 13, 15, 17, 21, 25, 29
SPACE MISSIONS, 26
SPACE SHUTTLE MISSIONS, 32
SPACEBORNE EXPERIMENTS, 7, 8, 9
SPACECRAFT DOCKING, 29
SPACECRAFT MANEUVERS, 29
SPACECREWS, 16
SPACELAB, 11
SPATIAL DISTRIBUTION, 27
SPINE, 21, 28
STANDARDIZATION, 29
STATISTICAL ANALYSIS, 27
STERILIZATION, 11
STORAGE STABILITY, 32
STRESS (BIOLOGY), 12
STRESS (PHYSIOLOGY), 14, 16
STRUCTURAL ANALYSIS, 10, 21, 25
SUSPENDING (HANGING), 5
SYMPATHETIC NERVOUS SYSTEM, 19

T

TACHYCARDIA, 24
TECHNOLOGICAL FORECASTING, 18
TECHNOLOGY ASSESSMENT, 18, 22
TECHNOLOGY TRANSFER, 30, 33
TECHNOLOGY UTILIZATION, 26, 30
TELEROBOTICS, 34
TEMPERATURE CONTROL, 7
TEMPORAL DISTRIBUTION, 27
THERMAL SHOCK, 12
THIGH, 13
THREE DIMENSIONAL MODELS, 28
TIME MEASUREMENT, 11
TRANSPORT PROPERTIES, 10
TWO PHASE FLOW, 11

U

ULTRASONICS, 23
UNLOADING, 20
URINE, 16

V

VARIABILITY, 5, 14
VARIATIONS, 15, 19
VEGETATION GROWTH, 8, 9, 10
VEINS, 14, 15
VENTILATION, 6
VERTEBRATES, 13
VESTIBULES, 4
VIBRATION, 29
VIBRATION EFFECTS, 11
VIBRATION PERCEPTION, 29
VIDEO DATA, 26, 30
VISUAL ACCOMMODATION, 25
VOICE COMMUNICATION, 29
VOLUMETRIC ANALYSIS, 19

W

WAKEFULNESS, 3
WALKING, 27, 32
WASTE WATER, 28
WATER BALANCE, 10
WATER CIRCULATION, 10
WATER IMMERSION, 19
WATER RECLAMATION, 33
WATER TREATMENT, 28
WEIGHT (MASS), 20
WEIGHTLESSNESS, 1, 2, 3, 5, 6, 10, 18
WEIGHTLESSNESS SIMULATION, 2, 4, 5, 6, 13, 14, 15, 16, 17, 18, 19, 20, 23
WORK CAPACITY, 20
WORKLOADS (PSYCHOPHYSIOLOGY), 30
WORKSTATIONS, 25

Personal Author Index

A

Abbrecht, Peter H., 6
Achaibou, F., 13
Adolf, Jurine A., 23
Aizikov, Gregory S., 4
Alexander, R. A., 5
Allen, David L., 17
Allevard, A. M., 15, 18
Anderson, Frank C., 32
Arbeille, Ph., 13
Arnaud, Sara B., 4
Arndt, G. D., 11

B

Baer, Lisa A., 7
Baker, Michael J., 2
Baldwin, Kenneth M., 2, 18
Ballard, R. E., 15, 23
Balzamo, Emmanuel, 3
Ban, Takashi, 12
Baoshen, Xie, 2
Belyavskaya, N. A., 9
Berenji, Hamid R., 27
Bernauer, E. M., 15
Blomqvist, C. G., 15, 19
Bodine-Fowler, Sue C., 2
Booher, Cletis R., 30
Bourland, Charles T., 31
Breit, G. A., 15
Broach, Dana, 27
Brown, Christopher S., 8, 10
Bryant, Howard J., 6
Buhrman, John R., 28

C

Caiozzo, Vincent J., 2
Campbell, Paul D., 26
Cantrell, J. H., 23
Cardus, David, 19
Carl, J. R., 11
Carpenter, David, 21
Chandlee, G. O., 29
Chang, D. S., 23
Chela Fores, J., 11
Chen, S. M., 31
Cheung, Jeffery T., 31
Chien, Chiun Hong, 33
Chu, H. W., 31
Coffey, James D., 25
Cogoli, Augusto, 22
Cogoli-Greuter, Marianne, 22
Constable, Roxanne, 21
Convertino, V. A., 19
Corbin, B. J., 5
Corbin, Barbara J., 7
Corsale, Dominic, 18
Cram, L. Scott, 24
Csotai, J., 25

D

Dabrowski, Olaf B., 17
Danevich, Larisa A., 7
Day, M. Kathleen, 17
Debinski, Wojciech B., 16, 17
Demaria-Pesce, Victor H., 6
DeRoshia, C. W., 1
Diedrich, Andre, 13, 14
Dietrich, Bruce H., 18
Drescher, Juergen, 13, 14
Driggers, Donald C., 30

E

Ebina, Yoshio, 12
Edgerton, V. Reggie, 17
Edwards, P. K., 4
Engelke, K. A., 19

F

Farmer, William L., 27
Feuerstein, Irwin, 6
Fields, B., 32
Fischer, F., 29
Fitzpatrick, Steven J., 34
Fohey, Michael F., 31
Fomina, G., 13
Fuller, C. A., 3
Fuller, Charles A., 1

G

Gallegos, Gregory L., 8, 9
Gauquelin, G., 18
Gauquelin-Koch, G., 15
Gembicka-Kuzak, Danuta M., 16, 17
Gharib, C., 15, 18
Gharib, Claude, 5
Giacomozzi, Claudia, 26
Girten, Beverly, 4, 5
Glaus-Late, Kimberly D., 31
Glennon, Terrance P., 20
Goldsberry, B. S., 29
Goldsberry, Betty S., 30
Goto, S., 20
Grana, Erick A., 20
Greenisen, Michael C., 17
Greenleaf, J. E., 1
Grethe, Nadine, 5
Grigorian, Roman A., 4
Grindeland, Richard E., 7
Grueber, Wilhelm, 13, 14
Guan, X., 11
Guell, Antonio, 14
Guezennec, Charles-Yannick, 14
Guikema, James A., 8, 9, 10
Gulyar, Serge A., 22
Gunga, H. C., 15
Gunji, A., 20
Gunji, Atsuaki, 16

H

Haddad, Fadia, 2
Haller, H., 29
Hargens, A. R., 15, 23
Harper, Jennifer S., 4
Haruna, Y., 20
Haruna, Yuichiro, 16
Henninger, D., 32
Hilaire, Emmanuel, 8, 10
Hilaire, Emmanuel M., 8
Hill, Susan G., 34
Hinghofer-Szalkay, Helmut G, 23
Hinghofer-Szalkay, Helmut G., 15
Hoban-Higgins, T. M., 3
Hoffler, G. W., 19
Holden, Kritina L., 23
Holley, D. C., 6
Hoy, Michael, 31
Hughson, Richard L., 5, 18

I

Igawa, S., 20

J

Jaweed, M. Mazher, 20
Jaweed, Mazher, 19
Jenner, J. W., 6
Jianhe, Chen, 2
Jingrui, Meng, 2
Johannes, B., 29
Johansen, Lars Bo, 19
Johnson, Scott R., 31
Juergensmeyer, Elizabeth A., 10
Juergensmeyer, Margaret A., 10

K

Kawakubo, K., 20
Kawakubo, Kiyoshi, 16
Kedar, Smadar T., 26
Khedkar, Pratap S., 27
Kirsch, K. A., 15
Kloeris, Vickie L., 31
Kondrachuk, Alexander, 22
Kondrachuk, Alexander V., 21
Kordyum, E. L., 9
Kordyum, Elizabeth L., 7
Koryak, Yuri, 20
Kotovskaya, A., 13
Kreidich, Jury V., 4
Kuriyama, K., 20
Kuzak, Wlodzimierz, 16, 17
Kyle, Richard R., 6

L

Laczko, L., 25
Ladoulis, Charles T., 34
Laird, Philip, 26
Lane, L. D., 19
Lang, C. K., 5
Laszlo, Zoltan, 15
Lebedev, Arthur N., 13
Lee, Mona, 5
Lee, Mona D., 4
Li, Jeffrey S., 31
Li, K. Y., 31
Lillywhite, Harvey B., 12
Lin, Min-Ray, 27
Littlefield, Mark L., 33
Louisy, Francis, 14
Lu, Chungsying, 27
Lundvall, Jan, 22

M

Ma, Jin, 13
Macellari, Velio, 26
Magee, Michael, 33
Maillet, A., 15, 18
Makita, Y., 20
Mazurin, Yu. V., 21
McDowell, Raquel, 5
McKay, Timothy D., 30
McKusick, Kathleen B., 26
McPherson, Laurie, 5
McPherson, Scott, 5
McTaggart, Wesley, 19
Mele, G., 6
Meloni, Maria Antonietta, 22
Mendonca, Margarida M., 2, 16
Ming, D., 32
Mirabi, Batool, 20
Moebes, T. A., 24
Mohajerani, Laleh, 17
Moiseyev, Yu. B., 21
Monga, Trilok N., 20
Montgomery, Ronald W., 25
Moran, M. M., 4
Murakami, D. M., 3
Murthy, G., 23

N

Naidu, S., 6
Nakagawara, Van B., 25
Nalishitij, Vladimir, 14
Navidi, Meena, 4
Nedukha, Elena M., 10
Nguyen, T. X., 11
Normand, S., 15
Norsk, Peter, 19

O

Obergefell, Louise, 28
Odom, William R., 9
Oswald, K. A., 1

P

Pachiaudi, C., 15
Pandy, Marcus G., 32
Pendleton, Thomas W., 33
Perry, Chris E., 28
Peterson, Barbara V., 8
Pierotti, David J., 2
Pippia, Proto, 22
Polet, J. L., 19
Popova, A. F., 9
Pottier, J. M., 13

Q

Qiulu, Xiang, 2

R

Raven, Peter B., 14
Reece, Wendy J., 34
Reyna, V. L., 1
Roessler, Andreas, 15
Rome, Jean-Luc, 13, 14
Rorvig, Mark E., 34
Roy, Roland R., 17

S

Sada, Hideaki, 12
Saggini, Raoul, 26
Salnitzki, V. P., 29
Saul, Ronald, 26
Schlykova, L., 29
Schroiff, Philippe, 14
Sciola, Luigi, 22
Sebastian, L. A., 3
Segall, Paul E., 7
Shi, Xiangrong, 14
Shnyukova, E. I., 9
Shoemaker, J. Kevin, 18
Sigaudo, D., 18
Simon, L., 25
Simon, W. E., 31
Smith, Arthur H., 1
Smith, Suzanne D., 28
Spano, Alessandra, 22
Spatenko, Juri A., 13, 14
Stafford, Carolyn, 24
Steele, M. K., 5
Sternberg, Hal, 7
Strollo, F., 15
Stupakov, G .P., 29
Stupakov, G. P., 21
Suzuki, Y., 20
Suzuki, Yoji, 16
Sytnik, K. M., 9

T

Talmadge, Robert J., 2
Tanaka, Kotaro, 12

Tandon, T., 3
Tipton, C. M., 3
Torikoshi, S., 23
Treadwell, Teresa A., 33
Tshchakovsky, Michael E., 18
Tucker, Bryan J., 2, 16
Turski, Bronislaw K., 16, 17
Tuttle, Ronald, 4
Tuttle, Ronald R., 5

U

Uberbacher, E. C., 11

V

Vasques, Marilyn, 7
Verostko, C. E., 32
Vitthal, Sanjay, 34

W

Wade, C. E., 5
Waitz, Harold D., 7
Watenpaugh, D. E., 15, 23
Wentworth, A. L., 11
Wentworth, B. C., 11
Whalen, Robert T., 32
Whitmore, Mihriban, 30
Wilke, D., 29
Williams, Trevor W., 33
Wilson, M. H., 23
Winget, C. M., 6
Wirth, D., 25

X

Xianyun, Shen, 1

Y

Yanagibori, Ryoko, 16
Yaws, C. L., 31
Yeh, An-Chin, 27
Yost, W. T., 23
Youmans, Julian R., 1
Young, Willie C., 27
Yu, Zhi-Bin, 13
Yueying, Xue, 1
Yuqing, Wang, 2

Z

Zhang, Li-Fan, 13
Ziegler, James M., 32

Availability of Cited Publications

Open Literature Entries (A96-60000 Series)

Inquiries and requests should be addressed to:

NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934.

Orders are also taken by telephone, (301) 621-0390, e-mail, help@sti.nasa.gov, and fax, (301) 621-0134. Please refer to the accession number when requesting publications.

STAR Entries (N96-10000 Series)

One or more sources from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below, and their addresses are listed on page APP-3. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NASA CASI. Sold by the NASA Center for AeroSpace Information. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page APP-4.

Note on Ordering Documents: When ordering publications from NASA CASI, use the N accession number or other report number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collec- tions of Department of Energy reports, usually in microfiche form, are listed in Energy Research Abstracts. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center—Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on Engineering Sciences Data Unit (ESDU) topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address, both of which are on page APP-3.

Avail: Fachinformationszentrum Karlsruhe. Gesellschaft für wissenschaftlich-technische Information mbH 76344 Eggenstein-Leopoldshafen, Germany.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, CA. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration (JBD-4), Public Documents Room (Room 1H23), Washington, DC 20546-0001, or public document rooms located at NASA installations, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: NTIS. Sold by the National Technical Information Service. Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) are available. For information concerning this service, consult the NTIS Subscription Section, Springfield, VA 22161.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free.

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INlS) representative in their country, or by applying directly to the issuing organization.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed on page APP-3. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Federal Depository Library Program

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 53 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 53 regional depositories. A list of the regional GPO libraries, arranged alphabetically by state, appears on the inside back cover of this issue. These libraries are not sales outlets. A local library can contact a regional depository to help locate specific reports, or direct contact may be made by an individual.

Public Collection of NASA Documents

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols # and * from FIZ—Fachinformation Karlsruhe—Bibliographic Service, D-76344 Eggenstein-Leopoldshafen, Germany and TIB—Technische Informationsbibliothek, P.O. Box 60 80, D-30080 Hannover, Germany.

Addresses of Organizations

British Library Lending Division
Boston Spa, Wetherby, Yorkshire
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, DC 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

European Space Agency–
Information Retrieval Service ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

Engineering Sciences Data Unit International
P.O. Box 1633
Manassas, VA 22110

Engineering Sciences Data Unit
International, Ltd.
251–259 Regent Street
London, W1R 7AD, England

Fachinformationszentrum Karlsruhe
Gesellschaft für wissenschaftlich–technische
Information mbH
76344 Eggenstein–Leopoldshafen, Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090–2934

National Aeronautics and Space Administration
Scientific and Technical Information Office
(Code JT)
Washington, DC 20546–0001

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, CA 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, MI 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library National Center
MS 950
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, AZ 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, CO 80225

The New NASA Video Catalog is Here

Free!

To order your copy,
call the NASA Access Help Desk at
(301) 621-0390,
fax to
(301) 621-0134,
e-mail to
help@sti.nasa.gov,
or visit the NASA STI program
homepage at
http://www.sti.nasa.gov/STI-homepage.html

(Select STI Program Bibliographic Announcements)

Explore the Universe!

NASA CASI Price Code Table

(Effective July 1, 1996)

CASI PRICE CODE	NORTH AMERICAN PRICE	FOREIGN PRICE
A01	$ 6.50	$ 13.00
A02	10.00	20.00
A03	19.50	39.00
A04-A05	21.50	43.00
A06	25.00	50.00
A07	28.00	56.00
A08	31.00	62.00
A09	35.00	70.00
A10	38.00	76.00
A11	41.00	82.00
A12	44.00	88.00
A13	47.00	94.00
A14-A17	49.00	98.00
A18-A21	57.00	114.00
A22-A25	67.00	134.00
A99	Call For Price	Call For Price

Important Notice

The $1.50 domestic and $9.00 foreign shipping and handling fee currently being charged will remain the same. Foreign airmail is $27.00 for the first 1-3 items, $9.00 for each additional item. Additionally, a new processing fee of $2.00 per each video ordered will be assessed.

For users registered at the NASA CASI, document orders may be invoiced at the end of the month, charged against a deposit account, or paid by check or credit card. NASA CASI accepts American Express, Diners' Club, MasterCard, and VISA credit cards. There are no shipping and handling charges. To register at the NASA CASI, please request a registration form through the NASA Access Help Desk at the numbers or addresses below.

Return Policy

The NASA Center for AeroSpace Information will gladly replace or make full refund on items you have requested if we have made an error in your order, if the item is defective, or if it was received in damaged condition and you contact us within 30 days of your original request. Just contact our NASA Access Help Desk at the numbers or addresses listed below.

NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

E–mail: help@sti.nasa.gov
Fax: (301) 621-0134
Phone: (301) 621–0390

Rev. 6/96

Report Documentation Page

1. Report No. NASA SP-7011 (417)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aerospace Medicine and Biology A Continuing Bibliography (Supplement 417)		5. Report Date July 8, 1996 6. Performing Organization Code JT
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address NASA Scientific and Technical Information Office		10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546-0001		13. Type of Report and Period Covered Special Publication 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report lists 101 reports, articles and other documents recently announced in the NASA STI Database.

17. Key Words (Suggested by Author(s)) Aerospace Medicine Bibliographies Biological Effects	18. Distribution Statement Unclassified – Unlimited Subject Category – 52

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 52	22. Price A04/HC

For sale by the NASA Center for AeroSpace Information, 800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934

Federal Regional Depository Libraries

ALABAMA
AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Dept.
7300 University Dr.
Montgomery, AL 36117–3596
(205) 244–3650 Fax: (205) 244–0678

UNIV. OF ALABAMA
Amelia Gayle Gorgas Library
Govt. Documents
P.O. Box 870266
Tuscaloosa, AL 35487–0266
(205) 348–6046 Fax: (205) 348–0760

ARIZONA
DEPT. OF LIBRARY, ARCHIVES, AND PUBLIC RECORDS
Research Division
Third Floor, State Capitol
1700 West Washington
Phoenix, AZ 85007
(602) 542–3701 Fax: (602) 542–4400

ARKANSAS
ARKANSAS STATE LIBRARY
State Library Service Section
Documents Service Section
One Capitol Mall
Little Rock, AR 72201–1014
(501) 682–2053 Fax: (501) 682–1529

CALIFORNIA
CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 942837 – 914 Capitol Mall
Sacramento, CA 94337–0091
(916) 654–0069 Fax: (916) 654–0241

COLORADO
UNIV. OF COLORADO – BOULDER
Libraries – Govt. Publications
Campus Box 184
Boulder, CO 80309–0184
(303) 492–8834 Fax: (303) 492–1881

DENVER PUBLIC LIBRARY
Govt. Publications Dept. BSG
1357 Broadway
Denver, CO 80203–2165
(303) 640–8846 Fax: (303) 640–8817

CONNECTICUT
CONNECTICUT STATE LIBRARY
231 Capitol Avenue
Hartford, CT 06106
(203) 566–4971 Fax: (203) 566–3322

FLORIDA
UNIV. OF FLORIDA LIBRARIES
Documents Dept.
240 Library West
Gainesville, FL 32611–2048
(904) 392–0366 Fax: (904) 392–7251

GEORGIA
UNIV. OF GEORGIA LIBRARIES
Govt. Documents Dept.
Jackson Street
Athens, GA 30602–1645
(706) 542–8949 Fax: (706) 542–4144

HAWAII
UNIV. OF HAWAII
Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948–8230 Fax: (808) 956–5968

IDAHO
UNIV. OF IDAHO LIBRARY
Documents Section
Rayburn Street
Moscow, ID 83844–2353
(208) 885–6344 Fax: (208) 885–6817

ILLINOIS
ILLINOIS STATE LIBRARY
Federal Documents Dept.
300 South Second Street
Springfield, IL 62701–1796
(217) 782–7596 Fax: (217) 782–6437

INDIANA
INDIANA STATE LIBRARY
Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204–2296
(317) 232–3679 Fax: (317) 232–3728

IOWA
UNIV. OF IOWA LIBRARIES
Govt. Publications
Washington & Madison Streets
Iowa City, IA 52242–1166
(319) 335–5926 Fax: (319) 335–5900

KANSAS
UNIV. OF KANSAS
Govt. Documents & Maps Library
6001 Malott Hall
Lawrence, KS 66045–2800
(913) 864–4660 Fax: (913) 864–3855

KENTUCKY
UNIV. OF KENTUCKY
King Library South
Govt. Publications/Maps Dept.
Patterson Drive
Lexington, KY 40506–0039
(606) 257–3139 Fax: (606) 257–3139

LOUISIANA
LOUISIANA STATE UNIV.
Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803–3312
(504) 388–2570 Fax: (504) 388–6992

LOUISIANA TECHNICAL UNIV.
Prescott Memorial Library
Govt. Documents Dept.
Ruston, LA 71272–0046
(318) 257–4962 Fax: (318) 257–2447

MAINE
UNIV. OF MAINE
Raymond H. Fogler Library
Govt. Documents Dept.
Orono, ME 04469–5729
(207) 581–1673 Fax: (207) 581–1653

MARYLAND
UNIV. OF MARYLAND – COLLEGE PARK
McKeldin Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 405–9165 Fax: (301) 314–9416

MASSACHUSETTS
BOSTON PUBLIC LIBRARY
Govt. Documents
666 Boylston Street
Boston, MA 02117–0286
(617) 536–5400, ext. 226
Fax: (617) 536–7758

MICHIGAN
DETROIT PUBLIC LIBRARY
5201 Woodward Avenue
Detroit, MI 48202–4093
(313) 833–1025 Fax: (313) 833–0156

LIBRARY OF MICHIGAN
Govt. Documents Unit
P.O. Box 30007
717 West Allegan Street
Lansing, MI 48909
(517) 373–1300 Fax: (517) 373–3381

MINNESOTA
UNIV. OF MINNESOTA
Govt. Publications
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624–5073 Fax: (612) 626–9353

MISSISSIPPI
UNIV. OF MISSISSIPPI
J.D. Williams Library
106 Old Gym Bldg.
University, MS 38677
(601) 232–5857 Fax: (601) 232–7465

MISSOURI
UNIV. OF MISSOURI – COLUMBIA
106B Ellis Library
Govt. Documents Sect.
Columbia, MO 65201–5149
(314) 882–6733 Fax: (314) 882–8044

MONTANA
UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812–1195
(406) 243–6700 Fax: (406) 243–2060

NEBRASKA
UNIV. OF NEBRASKA – LINCOLN
D.L. Love Memorial Library
Lincoln, NE 68588–0410
(402) 472–2562 Fax: (402) 472–5131

NEVADA
THE UNIV. OF NEVADA LIBRARIES
Business and Govt. Information Center
Reno, NV 89557–0044
(702) 784–6579 Fax: (702) 784–1751

NEW JERSEY
NEWARK PUBLIC LIBRARY
Science Div. – Public Access
P.O. Box 630
Five Washington Street
Newark, NJ 07101–7812
(201) 733–7782 Fax: (201) 733–5648

NEW MEXICO
UNIV. OF NEW MEXICO
General Library
Govt. Information 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) 827–3824 Fax: (505) 827–3888

NEW YORK
NEW YORK STATE LIBRARY
Cultural Education Center
Documents/Gift & Exchange Section
Empire State Plaza
Albany, NY 12230–0001
(518) 474–5355 Fax: (518) 474–5786

NORTH CAROLINA
UNIV. OF NORTH CAROLINA – CHAPEL HILL
Walter Royal Davis Library
CB 3912, Reference Dept.
Chapel Hill, NC 27514–8890
(919) 962–1151 Fax: (919) 962–4451

NORTH DAKOTA
NORTH DAKOTA STATE UNIV. LIB.
Documents
P.O. Box 5599
Fargo, ND 58105–5599
(701) 237–8886 Fax: (701) 237–7138

UNIV. OF NORTH DAKOTA
Chester Fritz Library
University Station
P.O. Box 9000 – Centennial and University Avenue
Grand Forks, ND 58202–9000
(701) 777–4632 Fax: (701) 777–3319

OHIO
STATE LIBRARY OF OHIO
Documents Dept.
65 South Front Street
Columbus, OH 43215–4163
(614) 644–7051 Fax: (614) 752–9178

OKLAHOMA
OKLAHOMA DEPT. OF LIBRARIES
U.S. Govt. Information Division
200 Northeast 18th Street
Oklahoma City, OK 73105–3298
(405) 521–2502, ext. 253
Fax: (405) 525–7804

OKLAHOMA STATE UNIV.
Edmon Low Library
Stillwater, OK 74078–0375
(405) 744–6546 Fax: (405) 744–5183

OREGON
PORTLAND STATE UNIV.
Branford P. Millar Library
934 Southwest Harrison
Portland, OR 97207–1151
(503) 725–4123 Fax: (503) 725–4524

PENNSYLVANIA
STATE LIBRARY OF PENN.
Govt. Publications Section
116 Walnut & Commonwealth Ave.
Harrisburg, PA 17105–1601
(717) 787–3752 Fax: (717) 783–2070

SOUTH CAROLINA
CLEMSON UNIV.
Robert Muldrow Cooper Library
Public Documents Unit
P.O. Box 343001
Clemson, SC 29634–3001
(803) 656–5174 Fax: (803) 656–3025

UNIV. OF SOUTH CAROLINA
Thomas Cooper Library
Green and Sumter Streets
Columbia, SC 29208
(803) 777–4841 Fax: (803) 777–9503

TENNESSEE
UNIV. OF MEMPHIS LIBRARIES
Govt. Publications Dept.
Memphis, TN 38152–0001
(901) 678–2206 Fax: (901) 678–2511

TEXAS
TEXAS STATE LIBRARY
United States Documents
P.O. Box 12927 – 1201 Brazos
Austin, TX 78701–0001
(512) 463–5455 Fax: (512) 463–5436

TEXAS TECH. UNIV. LIBRARIES
Documents Dept.
Lubbock, TX 79409–0002
(806) 742–2282 Fax: (806) 742–1920

UTAH
UTAH STATE UNIV.
Merrill Library Documents Dept.
Logan, UT 84322–3000
(801) 797–2678 Fax: (801) 797–2677

VIRGINIA
UNIV. OF VIRGINIA
Alderman Library
Govt. Documents
University Ave. & McCormick Rd.
Charlottesville, VA 22903–2498
(804) 824–3133 Fax: (804) 924–4337

WASHINGTON
WASHINGTON STATE LIBRARY
Govt. Publications
P.O. Box 42478
16th and Water Streets
Olympia, WA 98504–2478
(206) 753–4027 Fax: (206) 586–7575

WEST VIRGINIA
WEST VIRGINIA UNIV. LIBRARY
Govt. Documents Section
P.O. Box 6069 – 1549 University Ave.
Morgantown, WV 26506–6069
(304) 293–3051 Fax: (304) 293–6638

WISCONSIN
ST. HIST. SOC. OF WISCONSIN LIBRARY
Govt. Publication Section
816 State Street
Madison, WI 53706
(608) 264–6525 Fax: (608) 264–6520

MILWAUKEE PUBLIC LIBRARY
Documents Division
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 286–3073 Fax: (414) 286–8074