

**A88-32048 Physiological reserves of the body (O fiziologicheskikh rezervakh organizma).** V. P. ZAGRIADSKII and Z. K. SULIMO-SAMUILLO, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Jan. 1988, pp. 51-53.

The demands placed on the physiology of the body by military activity and, often, by the extremal conditions of such activity rely on the mobilization of the reserves in metabolic energy and on the activation of systems that regulate energy distribution. Different mechanisms that induce the mobilization of energy under different extremal conditions, such as hypoxia or sustained physical load, are discussed together with the parameters characterizing mobilization of physiological reserves and the role played by physical training in increasing these reserves. It is shown that physical training increases the respiratory capacity, the volume of pulmonary ventilation, and, during exposure to physical load, the minute blood output and stroke output.

**A88-32016 Reactions of the cardiovascular system to static load in athletes and in untrained subjects (Reaktsii sistemy krovoobrashcheniia na staticheskuiu nagruzku u sportsmenov i malotrenirovannykh lits).** M. A. VODOP'IANOVA, N. V. DROBOTIA, and G. S. KARAPETIAN, *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), Vol. 74, Feb. 1988, pp. 294-299. 17 Refs.

The effect of physical training on the cardiovascular system was investigated by measuring cardiovascular responses to a static load (a 3-kg load held with the arm outstretched) in untrained subjects (group 1) and in trained cyclists (group 2). In the group-1 subjects, the effect of the load included increases in systolic output, pulse rate, minute blood volume, rate of pulse wave propagation, and mean hemodynamic pressure. In the group-2 subjects, the load-induced responses also increased the pulse rate, minute blood volume, and mean hemodynamic pressure; however, the systolic output and peripheral vasoconstriction indices were decreased, indicating a reaction of energy economy. It is suggested that the

increases in the systolic output, the rate of pulse-wave propagation, and the mean hemodynamic pressure can serve as criteria for predicting the degree of fatigue.

**A88-33835 A shift in the set point of temperature regulation under physical load conditions (Sdvig ustanovochnoi tochki temperaturnoi reguliatsii v usloviakh fizicheskoi nagruzki).** S. A. PAVLOV, *Akademiia Nauk SSSR, Izvestiia, Seriya Biologicheskaya* (ISSN 0002-3329), Mar.-Apr. 1988, pp. 229-237. 20 Refs.

Human organisms exposed to prolonged physical load with the accompanying muscle hyperthermia experience a shift in the temperature set point rather than a tendency to return to the original temperature. This paper examines the changes in the temperature-regulation set point under physical load and the role of the set-point shift in the increase in the work capacity observed after reaching the stable level of core hyperthermia. It is shown that the new set point which is about 1.5°C above the normothermic level is accompanied by the optimal mobilization of the cardiorespiratory system. The new set point is stable, i.e., it is physiologically regulated.

**A89-30074 Neurosis and hypertensive disease (Nevroz i gipertonicheskaia bolezni').** V. B. ZAKHARZHEVSKII, *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), Vol. 74, Nov. 1988, pp. 1645-1653. 21 Refs.

The relationship between neurosis and psychosomatic pathology were investigated using clinical and laboratory data as well as literature reports. Results obtained from experimental modeling of psychosomatic diseases indicate that, in a visceral system, there is a combined action of neurotization and the destabilization of regulatory mechanisms. A suppression of the vascular system's self-regulatory mechanism was detected in subjects in initial stages of hypertensive disease, in contrast to a neurosis with a hypertensive syndrome, suggesting that different mechanisms are active in the formation of a neurosis and of hypertensive disease.

## Japanese Aerospace Literature This month: *Aerospace Medicine*

**A89-38366 Development of electrophoresis equipment for SFU (Space Flyer Unit).** NOBORU HAMANO, KENJI MITANI, KUNIOYOSHI TSUBOUCHI, YUSUKE TAKAGI, TSUTOMU OKUSAWA et al., *Proceedings of the 16th International Symposium on Space Technology and Science*, Sapporo, Japan, May 22-27, 1988, Vol. 2 (A89-38031 16-12). Tokyo, AGNE Publishing, Inc., 1988, pp. 2459-2464. Research supported by the Ministry of International Trade and Industry.

Results obtained during conceptual studies of electrophoresis equipment for a space flyer unit are presented. The thermal and fluid mechanical characteristics of the separation chambers were analyzed. Areas of further development include: (1) the determination of a detailed specification of the system based on the thorough interaction between main investigators and the equipment developer, and (2) the establishment of a sterilization method suitable for the equipment aboard the SFU.

**A89-38350 Response of rats to short- and long-term centrifugal acceleration.** MASAMICHI SUDOH, KUMIKO SHIODA, SACHIO IKAWA, and HISASHI SAIKI, *Proceedings of the 16th International Symposium on Space Technology and Science*, Sapporo, Japan, May 22-27, 1988, Vol. 2 (A89-38031 16-12). Tokyo, AGNE Publishing, Inc., 1988, pp. 2337-2342. 9 Refs.

The physiological changes in rats exposed to hypergravity for 30 min and 3 weeks are studied. Changes in respiratory and circulatory functions are of particular interest. In the short-term experiment, female rats were exposed to hypergravity in intensities of 3, 4, 5, and 6 G in the following directions: back-to-abdomen (-Gx), head-to-tail (+Gz), and tail-to-head (-Gz). While the heart rate did not change during the -Gx and +Gz exposures, it showed a slight decrease during the -Gz exposure.

**A89-38031 International Symposium on Space Technology and Science, 16th, Hokkaido University, Sapporo, Japan, May 22-27, 1988, Proceedings. Volumes 1 & 2.** KYOHEI KONDO, ED. Symposium sponsored by Hokkaido Aerospace Industry Development Council, Ad Melco Co., Ltd., National Space Development Agency of Japan, et al., Tokyo, AGNE Publishing, Inc., 1988. Vol. 1, 1448 p.; Vol. 2, 1310 pp. For individual items see A89-38032 to A89-38396.

Recent advances in space science and technology are discussed in reviews and reports, mainly from Japan. Topics addressed include propulsion, materials and structures, flight dynamics and astrodynamics, fluid dynamics, thermophysics and thermochemistry, electronic components and devices, computers and data systems, systems engineering, and space transportation systems. Consideration is given to guidance, navigation, and control; spacecraft systems; the International Space Station and manned space technology; balloons; satellite communication and broadcasting; lunar and planetary exploration; terrestrial remote sensing; space medicine; biology and the cosmos; microgravity; space industrialization; and the Japanese national space program.

**A87-50649 Changes of pilots' skin temperature in flight.** HIROHIDE URANO, HIROTAKA SATAKE, and TAKASHI KAWASHIMA, *Japanese Journal of Aerospace and Environmental Medicine* (ISSN 0387-0723), Vol. 24, March 1987, pp. 1-6. 9 Refs.

The skin temperatures of nine amateur pilots aged 28 to 40 years old were taken in 10 experimental flights from May through December 1986 using thermistors and an analog tape recorder. The temperature went up and down slowly with little delay following changes in cabin air temperature. All crews showed a small fall in skin temperature over one hour of flight. Abrupt drops in temperature overlapped the slow changes. The skin temperature fall during takeoff was 0.6°C lower at level flight in traffic than during taxiing. The same small drop occurred during turbulence or steep turn, but no change was observed during calm cruise. A 0.4-0.5°C drop in skin temperature occurred during plane landing even though cabin temperature was rising. Tachycardia and cold sweat were observed simultaneously with the drop in skin temperature.

**A87-44094 Skin potential reflex corresponding to transient motion discomfort.** NAOKI ISU, NOBUYUKI TAKAHASHI, JIRO KOO, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 58, June 1987, pp. 576-580. 13 Refs.

The qualitative and quantitative correspondence between the degree of motion discomfort and the skin potential reflex (SPR) was examined in four subjects. Head movement was provided three times during body rotation at three different angular velocities (Coriolis stimulus) to induce motion discomfort, and at rest as a control. SPRs were caused in the arousal sweat area by head movement. The wave form, latency, time-to-peak, and amplitude of SPR were analyzed. The amplitude of the depolarizing response (P response) of SPR increased proportionally to the angular velocity of body rotation and decreased in the course of repetitive Coriolis stimulation. It was revealed that the amplitude of P response of SPR in the arousal sweat area corresponds to the degree of transient motion discomfort.

**A89-36353 Symptoms and signs associated with anti-G training.** FUKUMI NOZAWA, AKIO NAKAMURA, TADAO YANAKA, TOYOFUMI KAKU, WATARU MITSUHASHI et al., *Japan Air Self Defense Force, Aeromedical Laboratory Reports* (ISSN 0023-2858), Vol. 29, June 1988, pp. 77-83. 9 Refs.

The symptoms displayed by three groups in anti-G training are examined. The symptoms include autonomic imbalance due to motion sickness and spatial disorientation and visual symptoms due to high-G hydrostatic stress. The severity of symptoms among groups in different types of training are compared. The frequency of symptoms which occur at each phase of training is discussed. The types of training considered include basic course pattern, gradual and rapid onset rate, and simulated air combat maneuver training for F-15 pilots.

**A89-38347 Eye movement responses during linear acceleration.** MOTOYUKI HASHIBA, SATORU WATANABE, AKIRA TAKABAYASHI, MASAFUMI TANAKA, SADAHARU TAKAGI et al., *Proceedings of the 16th International Symposium on Space Technology and Science*, Sapporo, Japan, May 22-27, 1988, Vol. 2 (A89-38031 16-12). Tokyo, AGNE Publishing, Inc., 1988, pp. 2319-2324. 5 Refs.

The vestibulo-oculomotor reflex induced by linear acceleration is used to study the characteristics of the gravity sensory organ. A sled is used to generate linear acceleration and the otolith-oculomotor response is studied by changing the direction of acceleration to a variety of the subject's postures. It was found that eye movements with a nystagmic pattern were elicited by linear acceleration. Horizontal eye movements were produced by right-left acceleration and vertical eye movements were produced by head-foot acceleration.

**A89-34999 Blunted hypoxic ventilatory drive in subjects susceptible to high-altitude pulmonary edema.** YUKINORI MATSUZAWA, KEISAKU FUJIMOTO, TOSHIO KOBAYASHI, NAMUSHI R. NAMUSHI, KAZURO HARADA et al., *Journal of Applied Physiology* (ISSN 0161-7567), Vol. 66, March 1989, pp. 1152-1157. 33 Refs.

The relationship between the susceptibility to high-altitude pulmonary edema (HAPE) and the blunted hypoxic ventilatory response (HVR) was investigated using the results of conventional pulmonary function test and HVR and hypercapnic ventilatory response (HCVR) tests performed on lowlanders with or without a previous history of HAPE. In the pulmonary function and HCVR tests, no significant differences were found between the two groups. On the other hand, in the HVR test, HAPE-susceptible subjects showed significantly lower HVR values than control subjects.

**A89-19880 The estimation of atherosclerosis in physical examination for flying duty - An examination about serum value of high density lipoprotein and atherogenic index.** NOBORU YONETSU, AZUSA KIKUKAWA, and TOMOMITSU AKAMATSU, *Japan Air Self Defence Force, Aeromedical Laboratory Reports* (ISSN 0023-2858), Vol. 28, Dec. 1987, pp. 165-178. 13 Refs.

The results of total-cholesterol and high-density-lipoprotein measurements in 809 Japanese military pilots are reported and analyzed statistically. The data are presented in extensive graphs and characterized in detail. About 10 percent of the pilots over 40 years old were found to have atherogenic index values (determined from the serum lipid measurements) indicative of atherosclerotic changes. Smoking and obesity were identified as risk factors for atherosclerosis, while exercise and moderate alcohol use were preventive factors.

**A89-16719 A case of high altitude pulmonary edema followed by brain computerized tomography and electroencephalogram.** MASAO FUKUSHIMA, TOSHIO KOBAYASHI, KEISHI KUBO, KAZUHIKO YOSHIMURA, and TOSHISHIGE SHIBAMOTO, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, Nov. 1988, pp. 1076-1079. 21 Refs.

The use of computer tomography and EEG to monitor patients with high-altitude pulmonary and cerebral edema is demonstrated in a case study. The clinical parameters of a 22-year-old male patient are compiled in an extensive table, and sample brain tomograms are shown. Although the patient recovered fully from these disorders, a tomogram obtained 6 years later revealed some brain atrophy, and he did experience some psychological problems after release from the hospital.

**A89-13939 Responses in muscle sympathetic activity to acute hypoxia in humans.** MITSURU SAITO, TADAOKI MANO, SATOSHI IWASE, KAZUO KOGA, HIROSHI ABE et al., *Journal of Applied Physiology* (ISSN 0161-7567), Vol. 65, Oct. 1988, pp. 1548-1552. 26 Refs.

The effect of hypobaric hypoxia on the muscle sympathetic activity (MSA) in humans was investigated using a direct recording technique to monitor sympathetic nerve activity in subjects participating in a mountaineering training to high altitude. Postganglionic MSA was recorded with the use of a tungsten microelectrode inserted percutaneously into the muscle nerve fascia of the tibial nerve of subjects exposed to hypoxic conditions at simulated altitudes of 4000, 5000, and 6000 m. The average values of the MSA burst rate and total MSA activity (burst rate times mean burst amplitude) at these altitudes were significantly higher than the values recorded at sea level, indicating that MSA is activated under hypoxia. Heart rate also was found to increase significantly. At 6000 m, there were large interindividual differences in the MSA responsiveness to hypoxia. It is suggested that central controlling mechanisms that would be affected by hypoxia may also influence the MSA responsiveness under severe hypoxia.

**A87-44093 Saliva cortisol - A good indicator for acceleration stress.** HIDEO TARUI and AKIO NAKAMURA, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 58, June 1987, pp. 573-575. 23 Refs.

The effects of +Gz stress on the salivary cortisol were studied using four healthy male volunteers (nonaircrew). They were subjected to acceleration up to +5Gz for 1 min without G-suit. At +4Gz and +5Gz stress, the level of saliva cortisol increased significantly ( $p$  less than 0.001) 20 min following centrifugation. At higher +Gz levels, the response of the salivary cortisol was noted to increase. The advantages of monitoring cortisol level in saliva as an indicator for +Gz stress are discussed.

**A88-54013 Effect of acutely exposing to 40 mm Hg LBNP on cardiovascular responses during rest and mild exercise after 6 hrs rest in 5-deg head down tilting (HDT).** S. TORIKOSHI, K. YOKOZAWA, M. INAZAWA, K. ITOH, Y. FUKASE et al., *Physiologist, Supplement* (ISSN 0031-9376), Vol. 31, Feb. 1988, pp. S-16, S-17.

The restoration of sympathetic control of cardiovascular function after 6 h of 5-deg HDT and acute exposure to 40-mm Hg LBNP was investigated experimentally in six healthy female subjects. Immediately after sympathetic control was broken (after an average time of 10 min), bicycle-ergometer exercise to 40 percent of  $\dot{V}O_2(\max)$  was begun and continued for 15 min. The response of the cardiovascular parameters is shown in graphs and discussed. It is found that the mild bicycle exercise was effective in restoring the marked decreases in systolic arterial pressure, heart rate, and pulse pressure observed at the intolerance point.

**A88-46574 The relationship between +Gz tolerance and maximal anaerobic power.** CHIEKO MIZUMOTO and MITSUKO KAMIKURA, *Japan Air Self Defence Force, Aeromedical Laboratory Reports* (ISSN 0023-2858), Vol. 28, Sept. 1987, pp. 79-83. 17 Refs.

The relationship between +Gz tolerance and maximal anaerobic power was tested in eight healthy men repeatedly exposed to 6 Gz for 15 sec and 3 Gz for 30 sec. The onset and offset rates were 1.0 Gz/sec, and the repetition of 6 Gz exposure was limited to six times. +Gz tolerance was determined by the G level at which the subjects felt a grayout. MAnP was measured by bicycle ergometer. A high-tolerance group (HTG) showed greater MAnP than a low-tolerance group. Higher +Gz tolerance may be related to heavier mean body weight of the HTG. The HTG showed significantly higher blood pressure elevation during the bicycle exercise. Individual +Gz tolerance appears to be determined by cardiovascular responsiveness to maximal exercise.

**A88-40986 Crew workload in JASDF C-1 transport flights. I - Change in heart rate and salivary cortisol.** YUKIKO KAKIMOTO, AKIO NAKAMURA, HIDEO TARUI, YUKO NAGASAWA, and SHIGEYUKI YAGURA, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, June 1988, pp. 511-516. 24 Refs.

The physiological responses of heart rate and salivary cortisol for six paired captains and copilots during JASDF scheduled transport flights were compared to assess crew workload. The relative change of both responses showed similar patterns; the responses were influenced significantly by whether pilots were controlling the aircraft. Moreover, differences in flying experience and responsibility of captains and copilots influenced the two physiological responses; heart rate and salivary cortisol measures increased more for both captains and copilots while they were in control of the aircraft than when they were not. Compared to captains, copilots showed much higher activation and variability in relative change of heart rate and salivary cortisol between periods of controlling and noncontrolling the aircraft. On the other hand, captains showed relatively constant responses comparing aircraft controlling and noncontrolling periods, especially in the cruise phase of flight. Salivary cortisol may be a useful, noninvasive method of assessing crew workload.

**A88-29118 Human circadian rhythms in a time-cueless environment - Effects of bright light.** KEN-ICHI HONMA, SATO HONMA, and TATSUHIKO WADA, *Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51). Tokyo, MYU Research, 1987, pp. 121-128. 8 Refs.

The role of bright light as a zeitgeber for circadian rhythms in time-cueless environment was investigated in human subjects living alone for 2 or 3 weeks in an apartment isolated from natural (day-night) and social (schedule) periodicities, and exposed to two types of artificial bright-light cycle. The subjects were able to regulate the light from a bed lamp and the room temperature. Two types of experiments were performed. In an entrainment experiment, the subject was released into free-run for a week before the living room of the unit was illuminated daily by bright light for 8 h at 24 h intervals. In a pulse experiment, the living room was illuminated for either 3 or 6 h while the subject was free-running. The bright-light cycle of a 24-h period was found to entrain the circadian rhythms, which had been free-running with a period longer than 24 h. It is suggested that, to prevent an internal desynchronization of circadian rhythms in an isolated environment, an artificial bright-light cycle zeitgeber should be added to the scheduled routine.

**A88-29114 Sympathetic nervous responses in man to weightlessness simulated by head-out water immersion.** MITSURU SAITO, TADAOKI MANO, SATOSHI IWASE, KAZUO KOGA, and TOSHIYOSHI MATSUKAWA, *Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51). Tokyo, MYU Research, 1987, pp. 85-92. 6 Refs.

The response of muscle sympathetic activity (MSA) to weightlessness simulated by water immersion was studied applying the microneurographic technique to seven healthy human subjects aged 19 to 64 yrs. During stepwise water immersion from a dry condition to the neck, MSA was suppressed more and more by raising the immersion level. During 2.5 hours head-out immersion, MSA was suppressed strongly at the initial phase of immersion, then began increasing slightly, but was still suppressed remarkably throughout the immersion compared to the values for the dry condition. The suppression in MSA during water immersion may be related to the cephalad body fluid shift. It may be also related to changes in somatosensory afferent activities produced by immersion.

**A88-33587 USAF take-off and landing ejections, 1973-85.** GEOFFREY W. MCCARTHY, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, April 1988, pp. 359-362. 11 Refs.

This paper presents a review of ground-level ejection data from 1973 through 1985 for cases of ejections occurring during take-off and landing that clearly involved a decision between ground egress and ejection. Survival rate and the rate of major injuries were compared (by the chi-square analysis) to all ejections above 500 ft and to other ejections below 500 ft during the same period. There were 15 aircraft with 25 crewmembers, 22 of whom ejected. It was found that survival and injury rates for ground-level ejection did not differ significantly from those above 500 ft, indicating that ejection during take-off and landing phases is as safe as ejection above 500 ft, and safer than other ejections below 500 ft. Compared to ground egress, ejection offered greatly increased chances for survival (in only 33 percent of cases the ground egress would have been possible).

**A88-29120 Vasoconstriction in the hand heated locally - A mechanism for reducing heat transportation into the body from hot contact objects.** TETSUO NAGASAKA, MICHEL CABANAC, KOZO HIRATA, and TADAHIRO NUNOMURA, *Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51). Tokyo, MYU Research, 1987, pp. 135-144. 20 Refs.

The role of the skin vasoconstriction as a mechanism for reducing heat transportation into the body from skin exposed to a high local temperature was investigated. Blood flows from fingers or forearm were measured by venous occlusion plethysmography during immersion of the hand or forearm in water baths, the temperature of which was raised every 10 min by 2-C steps from 35 C to 41 C to 43 C; the water temperature for the control hand or forearm was kept at 35 C. The measurements were made in three environments: cool (25 C, 40 percent rh), warm (35 C, 40 percent rh) and hot (35 C and 80 percent rh), with both legs immersed in 42-C water. In the warm environment, the finger flow in the hand heated to 41 C was found to be significantly lower, compared to the control hand, although at 43 deg, vasodilation resumed. In the cool environment, no such vasoconstriction was observed. In the forearm skin, blood-flow in the heated arm increased steadily with increasing local temperature even in the warm environment.

**A88-29107 Space life sciences in Japan.** GENYO MITARAI, *Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51). Tokyo, MYU Research, 1987, pp. 25-37. 27 Refs.

Space life sciences (LSs) research activity of Japan is reviewed, and the present status of the twelve LS experiments planned for the First Materials Processing Test planned to be conducted aboard the Space Station is discussed. The experiments planned for the FMPT projects include studies on endocrine and metabolic changes and on visual stability in space, a neurophysiological study of posture control in fish, studies of the effect of microgravity on the development and formation of bone tissue, and studies on the genetic effects of HZE and cosmic radiation. Other experiments will include investigations on crystal growth in zero gravity, ultrastructural changes of cells in culture, the circadian rhythm of fungus, the electrophoretic separation of cells, and the efficiency of protein electrophoresis in zero gravity.

**A88-24504 Effect of fluid replacement on responses of angiotensin and aldosterone to a physical activity in heat.** MASATO SUZUKI, MASATOSHI SHIOTA, and SACHIO IKAWA, *Japanese Journal of Aerospace and Environmental Medicine* (ISSN 0387-0723), Vol. 24, Sept. 1987, pp. 81-93. 27 Refs.

A study was carried out on five healthy, non-heat-acclimated male volunteers with a mean age of 29.2 years to investigate their angiotensin II (pAng II) and aldosterone (pAld) responses to physical exercise in a hot environment and to assess the effect of commercial sports beverage replacement during the recovery period on diastolic blood pressure (DBP) and water-electrolyte balance. Significant decreases in percent plasma volume and DBP and significant increases in serum Na(+) concentration and osmolality were observed when the subjects consumed no fluid, and a significant elevation of pAng II and pAld concentration was maintained until 120 min after exercise without fluid replacement. The DBP recovered to the initial level by 30 min after sports beverage replacement, and a slight increase in DBP was maintained thereafter.

**A88-12463 Metabolic adaptation in hypokinesia in humans.** H. SAIKI, J. NAKAJIMA, M. NAKAYA, Y. SUGITA, and M. SUDOH, *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-121 to S-124. 7 Refs.

The relation between chronophysiological rhythm and adaptation to a hypogravic environment is studied. Three healthy male adults were subjected to 6 days of thermal neutral water immersion. Changes in the circadian rhythms of urinary excretion of minerals and hormones are examined. Particular attention is given to the excretion of urine, Na(+), 17-OHCS, adrenalin, noradrenalin, and K(+). The fluctuations in the distribution patterns of each sleep stage before, during, and after water immersion are analyzed. It is observed that new steady states for urine volume and urinary excretion of Na(+) are attained during the water immersion conditioning; steady states for urinary excretion of 17-OHCS, adrenalin, and noradrenalin are obtained at the control level, and no steady state is attained for K(+) during the immersion period.

**A88-29103 Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986.** SATORU WATANABE, SHIGEO MORI, and GENYO MITARAI, EDS. Symposium sponsored by MOESC, Natural Space Development Agency of Japan, Japan Society of Microgravity Application, et al. Tokyo, MYU Research (International Symposium Series, No. 2), 1987, 392 pp. For individual items see A88-29104 to A88-29148.

This book includes topics in space physiology and medicine, space biology and CELSS (Controlled Ecological Life Support System), space radiology, and space biotechnology. Papers are presented on the role of preventive medicine in the future of USA space life sciences and the status of space life sciences in Japan. Consideration is given to sympathetic nervous responses in man to weightlessness simulated by head-out water immersion, the effect of centrifugal force on the gain and phase of the canal-ocular reflex in rabbit, DNA damage and mutation induced by health lamp-light (UVB) in *Echerichia coli*, Azolla and other small vascular floating plants as a functioning agent of nitrogen fixation in CELSS, the interaction of cosmic radiation and microgravity in the development processes of *Carausius morosus*, and the electrofusion of plant protoplasts under microgravity conditions.

**A88-12450 Effects of LBPP stocking on cardiovascular responses during rest and exercise in LBPN and upright position in woman.** JUNKO NAGANO, SHIGEYO TORIKOSHI, KIKUKO YOKOZAWA, MIYAKO IONAZAWA, KATSUKO ITOH et al., *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-72, S-73.

The effect of wearing a lower body positive-pressure stocking (LBPPS) with about 20-mm Hg pressure on cardiovascular responses during rest and exercise (pedaling or treadmill running) was investigated in young women subjected to lower-body negative pressure (LBPN). Systolic and diastolic arterial pressures (SAP and DAP, respectively), pulse pressure (PP), cardiac output (CO), stroke volume (SV), and arteriovenous (A-V) O<sub>2</sub> difference were measured at rest, exercise, and recovery. Wearing the LBPPS resulted in lower HR and PP, indicating that the positive pressure was accelerating venous return. In addition, during the exercise, the LBPPS effected increases in CO and SV and a decrease in A-V O<sub>2</sub> difference. The results demonstrated that the 20-mm Hg lower-body positive pressure lowers the defensive cardiovascular responses to gravity stimulation.

**A88-12448 Ten-degree head-down and -up tilting on the water intake and cardiovascular responses during mild exercise in woman.** KIKUKO YOKOZAWA, SHIGEYO TORIKOSHI, MIYAKO INAZAWA, KATSUKO ITOH, YASUKO FUKASE et al., *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-66, S-67.

The effects of head-up tilt (HUT) and head-down tilt (HDT) on water intake and cardiovascular responses during mild exercise were investigated in female subjects performing a 300 kpm/min pedaling exercise in 10-deg or -10-deg tilts. Water intake at 50 min of exercise was 14 percent lower in HDT than in HUT. Mean arterial blood pressure (MAP), cardiac output, stroke volume (SV), and forearm blood flow (FBF) measured just before drinking water were significantly lower in HDT than in HUT, although VO<sub>2</sub>, heart rate, skin temperature, and audiomus temperature were not different. Water intake was significantly correlated to the values of SV, FBF, and arteriovenous oxygen difference (but not to the MAP). The results indicate that the increase in central blood volume inhibits water intake during mild exercise in HDT.

**A88-29121 Applications of a mass spectrometer-computer system to the study of gravitational effects on respiration, circulation and metabolism.** I. NISHI, G. TOMIZAWA, H. ISHII, A. NAGANO, K. GAN et al., *Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51). Tokyo, MYU Research, 1987, pp. 145-154. 10 Refs.

A mass spectrometer-computer system developed for studies of gravitational effects in space on the physiological and biochemical processes is described. The system makes it possible to make multidimensional measurements of respiration, circulation, metabolism, and body heat noninvasively and relatively easily. Application of the system is demonstrated on a few examples.

**A88-12459 Neurophysiological responses in suspended animal models.** YUTAKA OOMURA, TOSHIHIKO KATAFUCHI, *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-106 to S-108. 20 Refs.

The effects of a hypogravic condition induced by horizontal and head-down suspensions on single neuron activity in the lateral hypothalamic area (LHA) and paraventricular nucleus (PVN) of rats are studied. It is observed that horizontal suspension causes a change in the discharge frequency of 21 of 44 LHA neurons; seven of the 21 neurons increase activity immediately after raising the rat from the ground level (type I), three decrease activity immediately (type II), and 11 gradually decrease activity (type III). In the 10 neurons tested using the head-down suspension, three were of type I and seven of type III. It is detected that the activity of eight of 34 PVN neurons change due to horizontal suspension: six display a gradual decrease and two a gradual increase in activity; and eleven neurons exhibited gradual decreases in activity during head-down tilting. Signals that may induce changes in the neuron activity and the role of the hypothalamus in the regulation of the automatic nervous and endocrine systems are examined.

**A88-12445 The effect of body position on ventilation and perfusion in the lung.** E. MORIYA, K. KAWAKAMI, M. SUDOH, and S. IKAWA, *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-60, S-61.

The effects of 45-deg head-up tilt (HUT) and 45-deg head-down tilt (HDT) on the parameters of lung ventilation and perfusion were investigated. Pulmonary pulses, base transthoracic impedance, and cardiac output were measured in six healthy men, and total peripheral resistance was calculated from cardiac output and blood pressure; changes in pulmonary blood volume were measured using Tc-99-labeled RBCs. Compared to supine position, HUT and HDT (less significantly than HUT) increased blood pressure; HUT resulted in significant decrease in the cardiac output. As a result, total peripheral resistance in HUT remained higher than in the other two positions. On the other hand, the HDT caused a significant decline in blood gas, implying that some unknown changes have occurred in the pulmonary-circulatory system.

**A88-12323 Effect of brain blood flow on hypoxic ventilatory response in humans.** M. NISHIMURA, A. SUZUKI, Y. NISHIURA, H. YAMAMOTO, K. MIYAMOTO et al., *Journal of Applied Physiology* (ISSN 0161-7567), Vol. 63, Sept. 1987, pp. 1100-1106. 21 Refs.

The effect of brain blood flow on hypoxic ventilatory response was assessed by simultaneously measuring arterial and internal jugular venous blood gases and ventilation in healthy male humans subjected to either progressive and subsequently sustained hypoxia or to stepwise and progressive hypercapnia. A withdrawal test (modified transient O<sub>2</sub> test) was performed on another day. The average of the estimated depressant effect due to increased brain blood flow in progressive isocapnic hypoxic ventilatory response was about 122 percent of the original response. The value of the withdrawal test correlated significantly with the hypoxic response in each subject. The results suggest that the wide interindividual variation of the hypoxic response that was observed more likely depends on the activity originated from the peripheral chemoreceptor rather than the magnitude of central depressant effects due to the change of brain blood flow.

**A89-19879 Study on pilot workload - Hormone response to flight stress.** HIDEO TARUI, *Japan Air Self Defence Force, Aeromedical Laboratory Reports* (ISSN 0023-2858), Vol. 28, Dec. 1987, pp. 155-163. 17 Refs.

This study deals with the endocrine responses to flight stress in F-4EJ fighter pilots engaged in seven successive sortie missions. Saliva and urine sampling was made prior to first flight, just after each sortie, and on a nonflight (control) day. The following hormones were measured: saliva cortisol and urine 17-OHCS, free cortisol, and catecholamines. It is suggested that changes in these hormones may reflect physical and mental stress of the pilots during the successive flights.

**A87-51178 Some characteristics of peripheral vision.** TADAHIKO FUKUDA, *NHK Technical Monograph* (ISSN 0077-2631), Jan. 1987, pp. 3-38. 22 Refs.

Some of the characteristics of peripheral vision were investigated not only as a pure way of understanding the visual system but also as a basis for wide angle display and other technical applications. Flicker perimetry and flicker perception are dealt with, and relationship between the conditions under which motion and retinal location can be perceived is given. The function of the visual field in figure perception and character recognition, and the relationship between recognition of character string and the lateral interference effect are also dealt with. Finally, information capacity for various characters is given with the discussion on lateral interference effect.

**A87-31697 Changes of skin potential level and of skin resistance level corresponding to lasting motion discomfort.** NAOKI ISU, JIRO KOO, and NOBUYUKI TAKAHASHI, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 58, Feb. 1987, pp. 136-142. 15 Refs.

The qualitative correspondence between degree of motion discomfort and electrodermal activity was investigated. Skin potential level (SPL) and skin resistance level (SRL) in the arousal sweat area and the thermal sweat area were recorded. In order to induce motion discomfort, Coriolis stimulation and/or horizontal body rotation were provided by using a rotatory chair. The degree of discomfort was evaluated according to reports by the subjects. It was observed that SPL depolarized in the arousal sweat area as well as in the thermal sweat area and SRL lowered in the thermal sweat area coincidentally with lasting motion discomfort. SPL showed better correspondence to lasting motion discomfort than did SRL, especially during the recovery period from the motion discomfort.

**A88-12440 Magnetic effect on cardiopulmonary function in man.** OSAMU OKAI, *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb. 1987, pp. S-49, S-50.

The effect of a magnetic field on pulmonary function was investigated, using human subjects placed between the poles of a magnet whose maximum field intensity could be varied. The subjects were requested to maintain voluntary apnea by holding their breath for 30 sec, while their oxygen saturation curve, ECG, pulse wave, and respiratory wave were recorded. During apnea, the mean time ECG exhibited no change, the amplitude of the pulse wave was reduced, and the respiratory wave did not appear. The oxygen saturation curve descended to the minimum point of oxygen saturation, and, thereafter, ascended to the normal level. The application of a magnetic field of 1.2 kg caused a significant fall in the oxygen saturation decrease ratio. The results are attributed to the fact that the magnet attracts oxygen and deoxyhemoglobin, but not oxyhemoglobin, which gravitates downward.