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# USSR Space Life Sciences Digest

*Issue 2*

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# USSR Space Life Sciences Digest

*Issue 2*

*Edited by*

Lydia Razran Hooke, Mike Radtke,  
Victoria Garshnek, Joseph E. Rowe,  
and Ronald Teeter

*Management and Technical Services Company  
Washington, D.C.*

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Scientific and Technical  
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1985

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To our readers: We are working in a large number of highly technical, specialized areas for which adequate Russian-English glossaries have yet to be compiled. We ask your help in improving the accuracy and specificity of our English terminology. Please fill out the form below whenever you encounter an incomprehensible, incongruous, awkward or otherwise inappropriate term. While we solicit all suggestions for improved renderings, the statement that a term is inappropriate provides us with useful information, even when no better alternative can be suggested. A copy of this form will appear in all future issues of the digest. Thank you for your help.

Abstract #	Incorrect or contextually inappropriate word or phrase:	Suggested rendering: ("???" is an acceptable entry)

Dr. Lydia Hooke  
Management and Technical Services Company  
600 Maryland Ave. SW  
Suite 209, West Wing  
Washington, DC 20024

## FROM THE EDITORS

This is the second issue of the USSR Space Life Sciences Digest. The reader will notice a number of new features not appearing in the first issue. First, where figures in the original articles convey complex results clearly, we have included reproductions of them in our abstracts. Second, when authors' affiliation is provided by the journal, we have included this information in the bibliographic citation. (Note: Space Biology and Aerospace Medicine does not cite affiliation for any of its authors.) Third, we have provided a list, including full bibliographic citations, of titles we considered abstracting but rejected because of space limitations. Fourth, we have translated Soviet reviews of two books abstracted in our last issue in a new Book Review Section. Fifth, for one monograph, we have translated the section relevant to space life sciences, in lieu of offering an abstract in the usual format. We encourage readers to send us comments on the utility of these new features and the desirability of retaining them.

Exobiology, Biospherics and Space Biology. We are still actively searching for additional Soviet publications relevant to Exobiology, Biospherics (formerly Global Biology) and the effects of space flight factors on plants and lower animals (Space Biology). Readers' nominations of such publications would be greatly appreciated.

Reader Survey. The reader survey, which has been sent to everyone on our mailing list, was designed to provide us with the information necessary to ensure that the Digest is as useful and relevant to its audience as possible. If you have received a survey and not yet returned it, we urge you to do so. If you did not receive a survey and would like to participate, please write to us at the address below. We also call your attention to the reader feedback sheet which will be included in every digest issue. Please use this sheet to suggest improvements in our technical terminology or simply to indicate where this terminology needs improvement.

Abstract Numbers. Preceding the citation for each abstract is a number which serves as a unique identifier for that abstract and the original on which it is based. The initial letter in this identifier indicates whether the original is a periodical article (P), a monograph (M), or book review (BR). If, in future issues, it seems appropriate to include additional types of material in the Digest, additional letters will be used. The second element of the identifier is a number uniquely and consecutively assigned to each abstract within its material type. The third element of the identifier, enclosed in parentheses, refers to the date of the issue in which the abstract is included. An asterix following a P abstract indicates that the original came from the journal, Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina [Space Biology and Aerospace Medicine], which we abstract in its entirety.

Citation formats. Bibliographic citations in the digest follow the format proscribed by the Council of Biology Editors in the version used by the American journal, Aviation, Space, and Environmental Medicine.

Authors' Names. Some of our readers may find it useful to learn more about the information to be derived from author's names as cited in technical literature. All ethnic Russians and the majority of members of the other nationalities in the Soviet Union use two initials, referring to first name and patronymic (name derived from father's first name). An author with a Slavic sounding name with only one initial cited is virtually certainly a citizen of one the Soviet bloc nations outside the USSR. Because of the way the Russian language handles gender, with the exception of obviously non-Slavic surnames, any author whose surname ends in "a" is a woman. Because many Soviets do not have Russian names, the converse is not true: an author whose name does not end in "a" may also be female. However, a surname ending in "ov", "ovich", "in" or "skiy" invariably belongs to a male.

ADDRESS CORRESPONDENCE TO:

Dr. Lydia Hooke  
Management and Technical Services Company  
600 Maryland Ave. SW  
Suite 209, West Wing  
Washington, DC 20024



## PERIODICALS

### ADAPTATION

(See also Cardiovascular and Respiratory Systems: P55; Hematology: P50, P90; Radiobiology: P55.)

P52(8/85) Bobrov LL. Effect of the adaptation facilitator bemityl on seasonal and diurnal fluctuation in the physical work capacity of people stationed in the Antarctic. Informativnyy Byulleten' Sovetskoy Antarkticheskoy ekspeditsii. 105: 59-64; 1984. [8 references; none in English] Affiliation: Arctic and Antarctic Scientific-Research Institute [AANII] (Publication)

Adaptation, Drugs  
Humans, Antarctic Regions  
Performance, Physical Work Capacity

Abstract: This study involved the administration of bemityl, a general adaptation facilitator to six workers stationed in the Antarctic for three 4-week periods during the spring, summer and fall. Bemityl is described as a Soviet synthetic drug. A matched control group was also used. Work capacity was measured, using the PWC<sub>170</sub> procedure, with graded physical exercise tests on a bicycle ergometer. Measurements were taken three times a day over a three-day period before the beginning of bemityl administration and during each administration period. Work capacity of the treatment and control subjects was lower in the second and third series of tests (after 3 and 6 months in the Antarctic), as compared to the baseline levels. No significant differences between the two groups were found. In the fourth series of tests, performed in December after 9 months in the Antarctic, when the group under R<sub>x</sub> was taking the drug for the third time, the work capacity of the its members began to show recovery (significant for some times during the day), while the control group continued to decline. Differences between groups were significant for some tests in this series. Long-term use of this drug for Antarctic residents is recommended.

Table and Figure Titles: Table 1: Physical work capacity of people stationed at the Antarctic in the experimental and control groups

Table 2: Physical work capacity of people stationed at the Antarctic in the experimental and control groups per kilogram body weight

Figure 1: Seasonal and diurnal changes over time in physical work capacity of people stationed at the Antarctic (per kilogram body weight)

## BIOMEDICAL DATA AND CYBERNETICS

P84(8/85)\* Nidekker IG, Nechayev AP, Brodetskaya YeYe, Zarovnyy AV, Ryzhov BN, Stepanov VA, Odinov GI. Development of an interactive system for data processing in human factors engineering experiments. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 78-81; 1985. [7 references; none in English]

Biomedical Data Processing, Human Factors Engineering  
System Description  
Man-Machine Systems

Abstract: This paper describes an automated system for recording operator performance in compensatory tracking tasks. The system has the capability to accept input of physiological data and performance characteristics of an operator in real time, to calculate and display specified parameters, and also to record information on magnetic tape for storage and later comparative analysis of data. The system utilizes the MN-10 analog computer; the current version monitors seven parameters: heart rate, respiration rate, beta two and gamma waves (electroencephalogram), galvanic skin response and tracking errors. This system allows the experimenter to: 1) perform automated real-time analysis of indicators of physiological status and performance; 2) change the experimental conditions on-line; 3) process information from more than one subject; 4) store information about the experiment, which can subsequently be subjected to more complex analyses.

Figure Titles: Figure 1: Flow chart of an automated system for human factors engineering experiments

Figure 2: [Data from] An experiment on the relationship between two samples

Figure 3: Flow chart of an interactive system for primary statistical analysis of archival data stored by the automated system

## BODY FLUIDS

P67(8/85)\* Grigor'yev AI, Dorokhova BP, Semenov VYu, Morukov BV, Baychorov EO, Skukina IS, Afonin BV. Fluid-electrolyte metabolism and renal function in cosmonauts after an 185-day space flight. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 21-27; 1985. (14 References; 5 in English)

Body Fluids, Mineral Metabolism; Also Endocrinology  
Humans, Cosmonauts  
Space Flight, Salyut-6

Abstract: Fluid-electrolyte metabolism and renal function were studied in the two-man crew of the Salyut-6 orbital station, at several points before their 185-day flight and during the 12 days post-flight completion. Fluid-electrolyte metabolism was evaluated by analyzing the blood and/or urine for: 1) sodium and potassium; 2) total and ionized calcium; 3) magnesium; 4) creatinine; 5) concentration of the C-fragment of parathyroid hormone and thyrocalcitonin; 6) aldosterone concentration; and 7) renin activity. The ion exchange function of the kidneys was evaluated before and 2 days post-flight with a potassium and water loading test. The crew commander showed the expected fluid, sodium and potassium retention post-flight. The flight engineer, on the other hand, excreted more sodium post-flight than he did pre-flight, while his potassium excretion remained unchanged. Effects of space flight on the renin-angiotensin-aldosterone system also differed for the two crew members. The commander showed increased aldosterone concentration and renin activity, while the flight engineer showed no change in renin activity, and a greatly decreased aldosterone level. The authors consider these hormonal changes primary, and the shifts in sodium and calcium excretion secondary. They attribute the variable hormonal results to individual differences in regional hemodynamics. Both crew members showed diminished blood serum concentration of calcium and calcium ions, parathyroid hormone and thyrocalitonin. The loading test revealed increased excretion of calcium and magnesium post-flight for both crew members. This is attributed to the inability of the tissues to retain calcium during weightlessness.

Table and Figure Titles: Table 1: Elimination of fluid, concentration and rate of excretion of electrolytes immediately and 1 day post-flight

Table 2: Urinary excretion and consumption of electrolytes and fluid before and 2-12 days post-flight

Table 3: Concentration in blood of total and ionized calcium, parathyroid hormone and thyrocalitonin pre- and post-flight

Figures 1 and 2: See following page.

Figure 3: Elimination of potassium and its excreted fraction, concentration of insulin and aldosterone in the blood during a potassium loading test before and after a 158-day period of bedrest

P67(8/85)\*

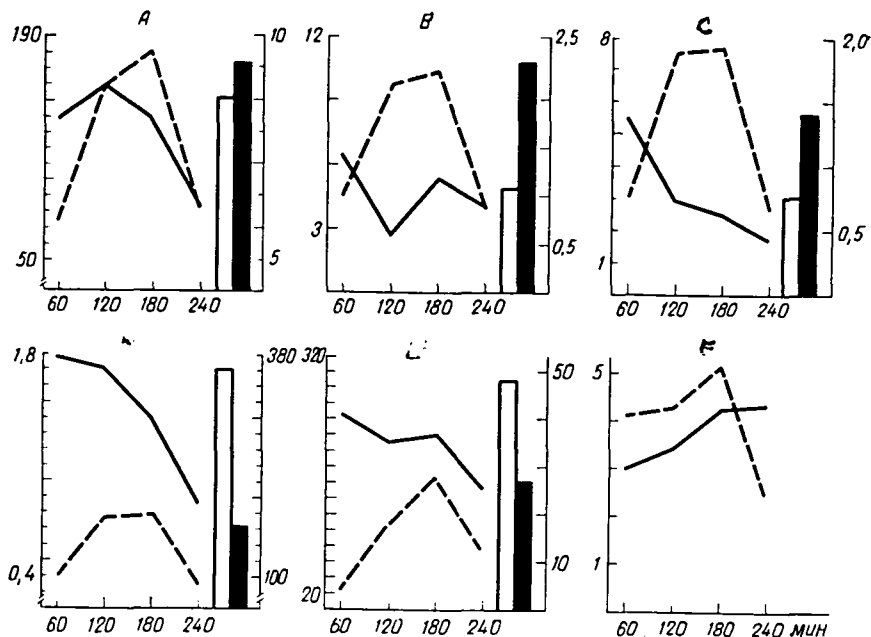


Figure 1: Diuresis, and rate of electrolyte (in m-equiv/min) and aldosterone (in picograms/min) excretion in potassium loading test on the crew commander pre- (solid line) and post-(dotted line) spaceflight

(For Figures 1 and 2: A - potassium; B - calcium; C - magnesium; D - fluid; E-sodium; F - aldosterone; Bars indicate excretion of substances in m-equiv. over 4 hour period; White bar - pre-flight; Black bar - post-flight)

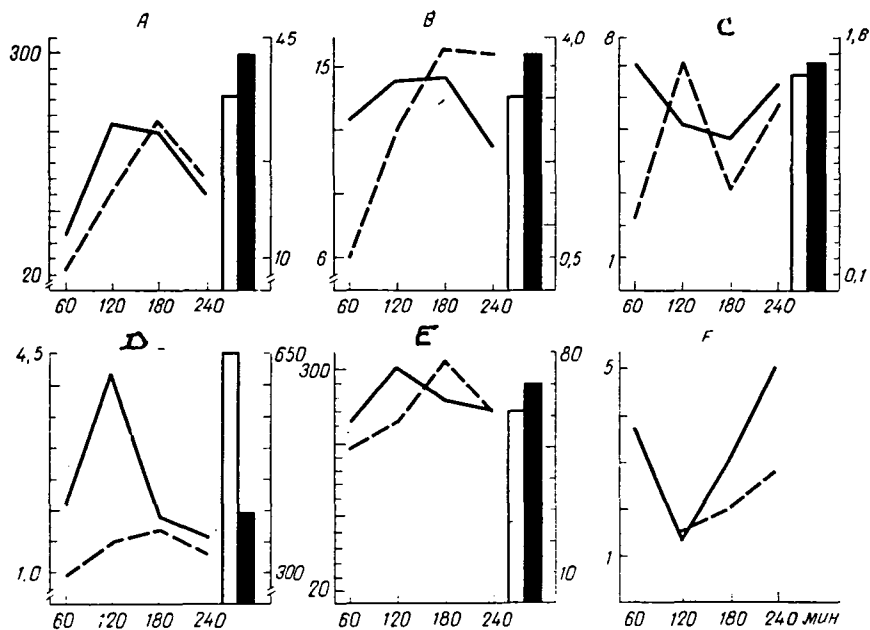


Figure 2: Diuresis and rate of electrolyte and aldosterone excretion in a potassium loading test on the flight engineer pre-(solid line) and post-(dotted line) space flight

BOTANY  
(See also Radiobiology: P88)

P80(8/85)\* Maksimova YeN. The effect of heavy charged particles (HZE) of galactic cosmic radiation on seeds. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):71-74; 1985. [4 references; 3 in English]

Botany, Cell Mutations; Also Radiobiology  
Lettuce, Seeds  
Radiation, HZE

Abstract: Seeds of the lettuce (Lactuca sativa) were exposed to space flight conditions on the "Cosmos-1129" biosatellite for 19 days and on the "Salyut-6" orbital station for 66, 123 and 308 days. The seeds were layered in biostacks alternating with layers of plastic HZE detectors. Each biostack also contained thermoluminescent dosimeters. Seeds which had been penetrated by HZEs were identified by holding each one up to the detector. The use of track detectors made it possible to distinguish the effects of HZE from those resulting from other space flight factors. After the seeds had been scanned, they were dampened and allowed to germinate. The resulting shoots were subjected to microscopic analysis for structural anomalies. A histological section was taken of the seeds in order to determine the exact structure hit by the HZE. When control seeds and seeds subjected to flight, but not hit by HZE were compared, difference in number of aberrant cells were significant only after the 308 day exposure, testifying to the relatively small effects of ionizing radiation and other space flight factors. Cells from seeds hit by HZE, for all exposure durations, showed more aberration than those which were not hit. The largest number of aberrant cells were produced after the 308 day flight, but the difference between number of aberrant cells for the two space flight groups was not significant. [Note: the authors imply but do not state that this difference was significant for the other flight durations.] No cells with two or more aberrations were found in the seeds not exposed to space. The proportion of such seeds increased with duration of exposure to space flight for both space flight groups. Seeds hit by HZE at all exposure durations showed more multiple aberrant cells than those which had not been hit. [No explicit mention is made of significance levels.] There were only enough seeds for a reliable examination of hit site for the "Cosmos" flight (19 days). For these seeds, it was found that the root meristems were the most susceptible to HZE effects

Figure Titles: Figure 1: Dimensions and location of sensitive structural elements in seeds of Lactuca sativa

P80(8/85)\*

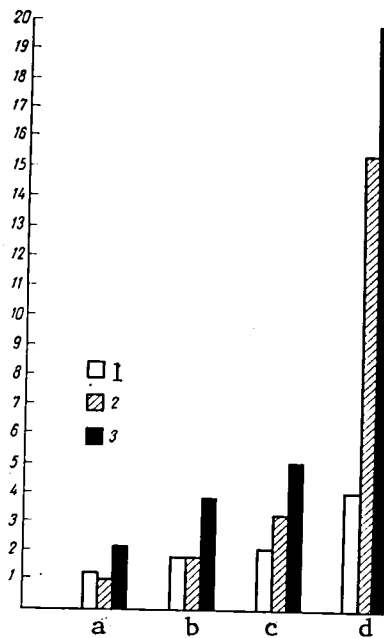


Figure 2

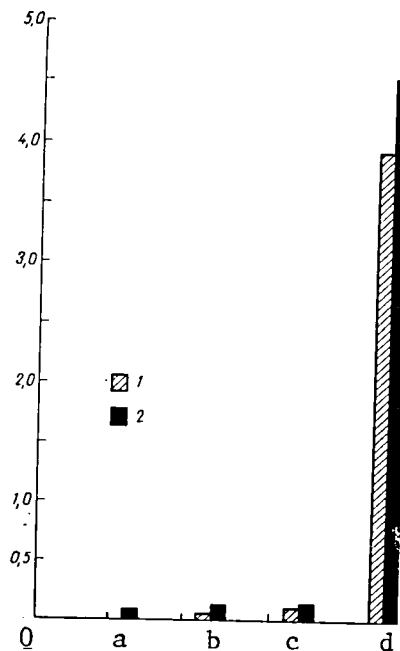


Figure 3

Figure 2: Number of aberrant cells in shoots from Lactuca sativa seeds exposed to space flight on a biosatellite and orbital station

Ordinate: Aberrant cells (in %); Abscissa: a - "Kosmos-1129" (exposure duration: 20 days); b, c, and d -- "Salyut-6" -- "Soyuz" (exposure duration: 66, 123, and 308 days); 1-control; 2-flight (baseline); 3- flight with HZE

Figure 3: Number of cells with multiple chromosome aberrations in shoots of Lactuca sativa exposed to space flight on a biosatellite and orbital station

Ordinate: Cells with multiple chromosome aberrations (in %); Abscissa: a - "Kosmos-1129" (exposure duration: 19 days); b, c, and d - "Salyut-6" -- "Soyuz" (exposure duration 66, 123, and 308 days respectively); 1 - flight (baseline); 2 - flight with HZE

Figure 4: Number of aberrant cells as a function of site hit by HZE during exposure to space flight on the "Cosmos-1129" biosatellite

P63(8/85) Vikhrov AI, Kovalev YeYe, Maksimova YeN, Nevzgodina LV, Potapov YuV. Cytogenic changes in cells of lettuce seedlings during irradiation with a beam of accelerated carbon nuclei. Radiobiologiya. XXV(1): 24-28; 1985. [4 references; 1 in English] Affiliation: Institute of Medicobiological Problems, USSR Ministry of Health, Moscow  
 Botany, Cells; Also Radiobiology  
 Lettuce, Seeds  
 Radiation, Heavy Nuclei

Abstract: This study investigates hypotheses which attribute cellular changes in biological test subjects during space flight to single hits by HZE. Air-dried lettuce seeds were irradiated with a beam of  $^{12}\text{C}$  nuclei of 3.6 GeV(gigaelectron volts=1000 MeV)/nucleon produced by a proton-synchrotron accelerator. The intensity of the ion beam emitted could be reduced by defocusing the beam using an ion source. This made it possible to control the number of times the seeds were hit in a range from no hits at all to several hundred hits. Number of hits for each group of seeds was determined with a layer of photographic emulsion in the seed container. A control group of seeds were used. Forty days after irradiation, a cytogenetic analysis of rootlings in initial mitosis was performed. Radiobiological effects were assessed on the basis of frequency of aberrant cells and of cells with multiple aberrations. While irradiated cells showed a significantly greater number of aberrations than control cells, within the restricted experimental range of fewer than ten to several hundred hits, no significant effect of number of hits was found. The authors attempt to explain this lack of effect with reference to the passage of short-range strongly ionizing particles (black tracks) through the meristem of the plant root.

Table and Figure Titles: Table 1: Results of cytogenetic analysis of seeds irradiated with carbon ions with energy of 3.6 GeV(gigaelectron volts=1000 MeV)/nucleon.

Table 2: Typical irradiation doses, including secondary radiation sources, as a function of the number of carbon ions passing through seeds

Figure: Number of aberrant cells and cells with multiple chromosome fragments as a function of number of times lettuce seeds were hit by carbon ions

## CARDIOVASCULAR AND RESPIRATORY SYSTEMS

P55(8/85) Karabayeva AK, Milovanov AP. Morphometric changes in the pulmonary bronchial tree of rats in response to high altitude and post-adaptation. Zdravokhraneniye Kirgizii. 1985(2): 25-26. [References cited, but not listed.] Affiliation: Kirgis State Medical Institute, Scientific Research Institute for Human Morphology, Soviet Academy of Medicine

Cardiovascular and Respiratory Systems, Lungs; Also Morphology  
and Cytology  
Rats  
High Altitude, Adaptation

Abstract: Albino rats were kept at an altitude of 3200 m above sea level for 7 weeks. Ten animals were sacrificed at the end of this period to investigate adaptive changes and 10 were returned to sea level conditions and sacrificed 7 weeks later. Histological sections were stained to reveal the surface of the lumen and walls at three levels of the bronchial tree: the right inferior lobar bronchus, the muscular bronchioles and the terminal bronchioles. Adaptation to high altitude appeared to constrict the lumens of the large and muscular bronchi as also of the terminal bronchioles. This was accompanied by thickening of the walls of the large and muscular bronchi and a tendency toward thinning of the walls of the terminal bronchioles. After the 7 week post-adaptation period, the morphological changes in the lungs of the animals had not yet fully returned to their baseline level.



P56(8/85) Moldotashev IK, Tiliis YuA, Tenenbaum, AM. Non-invasive evaluation of the mitral regurgitation volume and pumping function of the left ventricle of the heart. Zdravokhraneniye Kirgizii. 1985(2): 27-29. [References cited, but not listed.]  
Affiliation: Kirgiz Scientific-Research Institute for Cardiology

Cardiovascular and Respiratory Systems, Mitral Regurgitation; Also  
Health and Medical Treatment  
Humans, Patients  
Health and Medicine, Diagnosis, Non-invasive

Abstract: To provide a non-traumatic, non-invasive evaluation of mitral regurgitation volume, the authors propose a technique utilizing simultaneous echocardiography of the left ventricle of the heart and thoracic rheoplethysmography. Mitral regurgitation volume is computed as the difference between the volume of blood ejected into the aorta (determined through echocardiography) and the effective stroke volume (determined through rheoplethysmography). When this technique is applied to patients with mitral valve insufficiency, the total estimated error is 15 ml. No significant differences were found between the results of the invasive and noninvasive techniques for measuring mitral regurgitation volume.

Table Titles: Table 1: State of endocardiac hemodynamics in patients with mitral valve insufficiency of various etiologies

Table 2: Changes over time in measures of endocardiac hemodynamics in patients with acute myocardial infarction during treatment with nitroglycerin

Table 3: Parameters of endocardiac hemodynamics in patients with mitral valve insufficiency resulting from rheumatism, obtained using the proposed technique and angiographic examination

P68(8/85)\* Kotovskaya AR, Dimitrov DG, Luk'yanyuk VYu, Vil'Vil'yams IF, Golovkina OL, Andreyeva VG, Artamonova NP, Kuz'min MP (Bulgaria, USSR). Tolerance of healthy and arteriosclerotic middle-aged subjects to  $+G_z$  and  $+G_x$  acceleration. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 27-31; 1985. (6 references; 2 in English)

Cardiovascular and Respiratory Systems, Tolerance  
Humans, Patients, Arteriosclerosis  
Acceleration, Centrifugal

Abstract: Tolerance to centrifugal acceleration was determined in two groups of individuals in three consecutive test runs. One group (N=134, age=35-49) included healthy individuals, while members of the other (N=57, age=40-49) had been identified through rheoencephalography as showing the early signs of arteriosclerosis, with (Series I) and without (Series II and III) clinical symptoms. In the various tests, subjects were subjected to  $4-7+G_z$  for 30 seconds increasing up to the tolerance limit (Series I); to 3, 4 and 5  $+G_z$  for 30 seconds (Series II) and to 4- and 6- $+G_x$  for 60 seconds (Series III). All subjects were seated and the angle between the chair back and acceleration vector was  $12^\circ$  (I and II) or  $-78^\circ$  (III). In all tests measurements were made of heart rate, EKG, and arterial pressure in the brachial artery. Systolic arterial pressure of the vessels of the ear lobe as an indicator of cerebral blood circulation. In the first set of tests, tolerance limits of arteriosclerotic adults was 0.23 units lower than that of healthy counterparts (5.7, as opposed to 5.93), [but this difference may not have been statistically significant]. The major symptom limiting the tolerance of both groups was visual disturbances, noted in 50% and 29% of the arteriosclerotic and healthy subjects, respectively. Loss of consciousness occurred in 15.5% and 9.56% of these same groups. Resting heart rate and increases in heart rate during loadings to the tolerance limit appeared equivalent for both groups. Although members of both groups exhibited disturbances of cardiac rhythm, there was no difference between them. No differences were found in systolic pressure in the ear lobe or in systolic and diastolic pressure in the brachial artery. In the second series of tests, using only 7 people in each group, arteriosclerotic subjects exhibited threefold increase in extrasystolic arrhythmia. Other monitored physiological parameters did not show significant differences. Results of the three series taken together indicate that differences between the physiological reactions to acceleration stress of arteriosclerotic subjects and those of their healthy counterparts depends on the level of acceleration, as well as the degree of severity of the arteriosclerosis (Series I vs. Series II and III). The authors conclude that these results indicate the importance of evaluating acceleration tolerance individually for adults above the age of 40, both for those who are healthy and for those with signs of arteriosclerosis.

Table and Figure Titles: Table: Frequency and nature of disturbances in heart rhythm under the influence of up to 5  $+G_z$  and up to 6  $+G_x$  in healthy individuals and subjects with arteriosclerosis aged 40-49

P68(8/85)\*

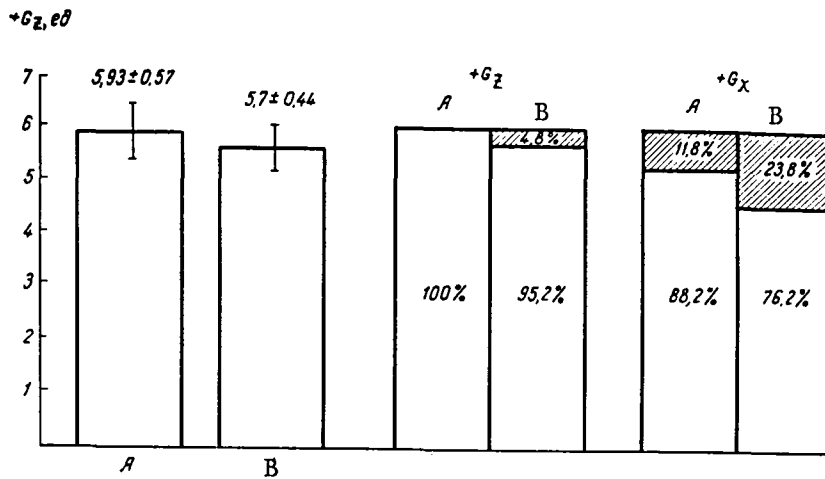


Figure 1

Figure 2

Figure 1: Tolerance limits  $+G_x$  acceleration on the Bulgarian centrifuge for healthy individuals aged 35-39 (A) and individuals with arteriosclerosis aged 40-49 (B)

Figure 2: Tolerance for acceleration on the Soviet centrifuge of up to  $5 +G_z$  and up to  $6 +G_x$  in healthy individuals (A) and subjects with arteriosclerosis aged 40-49 (B)

(White areas - good or satisfactory tolerance; cross-hatched areas - depressed tolerance)

P70(8/85)\* Vol'vach SI, Kovalenko YeA, Ponomarev SI, Gabyshev VK, Nikiforov VI, Kulev AP, Arkhipov VV. Oxygen supply and regional circulation in the gingival mucosa in response to lower body negative pressure. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 33-37; 1985. [6 references; none in English]

Cardiovascular and Respiratory Systems, Peripheral Circulation  
Humans, Males  
Lower Body Negative Pressure

Abstract: This study investigated oxygen supply to and blood perfusion in the gingival mucosa in response to lower body negative pressure as indicators of the efficiency of the compensatory responses of the cardiovascular system to LBNP. Five healthy males were subjected to LBNP utilizing the following profiles: -25 mm Hg for 2 minutes; -35 mm Hg for 3 minutes; -40 mm Hg for 5 minutes; -50 mm Hg for 5 minutes; recovery period -- 10 minutes. A total of 18 trials were conducted. For each subject an electrocardiogram and kinetocardiogram of the left heart were taken at rest and during LBNP. The functional status of the regional circulation system and oxygen supply to the tissues of the gingival mucosa was evaluated using impedance plethysmography and polarography. Data analysis was performed by computer. After two minutes, subjects who tolerated LBNP well (n=3) [It is not stated how this tolerance is operationally defined.] demonstrated a pronounced compensatory reaction of the vascular bed of the gingival mucosa. This reaction involved an increased rheographic index and increased  $pO_2$ , which exhibited sinusoidal variations, in these tissues. When LBNP was increased  $pO_2$  dropped, but rose again after 1-2 minutes. In these same subjects heart rate increased an average of 25% and minute volume increased by 13.6%. Stroke volume was held at its normal level by means of some slight changes in the volumetric parameters of the left heart. The two subjects who tolerated LBNP only moderately well showed little or no compensatory reaction in the tissues of the gingival mucosa. The level of  $pO_2$  showed no sinusoidal variations, and when two of the subjects reacted to the highest pressure by nearly losing consciousness the level of  $pO_2$  dropped sharply. These subjects showed a 55 percent increase in heart rate pulse and a 41 percent increase in minute volume. Stroke volume was maintained at its initial level, but only by virtue of more pronounced changes in the volumetric characteristics of the left heart. These results are interpreted as indicating that the magnitude of centralized compensatory reactions on the part of the cardiovascular system are inversely related to the magnitude of local compensatory reactions of the vessels of the area studied. The authors explain this with reference to activity of anastomoses arteriovenosa which facilitate adaptive centralization of circulation.

Figure Titles: Figure 1:  $pO_2$  in tissues of the gingival mucosa during LBNP

Figure 2: Polar diagrams of the volumetric activity of the left heart at rest and during LBNP

P71(8/85)\* Fomin IO, Orlov VN, Radzevich AE, Leksin GS. The effect of immersion in water on central hemodynamic parameters in individuals over 45. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 1985; 19(3):37-40. [12 references; 3 in English]

Cardiovascular and Respiratory Systems, Blood Pressure  
Humans, Patients, Arterial Hypertension, Middle-aged  
Water Immersion

Abstract: A total of six male subjects were used in this study. Four subjects (all over 45) had a history of borderline arterial hypertension; the remaining two were healthy. Subjects were exposed to 7 days of "dry" immersion, during which arterial pressure was measured every two hours. Blood pressure measurements were also taken before immersion and during the first two days of the readaptation period. The mean dynamic pressure (defined as systolic pressure + 2 diastolic pressure divided by three) was computed and the number of times pressure exceeded 139/89 mm Hg was recorded. A coefficient of diurnal covariance was computed to indicate instability of cardiovascular reaction. Central venous pressure was measured before, after and twice during immersion. Central impedance plethysmography was performed before, twice after and on days 1, 3, 5 and 7 of immersion. For all measurements, the mean dynamic pressure was greater for the patients than for the healthy controls. Effects of immersion on members of the experimental group differed: for 2 subjects mean dynamic pressure was lower than the baseline level by 4 and 7 percent and for the remaining two it rose by 4 percent. For the two healthy individuals this value dropped after immersion by an average of 2.5 percent. In the first day of readaptation, blood pressure rose significantly over the baseline in all subjects but one. On the second day of readaptation it had returned to normal in all six subjects. Examination of the diurnal covariance coefficient indicated greater instability in the cardiovascular reactions of the patients, during both the baseline period and immersion. Immersion increased the coefficient for all subjects. No significant differences were found between the experimental and the healthy groups with respect to the effect of immersion on: stroke volume and cardiac indices, heart rate, central venous pressure, or total peripheral resistance. The stroke volume and cardiac indices decreased; central venous pressure and total peripheral resistance increased; and heart rate remained the same. The authors conclude that the hemodynamic response to immersion is a general reaction which does not vary with age or functional disorders of the cardiovascular system characteristic of older people.

Table and Figure Titles: Table 1: Coefficient of covariance of mean dynamic arterial pressure over the course of the study

Table 2: Total peripheral resistance over the course of the study

Figure 1: Mean arterial pressure over the course of the study

Figure 2: Central venous pressure over the course of the study

Figure 3: Stroke volume index over the course of the study

P78(8/85)\* Bednenko VS, Polyakov VN, Dvornikov MV, Stepanov VK, Kozlov AN. The effect of acute hypoxia on coronary and systemic circulation. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):64-68; 1985. [14 references; 3 in English]

Cardiovascular and Respiratory Systems, Coronary Circulation  
Humans  
Hypoxia

**Abstract:** Eleven healthy individuals were exposed in a low pressure chamber to rarefaction of up to 321 mm Hg until their tolerance limits were exceeded. Heart rate, blood pressure and coronary circulation data were recorded using EKG, blood pressure, and Doppler echocardiogram apparatus. Symptoms of hypoxia (tremor, hyperkinetic disturbances) appeared after an average of 10.3 minutes and subjects remained in the chamber for an average of 17 minutes. Respiratory rate showed signs characteristic of the development of hyperventilation and hypocapnia. Hemodynamic changes appeared within 3-5 minutes. Heart rate increased from 66 beats/minute to 89-98 beats/ minute, reaching 112 by the time overt symptoms developed. Before the 17th minute, systolic pressure had risen to 25 mm Hg and diastolic pressure had dropped. By the 15th minute, effective coronary stroke volume had increased by a factor of two before dropping to 1.43 times its initial level. The minute volume of coronary circulation followed a similar pattern, increasing by the 15th minute by a factor of three and then dropping. The authors suggest that the observed progressive increase in the level of hemodynamic responses reflects a short period of temporary adaptation to the hypoxic conditions continuing until physiological reserves are fully utilized. After this point a crisis reaction occurs and the adaptation process stops, resulting in an increased accumulation of non-oxidized metabolic products in the coronary tissues. The observed breakdown of adaptive reactions in coronary circulation precede by a number of minutes manifestations of general circulatory disturbances. For this reason, the authors recommend that coronary circulation be monitored during exposure to hypoxia.

**Table Titles:** Table 1: Hemodynamic and external respiration parameters as a function of length of exposure to hypoxia

Table 2: Coronary circulation and myocardial contraction parameters as a function of length of exposure to hypoxia

P85(8/85)\* Kazakova PT, Yurenev AP, Kulayev BS, Nazin AN, Shevchenko YuV. Results of echocardiographic examinations of Macaca mulatta at rest. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 1985; 19(3): 81-84. [8 references; 5 in English]

Cardiovascular and Respiratory Systems, Echocardiography; Also Health and Medicine  
Primates, Macaca mulatta  
Validation

Abstract: This paper summarizes an echocardiographic examination of 20 rhesus monkeys (^UMacaca mulatta^U) at rest. The American "Echoview 80-C" (Picker [sic: Hewlett Packard?]) echocardiograph was used to measure the left ventricle of the animals' hearts. It was found that anatomical peculiarities of the monkey's chest cavities and their higher pulse rate make this procedure more difficult to use and interpret than when human subjects are used. However, this work generated normative data and demonstrated the feasibility of using ultrasound methods for studying the cardiac parameters of primates.

Figure Title: Figure 1: Echogram of the left ventricle of a rhesus monkey, taken with the "Echoview-80" echocardiograph

Figure 2: Echogram of the base of aorta of a rhesus monkey, taken with the "Echoview-80" echocardiograph

Figure 3: Echogram of the left ventricle of a rhesus monkey taken by the "Uzkar-3" echocardiograph

Figure 3: Incorrect recording of an echogram of the left ventricle of a rhesus monkey taken by the "Uzkar-3" echocardiograph

## GASTROINTESTINAL SYSTEM

P72(8/85)\* Medkova IL, Nikolayeva NM, Zhiznevskaya OV. Lipid hydrolysis in humans during hypokinesia with head-down tilt. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):40-44; 1985. [10 references; none in English]

Gastrointestinal System, Lipid Hydrolysis, Liver Function  
Humans, Males  
Hypokinesia, Head-down Tilt

**Abstract:** To investigate the effects of simulated space flight conditions on hydrolysis of lipids, six men were subjected to an 120-day period of bedrest with head-down tilt of  $-4.5^{\circ}$ . The experimenters measured the concentration of enzymes in the A-bile, the concentration of lipoprotein complexes in the B- and C- bile, the activity of pancreatic lipases in the A-bile, blood serum and urine and the activity of monoglyceride lipase in the bile and feces. Finally, the concentration of lipids in the feces (mono-, di-, triglycerides and total lipids) was evaluated. The bedrest apparently led to a substantial decrease of pancreatic lipase in the bile and an increase of pancreatic lipase in the blood serum (with large individual differences). Such effects demonstrate that the activity of lipases entering the gastrointestinal tract is depressed, resulting in decreased efficiency of fat hydrolysis. The most substantial decrease in lipid complexes in the bile was noted in the C-bile; this indicates that the synthetic function of the liver was also disrupted by the experimental treatment. Analysis of lipid digestion in the intestines points to an induction of the activity of monoglyceride lipases and of alkaline phosphatase to compensate for sharply decreased activity of lipolytic enzymes. In spite of decreased efficiency in lipid hydrolysis, steatorrhea (excess fat in the feces) did not occur, indicating that bile secretion was still sufficient. The authors conclude that the restructuring of types and amount of lipolytic enzymes in the gastrointestinal tract during head-down hypokinesia demonstrates the development of compensatory/adaptive processes in the digestive system which work toward optimizing the hydrolysis and transport of lipids.

**Table Titles:** Table 1: Activity of pancreatic lipases and monoglyceride lipases in bile

Table 2: Activity of monoglyceride lipases and alkaline phosphatases in feces

Table 3: Concentration of the lipid complex in the B- and C-bile



## HABITABILITY AND ENVIRONMENTAL EFFECTS

(See also Health and Medical Treatment: P61, P83; Hematology: P54;  
Immunology: P79)

P81(8/85)\* Sedov AV, Akimov VI. Metering out the dosage of volatile compounds in hypobaric experiments. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):74-75; 1985. [10 references; 2 in English]

Habitability and Environmental Effects, Gas Composition  
Apparatus Description  
Volatile Substances

**Abstract:** Existing apparatus is not suitable for metering out the amount of volatile substances (e.g, phenol, benzene, toluene, ammonia) in the atmosphere in hypobaric experiments. This paper describes an apparatus specifically designed for such a purposes.

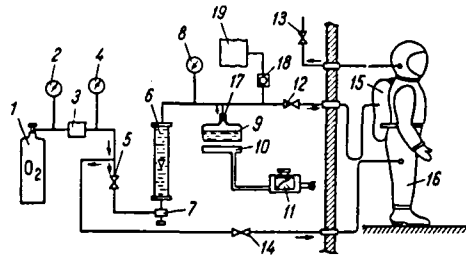


Figure Title: Apparatus for metering out the dosage of gaseous substances

## HEALTH AND MEDICAL TREATMENT

(See also Cardiovascular and Respiratory Systems: P56, P85;  
Psychology: P60)

P61(8/85) Kokhanov VP, Nikitin YeA. The effect of electro-acupuncture on the work capacity of ship crew members on long-term cruises. Voenno-meditsinskiy Zhurnal. 1984(4): 69-70. (No references)

Health and Medical Treatment, Electroacupuncture  
Humans, Crew, Ship  
Work Capacity, Productivity

Abstract: An unspecified number of technical crew members were stimulated with dry electrodes on the Gi-11 and Gi-4 acupuncture points for 12-15 minutes either directly before or during the second hour of a four-hour watch. This procedure was performed once a day for 5-6 days during the second month of a cruise. Work capacity was indirectly assessed through psychophysical indices developed by I.P. Sapov and correlated significantly with sailors' work capacities. These indices include simple and complex sensory-motor reactions, critical frequency at which light flickers are seen to merge, reactions to a moving object, performance on a tapping test, and manual dynamometry. Results were mixed and differed for different job classifications. However, preliminary data are interpreted as indicating that electrostimulation of acupuncture points may diminish fatigue for sailors with jobs involving high demands on sensory responses.

Table Title: Indirect indices of work capacity for ships' specialists as a function of electro-acupuncture

## HEALTH AND MEDICAL TREATMENT

P83(8/85)\* Zal'tsman GG, Kuchuk GA, Rovnyy. Identifying individual differences in susceptibility to hyperbaric oxygen. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):76-77; 1985. [3 references; none in English]

Health and Medical Treatment, Oxygen Toxicity; Also Habitability and  
Environmental Effects  
Humans, Individual Differences  
Hyperoxia

Abstract: In an attempt to develop a methodology for selecting personnel on the basis of susceptibility to oxygen toxicity, 54 individuals were subjected to 0.25 MPa in a hyperbaric chamber (partial oxygen pressure = 0.28 MPa) for 1.5 and 2 hours. Pilot experiments using 0.2 MPa failed to produce effects. The physical status of the subjects was monitored by a physician and measurements using electroplethysmography of the index finger, and galvanic skin response were made. By the 12th to 30th minute of exposure, five of the subjects experienced the initial symptoms of oxygen toxicity (bradycardia and local twitching of muscles), while the majority neither displayed nor reported any signs of distress. However, all of the recorded measurements revealed the effects of hyperoxia, with no significant differences between the five particularly sensitive subjects and the others.

## HEMATOLOGY

(See also Musculoskeletal System: P58; Radiobiology: P57.)

P50(8/85) Deribas VI, Ostan'kovich AA, Pogozhev IB, Sitnikov AP, Fedorova OP. Statistical analysis of the leukocyte ratios used to assess adaptive reactions. *Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR*. 6(1): 121-128; 1985. [19 references; 12 in English]  
Affiliation: Institute for Cytology and Genetics, Siberian Division, USSR Academy of Sciences

Hematology, Leukocytes; Also Adaptation  
Humans  
Statistical Processing, Confidence Intervals

**Abstract:** In order to assess adaptive reactions reliably on the basis of the ratio of segmented neutrophils to lymphocytes in the blood, one must calculate confidence intervals for the cell count. However, because of requirements for repeated sampling, standard statistical methods for computing such intervals are seldom practical. This paper proposes an alternative method for computing confidence intervals, utilizing the statistical distribution of cells in a blood smear, and determines confidence intervals for three types of adaptive reaction using the lymphocyte/segmented neutrophil ratio. A graph of the 95% and 99% confidence intervals for stress, training and activation reactions is presented. This graph provides an easy method of assessing adaptive reactions with stipulated reliability, if leukocyte ratios are known.

**Table and Figure Title:** Table 1: Leukocyte components of human blood in various adaptive reactions (%)

Table 2: Ratios of the percentage of lymphocytes to segmented neutrophils in various adaptive reactions

Table 3: 95% and 99% intervals for the absolute number of lymphocytes and neutrophils as a function of their sum

Table 4: Absolute values of lymphocytes and neutrophils in samples of varying sizes determined on the basis of the leukocyte composition of human blood

Figure 1: Theoretical Poisson distribution (1); Empirical distribution of the number of lymphocytes (2)

Figure 2: 95% and 99% confidence intervals for activation, training and stress reactions

P54(8/85) Volzhskaya AM, Troshikhin GV, Shumilova TYe. Oxygen transport capacity of the blood and erythropoiesis in rats after prolonged exposure to nitrogen-oxygen gas mixture under high pressure. *Fiziologicheskii Zhurnal SSSR (imeni I.M. Sechenov)*. 71(3): 320-324; 1985. [12 references; 2 in English]. Affiliation: Pavlov Institute of Physiology, USSR Academy of Sciences, Leningrad

Hematology; Also Habitability and Environmental Effects

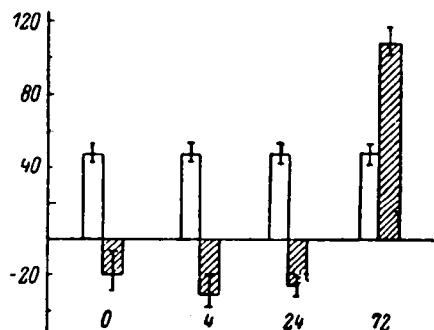
Rats

Hyperbaric Chambers, Gas Mixture

**Abstract:** Seventy rats were kept for 10 days in a hyperbaric chamber breathing a mixture of nitrogen and oxygen under pressure of 2000 kPa. The animals were sacrificed and blood obtained immediately, and 4, 24 and 72 hours after gradual decompression. Hemoglobin content, level of the hematocrit, quantity of erythrocytes, and concentration of 2,3-diphosphoglycerate in the erythrocytes, and the content of erythropoietin in the blood plasma were measured. Immediately and 4 hours after decompression, the rats' blood showed increases in concentration of hemo globin, level of hematocrit, and quantity of erythrocytes relative to control animals. These changes were no longer evident 24 and 72 hours after decompression. Concentration of 2,3-diphosphoglycerate was higher for experimental animals immediately, and again 72 hours after decompression. Immediately, 4 and 24 hours after decompression, experimental animals showed sharp decrements in erythropoietic activity compared to controls; however, after 72 hours experimental animals showed higher levels of erythropoiesis than the controls. The changes noted in experimental animals in response to increased barometric pressure all have the effect of improving oxygen supply to the tissues. The long-term effects of hyperbaric exposure pressure lasted as long as three days after animals had returned to normal conditions.

**Table and Figure Titles:** Table 1: Indices of erythrocyte composition of the blood of control and experimental rats

**Figure 1:** Concentration of 2,3-diphosphoglycerate in the erythrocytes of rats after prolonged hyperbaria



**Figure 2:** Erythropoietic activity in blood plasma of rats after prolonged hyperbaria. Ordinate: erythropoietic activity (number of mitoses); Abscissa: time (hrs) after cessation of hyperbaria. White bars: control rats; Crosshatched bars: experimental rats.

P69(8/85)\* Khapilov NV, Panchenko VS, Kotov NN, Asyamolov, BF. The effect of hypokinesia and  $+G_z$  acceleration on the transport function of the blood. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 31-33; 1985. [8 references; none in English]

Hematology  
Humans, Males  
Hypokinesia, Acceleration

Abstract: This study attempted to evaluate alterations in the transport function of the blood in response to simulated space flight factors of hypokinesia and gravity loading. Experimental subjects were 14 men subjected to 7 days of hypokinesia with  $-10^\circ$  head-down tilt. Before and after this treatment, the subjects were subjected to acceleration of up  $4.5+G_z$ . Blood samples were obtained during the experiment, before the hypokinesia period, on the third and seventh day of hypokinesia, and after the final gravitational loading procedure. Parameters indicative of the transport fractions of the blood were obtained from the partition coefficient using  $^{14}\text{C}$ -adenine as the tracer ligand. The immiscible phases utilized were plasma:oil and erythrocyte:oil. In addition, EKG, impedance plethysmography, heart rate, minute volume, cardiac output, and left ventricle ejection time were recorded. Three days into the hypokinetic period the distribution coefficient of the tracer ligand had dropped by 12-14% from its initial value. This was accompanied by hemodynamic effects typical of hypokinesia. By the seventh day of hypokinesia the coefficient had increased by 32-40% from its initial value with the expected hemodynamic effects. In response to the  $+G_z$  acceleration the partition ratio increased by 145-150%. Thus, both hypokinesia and  $+G$  acceleration substantially alter the binding capacities of the transport carriers of the blood demonstrating that these carriers play an active role in the adaptive responses to these simulated space flight factors. The authors suggest the importance of obtaining indicators of the transport function of blood when assessing fluctuations in the human responses to such factors.

Figure Title: Figure: Changes in hemodynamic parameters and in the partition coefficient for  $^{14}\text{C}$ -adenine in the system: erythrocytes:oil during a 7-day period of hypokinesia

P90(8/85) Dudarev VP. Compensation and adaptation mechanisms of the blood system in response to hematic hypoxia. *Fiziologicheskii Zhurnal* (Akademiya Nauk Ukrainskoy SSR). 31(1):21-27; 1985. [21 references; 3 in English] Affiliation: A.A. Bogomolets Institute of Physiology, Ukrainian Academy of Sciences, Kiev

Hematology, Adaptation

Rats

Hematic Hypoxia

**Abstract:** This experiment used three groups of rats, totaling 120 animals. Two of the groups were subcutaneously injected with a 1% solution of sodium nitrite in water five times a week for 2 months, up to a maximum dosage of 30 and 50 mg/kg. The third group was a control. Animals from all groups were sacrificed 50-60 minutes or 24 hours after the injection, and on days 5-7, 10-15, 30 and 60 of the treatment. The concentrations of hemoglobin and methemoglobin, 2,3-DPG, lactic acid, ATP, pyruvic acid, catalase and carbohydase in the blood were determined, along with the oxygen carrying capacity of the blood. The most pronounced change observed, aside from the effects on total hemoglobin, involved acute methemoglobinemia, evident after a single sodium nitrite injection and continuing for 5 to 7 days. A tendency toward some normalization for some of the blood parameters was observed, beginning 10-15 days after the injections. The methemoglobin content of the blood of the animals receiving 30 mg/kg sodium nitrite exceeded that of the controls by 24.7% during the first few days of the experiment, 24 hours after their last injection. By the 10-15th day this level had decreased to only 3-8% above control values. The animals receiving 50 mg/kg increased their methemoglobin by 32%, but this level gradually returned to normal by the day 30 or 60. In the first 5 to 10 days of the treatment, the amount of 2,3-DPG, lactic acid and pyruvic acid decreased, indicating the presence of hypoxia. Subsequently, there was a tendency toward normalization in these components as well. The fractional composition of the hemoglobin changed, with I, II, V and VI fractional groups increasing under hematic hypoxia, III decreasing and IV remaining stable.

**Table and Figure Titles:** Table: The effect of sodium nitrate [sic; should be nitrite] (50mg/kg) on certain blood parameters in rats

Figure 1: The effect of nitrite methemoglobinemia (30 kg/mg) on changes in certain parameters of the blood

Figure 2: Changes in the fractional composition of hemoglobin in hematic hypoxia

## IMMUNOLOGY

P79(8/85)\* Novikov VS, Bortnovskii VN. The effect of dibasolum on the general immunity of humans in a hermetically sealed cabin. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 68-70; 1985. [12 references; none in English]

Immunology; Also Habitability and Environmental Effects  
Humans, Males  
Isolation, Hypokinesia, Performance; Drugs

Abstract: Thirty-two healthy males, aged 25-32, spent 2 months in hermetically sealed cabins under demanding work conditions, hypokinesia, normal atmosphere and a microclimate with a high discomfort index. Eight of the men ingested 5 mg of dibasolum once a day. The other subjects were given a placebo as double blind controls. Subjects were examined one month before the beginning of the experiment, and after 15 days, 1 month and two months of exposure to the experimental conditions. The following parameters factors were determined: morphological composition of the peripheral blood; cellular factors in general immunity; antimicrobial resistance of the skin; physical work capacity; and self-report of well-being. Results showed significant effects of the drug on these parameters. No adverse changes were noted in the physiological parameters studied in the individuals receiving diabsolum; indeed, by the second month some parameters (particularly, intracellular digestion efficiency and microbial concentratrion on the skin) had improved. In contrast, by the second week, the individuals receiving the placebo exhibited decreases in phagocytic reactions and physical work capacity, and increases in leukocytes, leukocytic adhesions, and reported fatigue. As the experiment progressed, these individuals demonstrated a significant decrease in leukocyte absorption, increase in the microbes on the skin and, for 50% of these subjects, disruption of phagocyte digestion. These changes point to the presence of a stress reaction which is accompanied by a drop in the general immunity of the organism.

Table and Figure Titles: Table: The effect of dibasolum on parameters of general immunity

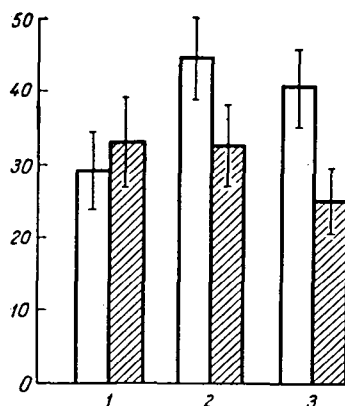


Figure: Amount of automicroflora on the skin before taking dibasolum (1) and on the 15th (20) and 60th day (3) of regular dosage. White bars - placebo; Cross-hatched bars - dibasolum.



## METABOLISM

P86(8/85)\* Makho L, Tigranyan RA, Shkottova N, Palkovich M (Czechoslovakia, USSR). The process of lipogenesis in the liver of rats after flight in the "Cosmos-1129" Biosatellite. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 84-85; 1985. [10 references; 3 in English]

Metabolism, Liver, Lipogenesis  
Rats  
Space Flight, Cosmos-1129

Abstract: This study involved the examination of one of the key lipogenic enzymes, malate dehydrogenase, in the liver of rats which had undergone an 18.5-day space flight in Cosmos-1129. Experimental animals were sacrificed 6-8 hours or 6 days after landing. Vivarious and synchronous control groups were used. Half of the animals in each group were subjected to periods of immobilization during the postflight period. Immediately after landing, activity of malate dehydrogenase was depressed in both the flight animals and the synchronous controls, but the decrease in enzyme activity was only statistically significant for the controls. Six days post flight, malate dehydrogenase activity had further decreased to a statistically significant extent for both these groups. Additional periods of immobilization further depressed liver enzyme activity for the flight animals and the vivarious controls.

Table Title: Activity of malic dehydrogenase in the livers of rats.

## MORPHOLOGY AND CYTOLOGY

(See also Cardiovascular and Respiratory Systems: P55.)

P74(8/85)\* Lychakov DV, Lavrova YeA. Investigation of the vestibular structure and the concentration of ions in the body of spurred frog tadpoles exposed to weightlessness. *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina*. 19(3): 48-52; 1985. [11 references; 5 in English]

Morphology and Cytology, Otolith Organs, Ontogeny; Also Neurophysiology  
Frogs

Space Flight, Salyut-6, Weightlessness

Abstract: Spurred frog (*Xenopus laevis*) tadpoles in either the blastula or tail bud stage were exposed to space flight conditions on the "Salyut-6" for 8-9 days. A scanning electron microscope was used to investigate the spatial organization of the otolithic membrane and the hairs of the receptor cells. Morphometry was used to measure the size of the otolith organs as a means of assessing their level of development. Chemical analyses were performed in order to determine the content of Na, K, Ca and Mg in the bodies of the tadpoles and in the water in which they had lived. No significant qualitative differences were found in the receptor and supporting cells of the maculae, nor in the otolithic membrane between the experimental animals and corresponding controls. Chemical analyses revealed no significant differences in the concentrations of the elements specified above. The otolith organs of the experimental animals were larger than those of the controls. However, this effect was only statistically significant for the utricular and not for the saccular otoliths. A satisfactory mechanism for this difference cannot be suggested on the basis of this data. Both control and experimental animals showed asymmetry between the sizes of the left and right otolith organs, with the effect stronger in the experimental groups, but not to a statistically significant extent.

Table and Figure Titles: Table 1: Results of measurements of the otolith organ in tadpoles of spurred frogs developing under 9 days of weightlessness

Table 2: Amount of alkali and alkali-earth metals in the bodies of spurred frog tadpoles developing under 8 days of weightlessness

Figure 1: Top view of a section of the right labyrinth of an 8-day-old spurred frog tadpole

Figure 2: Section of the surface of the macula of the sacculus and utricle of an 8-day-old spurred frog tadpole

## MUSCULOSKELETAL SYSTEM

P58(8/85) Osipenko AV. The effect of antimacrophage cytotoxic serum on blood composition and regeneration of bone tissue in distraction osteosynthesis. Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya. 1985(2): 68-71. [12 references; 6 in English] Affiliation: Scientific-Research Institute for Traumatology and Orthopedics, Sverdlovsk

Musculoskeletal System, Bone Regeneration; Also Hematology,  
Monocytes  
Dogs  
Injuries

**Abstract:** Antimacrophage cytotoxic serum was obtained by inoculating rabbits with macrophage cells from dogs. The dogs then had their limbs fractured. Ten days later the fractured bones were stretched by 1 mm each day and serum was injected intravenously in the fractured area. The animals' peripheral blood and bone marrow was examined frequently during the experiment and compared to values for control animals who had undergone the same treatment with the exception of serum injection. The serum had a strong influence on the quantity of monocytes in the blood and bone marrow during bone regeneration; but not on the quantity of neutrophils or leukocytes. Small doses of sera did not interfere with the regeneration process; however, large dosages appeared to inhibit regeneration of bone tissue. The authors conclude that the monocytic reaction is one of the processes linking osteogenesis and hematopoiesis and that hematic monocytes play an important role in bone regeneration.

**Table Title:** The effect of antimacrophage cytotoxic serum on a number of parameters of blood and marrow during bone regeneration

P76(8/85)\* Il'ina-Kakuyeva YeI, Novikov VYe. Skeletal muscles of rats in simulated weightlessness: A morphological investigation. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):56-59; 1985. [11 references; 4 in English]

Musculoskeletal System, Leg Muscles

Rats

Tail Suspension

Abstract: Ten rats were kept in a tail suspension apparatus (head-down angle of  $-15-20^{\circ}$ ) for 21 days; 10 others served as controls. Animals were weighed before and after treatment. After the treatment, the animals were sacrificed and a number of muscles of the hind and fore limbs were excised, weighed, histochemically analyzed for dehydrogenase activity; and morphometrically analyzed. The body weights of the experimental animals were lower than that of the controls, but this difference was not significant. Of the six muscles investigated (soleus, gastrocnemius, tibialis anterior, extensor digitorum longus, quadratus femoris and biceps brachii) only the soleus and the gastrocnemius, the primary antigravity muscles, showed significant decreases in weight in the experimental animals. Atrophic changes in these muscles were discovered through biometric analysis. Changes in metabolic processes were also evident. The changes observed in the muscles of the hindlimbs as a result of this treatment are analogous to those resulting from weightlessness. This is not the case when motion is restricted by immobilizing cages. The increase in the activity of glycerol-3-phosphate dehydrogenase and the decrease in succinate concentration observed in the experimental animals characterize muscular response to weightlessness. However, the accumulation of glycogen in the skeletal muscles during weightlessness was not observed here. Degenerative processes not characteristic of weightlessness occurred in the biceps brachii muscles under the experimental treatment and are attributed to disruption of normal blood circulation (venous congestion). The authors conclude that tail suspension is the most acceptable ground-based model for simulating the effects of weightlessness in the hind limb muscles but that it is not an acceptable simulation model for changes in the forelimb muscles.

Figure Title: Biceps brachii of rats subjected to 21 days of tail suspension

P77(8/85)\* Talipov MS, Bogoyavlenskaya ON. The effect of short-term exposure to heat on tissue respiration of the skeletal muscles and internal organs of chickens during hypokinesia. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 60-63; 1985. (18 references; none in English)

Musculoskeletal System, Muscles, Tissue Respiration  
Chickens  
Hypokinesia and Heat

Abstract: Thirty-eight chickens were kept in immobilization cages under temperatures of 20-22°C for 60 days. A control group (9 chickens) was kept at the same temperature under normal conditions of movement. After the first, 20th, 40th and 60th day of the treatment a number of animals from both groups were exposed to a temperature of 35° for 2 hours and then sacrificed. Consumption of oxygen and production of carbon dioxide were studied in the muscles of the neck, femur, chest and back and in the tissues of the liver and heart using a manometer. For the control group, exposure to heat was associated with decreases in oxygen consumption and carbon dioxide production in the muscles of the femur, neck and chest, and increases in respiration of the back muscles. No changes were noted in the liver tissue, while the metabolic activity of the heart muscles was substantially depressed (oxygen consumption decreased, carbon dioxide production increased). After a relatively short period of hypokinesia, the experimental animals experienced identical changes in the total level of gas exchange. In the first day of restricted movement, heat depressed the activity of oxygenation processes in the back, neck and femur muscles, while it increased such activity in the chest muscles. Carbon dioxide production remained at its initial level in all muscles. On the 20th day of hypokinesia, respiration was enhanced in the femur and back muscles, depressed in the chest, and no changes were found in the respiration of the liver and heart muscles. After 40 and 60 days of hypokinesia and two hours of heat, the consumption of oxygen by the cardiac and skeletal muscles was significantly diminished, while production of carbon dioxide remained unchanged. The heat treatment caused body temperature to rise in both groups of birds, but more so in the control animals.

Table and Figure Titles: Table: Total amount of oxygen consumption, carbon dioxide production and respiratory quotient in the tissues of experimental and control chickens under different environmental temperatures

Figure: Changes over time in consumption of oxygen and production of carbon dioxide of the skeletal muscles in control and experimental groups of chickens at room temperature and in response to heat

# NEUROPHYSIOLOGY

(See also Biomedical Data: P53; Morphology and Cytology: P74)

P51(8/85) Bazarov VG, Lutsenko VI. Vestibulospinal reactions and excitability thresholds of the cupular apparatus in chronic cochleovestibular insufficiency. Zhurnal Ushnykh, Nosovykh i Gorlovykh Boleznay. 1985(1): 17-21. [22 references; 7 in English] Affiliation: A.I. Kolomyichenko Scientific-Research Institute for Otolaryngology, Kiev

Neurophysiology, Motion Sickness, Vestibular Tests, Nystagmus  
Humans, Patients  
Cochleovestibular Pathology

Abstract: Patients (n=115) with various forms of cochleovestibular pathology were examined in order to investigate the potential diagnostic utility of measuring vestibulospinal reactions and thresholds for sensory and nystagmic responses. Vestibulospinal reactions were assessed using cephalography (recording of involuntary head movements), noting of gait disturbances, and "vertical writing" and "stepping" tests developed by Fukuda. Sensory and nystagmic thresholds were determined with regard to responses to a stop stimulus after rotation at various angular velocities through electronystagmography and reports of counter-rotation illusions. With regard to sensory and nystagmic reactivity, 9% of the patients showed normal responses, 38% heightened reactivity, 12% diminished reactivity, and 45% asymmetry in the vestibular reactivity of the right and left labyrinths. Cephalography showed 85% of the patients to be above the normal limits; however, the majority of patients were within normal limits on the remaining vestibulospinal tests. While correlations were found among the measures of nystagmic and sensory reactivity, no clear correlations were observed between these and results of vestibulospinal tests. The authors conclude that only tests of vestibular reactivity would be clinically useful as aids in diagnosing vestibular involvement in patients with cochleovestibular pathology.

P59(8/85) Shaposhnikov YeA. Prevention of neuro-psychological changes in hypokinesia. Zhurnal Nevropatologii i Psikhatrii imeni S.S. Korsakova. 85(2): 215-219; 1985. [17 references; 2 in English] Affiliation: Institute for Medicobiological Problems, USSR Ministry of Health

Neurophysiology, Hypokinesia Effects; Also Psychology, Hypokinesia Effects

Humans

Physical Exercise; Electrostimulation; Psychotherapy

Abstract: In order to investigate the relative efficacy of various means of preventing the adverse neuropsychological changes associated with prolonged bedrest, 78 healthy men were subjected to strict bedrest for from 45 to 182 days. The potential prophylactic measures studied included: electrostimulation of the muscles, electrostimulation combined with exercise on a bicycle ergometer, various systematic programs of physical training [Note: the article does not explicitly indicate how this training was implemented, possibly also on the ergometer], breathing of hypoxic gas mixtures (13.5% oxygen), and several types of psychotherapy. The efficacy of the prophylactic measures was evaluated on the basis of results of systematic neurological examination and a psychological evaluation using various types of tests. In addition, certain subgroups were evaluated with other techniques, (e.g., electroencephalography, fluorescent angiography of the retina). From the perspective of preventing or minimizing autonomic/vascular dystonia, the motor reflex syndrome, cerebrovascular disorders and neurotic symptoms associated with prolonged bedrest, results indicated that a program of physical exercise consuming up to 600kcal/day was most effective. The authors add that if such a program is not possible, electrostimulation of the muscles, particularly when supplemented by some level of exercise, may also be worthwhile. Psychotherapy is also mentioned as a possible supplement, targeted at secondary effects of hypokinesia.

P62(8/85) Shaposhnikov YeA, Khondkarian OA. Changes in the nervous system following prolonged hypokinesia (a clinical/experimental investigation). Zhurnal Nevropatologii i Psikhatrii imeni S.S. Korsakova. 84(12): 1761-1766; 1984. [9 references; none in English] Affiliation: Institute of Neurology, USSR Academy of Medicine; Institute of Biomedical Problems, USSR Ministry of Health

Neurophysiology  
Humans, Males  
Hypokinesia, Countermeasures

**Abstract:** Twelve healthy male volunteers were subjected to a 45-day period of strict bedrest with head-down tilt of  $-6^{\circ}$ . Eight of the men were further exposed to an experimental treatment in which the muscles of the calves and hip were stimulated electrically 6 days a week, twice daily for 30 minutes, using the "Tonus-2" apparatus. For four of these subjects the current was administered along the muscles via 20 electrodes and for the remaining four subjects it passed through the muscle via 12 electrodes. Throughout the period the subjects were systematically examined to determine their psychoneurological status, including neuroophthamological and otoneurological exams. On the fifth to sixth day of hypokinesia, most subjects started to develop neuroasthenic symptoms which included inability to concentrate, hypochondria, irritability, sleep disturbances and depressive episodes. There was a high correlation ( $r=0.85$ ) between the intensity of these symptoms and the extent of the neurophysiological changes observed. Autonomic/vascular dystony was also observed, beginning in some subjects by the fifth day, including lability and asymmetry of arterial pressure, fluctuations in resting heart rate, general and localized hyperhidrosis, chills, and changes in autonomic reactivity. Such symptoms were particularly pronounced 7-10 days after the cessation of hypokinesia. There was a high correlation ( $r=0.85$ ) between the clinical symptomology, measured autonomic dysfunction and changes noted on the EEG. An additional set of symptoms was associated with the motor system, particularly hypotonia and muscle atrophy. The first signs of these symptoms developed after 5-6 days of hypokinesis. The cerebrovascular syndrome was also present, including a microcirculatory and a macrocirculatory component. Rheoencephalography showed fluctuations in arterial tone with dystony and a tendency toward regulatory interhemispheric asymmetry. The ameliorative effects of electrical stimulation were noted in relation to the motor system symptoms and, to a lesser extent, to the neurotic symptoms. These effects were more marked for the 20 electrode group. Beneficial effects of the stimulation were particularly pronounced with regard to attenuating the atrophy of muscle tissue.

**Figure Title:** Changes over time of frequency indices of EMG of the flexor and extensor muscles of the feet and hands during hypokinesis accompanied by electrical muscle stimulation



P73(8/85)\* Krylov YuV, Vorob'yev OA, Zaritskiy VV. The dissociation of vestibular-autonomic and vestibular-sensory reactions. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 44-48; 1985. [23 references; 9 in English]

Neurophysiology, Vestibular System  
Humans, Patients, Deaf  
Caloric Irrigation

**Abstract:** The subjects for this study consisted of 72 individuals with impairments of labyrinthine function (of whom 97% were deaf with mean hearing loss of 80 decibels) and 50 normal individuals (control group). The functional state of the vestibular apparatus was assessed with a caloric irrigation technique using cold water. Vestibular sensitivity was assessed using a centrifuge chair rotated with an angular velocity of 180 degrees/second and acceleration of plus or minus 90 degrees/sec.<sup>2</sup> and continuously increasing Coriolus acceleration. Some subjects in both groups were also tested in a horizontal position on a specially designed rotating stand. The axis of rotation passed through the subject's head. Both sinusoidal rotation and Coriolus acceleration tests were performed. The angle of head-down tilt ranged from 10-15° and was individually determined to equate magnitude of fluid shift to the head. Subjects had their eyes closed for all types of vestibular stimulation and horizontal nystagmus was recorded through electronystagmetry. Coefficients of asymmetry for left and right nystagmus were calculated. Autonomic vestibular sensitivity was defined as tolerance of Coriolus acceleration before frank nausea was experienced. Vestibular-sensory reactivity was assessed on the basis of duration of reported counterrotation illusion and magnitude of rocking illusions during the cumulative Coriolus acceleration test. From the caloric irrigation test results, it was determined that the experimental subjects showed greater asymmetry of nystagmus parameters, indicating that vestibular impairment accompanied deafness. The magnitude of post-rotation nystagmus was significantly less for the deaf subjects than for the normal subjects, but the former demonstrated more asymmetry between left and right nystagmus. Subjects with vestibular disorders were also able to tolerate cumulative Coriolus acceleration for substantially longer periods than their normal counterparts. There was no difference among groups in the parameters related to the vestibular-sensory functions, (i.e., the counterrotation and rocking illusions). In the head-down tilt position, post-nystagmic parameters were diminished in comparison to those measured for subjects in the sitting position. Differences between groups were analogous to those found for the sitting position, but were not as pronounced. No differences were found in illusion parameters between the two groups rotated head-down. Dissociation between vestibular-autonomic and vestibular-sensory parameters, persisting in simulated weightlessness, is interpreted by the authors as confirming the hypothesis that even individuals with a high degree of vestibular-autonomic tolerance may be subject to vestibular-sensory disruptions and illusions. This must be considered when assessing sensory phenomena experienced by cosmonauts (who typically display high tolerance for motion sickness) in flight.

Table Titles: Table 1: Parameters of nystagmus after caloric irrigation with cold water

Table 2: Parameters of post-rotation nystagmus

Table 3: Parameters of nystagmic reactions to vestibular stimulation during head-down tilt

P75(8/85)\* Popov VK, Ivanova RS (Bulgaria). The pairing principle and kinematic asymmetry of the otolithic system. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3):53-55; 1985. [5 references; none in English]

Neurophysiology, Otolith Organs  
Humans  
Rotation; Mathematical Modelling

Abstract: This study attempts to determine whether symmetry of effects on the human otolithic system which is typical of rest and ordinary motion is retained when the human is in a rotating system. If such symmetry is not retained, autonomic discomfort and sensory phenomena experienced during rotation may be partially explained. A previously developed mathematical kinematic model of the otolith system, implemented on a computer, is extended to describe otolith organ stimulation in response to body movements while in a system rotating with constant angular velocity. Cases where the person in this system moved the head or body forward or sideways were examined, and the resulting stimulation of the left and right otolith organs were computed. When such movements occur, according to the model, changes in the vectors of the resulting accelerations are neither synchronic nor synphasic and result in asymmetrical stimulation of the left and right otolith organs.

Figure Titles: Figure 1. Diagram of the kinematic model

Figure 2: Acceleration hodographs

Figure 3: Phase and phase difference curves and changes in the of vector asymmetry and acceleration for the cases in Figure 2

Figure 4: Hodographs of vectors of asymmetry in the XY and XZ planes

PSYCHOLOGY  
(See also Neurophysiology: P59.)

P87(8/85)\* Yevdokimov VI. Means used by pilots and cadets to resolve frustrating situations by pilots and cadets. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 86-87; 1985. [7 references; none in English]

Psychology, Pilot Performance  
Pilots and Cadets  
Psychological Tests

Abstract: In this study 148 cadets and 67 pilots were asked to respond to the Rosensweig test, a projective instrument for eliciting responses to frustrating situations presented verbally and pictorially. Responses were categorized along two dimensions: direction (extrapunitive, intrapunitive and immunitive) and type of reaction (obstacle dominant, defensive, and need fulfillment). Response types were correlated with a number of factors relating to cadet success and pilot performance. The same cadets were tested in their first and fourth years in flight school. Moderate significant positive correlations were found for fourth-year cadets between the tendency to be intrapunitive and to focus on the obstacle (to problem solution) and success in flight school. For first-year cadets intrapunitive and immunitive reaction tendencies were positively correlated with success on the selection battery. Rosensweig results were stable for cadets over the four-year period confirming test reliability. Factor analysis of results was also performed and four factors were identified. Results of tests for pilots differed from those of cadets and an index of group conformity taken from pilots' test results was negatively correlated with their flight performance. The authors take this as an indication that the test needs modification if it is to be used for pilots.

P60(8/85) Ponomarenko VA. The psychological evaluation of flight performance. *Voyenno-meditsinskiy zhurnal*. 1985(4): 67-69. [No references] Affiliation: USSR Medical Corps

Psychology, Performance Evaluation; Health and Medical Treatment,  
Flight Surgeon  
Humans, Pilots  
Trends

Abstract: Any change in the job requirements (e.g, those arising from introduction of automation) for pilots, compels the specialist in aviation medicine to develop new means for monitoring the occupational fitness of his/her patients. The task confronting those concerned with the psychophysiological aspects of flight involves the development of methods and devices to: 1) increase the reliability and efficiency of crew performance through organization of the sensory and motor fields; and, 2) ensure the normal functioning of the organism, given the effects of the flight equipment and living conditions on vital functions. The psychological areas in which a modern flight surgeon must be expert include: 1) psychophysical understanding of spatial orientation; 2) modern concepts of the brain as an active participant in the construction of perceptions (discussed by the author with reference to Pavlov); 3) psychological processes involved in the simultaneous performance of more than one task; and 4) stress (also treated in Pavlovian terms). Psychological experiments of unspecified nature performed during flight are reported as establishing a direct relationship between the psychological state of the pilot and the reliability of his performance. This puts the study of the psychological effects of flight, including such manifestations as phobias, within the province of the flight surgeon. The identification of the mechanisms and features of psychological states and the development of techniques for determining the psychological state of a pilot at a given time is one of the most urgent problems facing aviation medicine.

RADIOBIOLOGY  
(See also Botany: P63; P80.)

P57(8/85) Moldotashev B, Daniyarov SB. Quantitative changes in Myelokaryocytes and Picture Produced by Myelography in Response to the Combined Influence of High Altitude and Ionizing Radiation. Izvestiya Akademii Nauk Kirgizskoy SSR. 1985(1): 32-36. [8 references; none in English] Affiliation: Kirgiz State Medical Institute [Note the Russian title of this paper listed in the journal table of contents is in error.]

Radiobiology; Also Hematology, Bone Marrow  
Rats and Dogs  
Adaptation, High Altitude

Abstract: Rats and dogs were subjected to a combination of radiation and high altitude (3200 m above sea level) conditions. Animals were either irradiated 3 days after being brought to the high altitude or after a 30 day high altitude adaptation period. Appropriate control groups for each factor were used. Dogs were exposed to gamma rays in a dosage of 4.0 Gy (1 Grey = 100 rads) with dose rate of 0.0000472 Gy/s (chronic condition), and rats to a dosage of 5.5 Gy with dose rate of 0.0000864 Gy/s (acute condition). The bone marrow of both species was examined at various times during adaptation to high altitude various times in the course of radiation sickness. For both species, the number of precursor cells increased and the number of mature erythrocytes cells decreased during the initial phase of the adaptation period. The reverse was the case for cells of the myeloblast series. In addition, during initial adaptation the proportion of cells associated with formation of monocytes, lymphocytes, and thrombocytes increased. Irradiation gave rise to aplasia of the bone marrow, decreasing the quantity of immature cell forms. However, under high altitude conditions the recovery process was accelerated. It was found that post-radiation changes in the granulocyte and lymphocyte cells of bone marrow were completely synchronous with changes in the corresponding cells of the circulating blood.

Table and Figure Titles: Table 1: Changes over time of bone marrow myelokaryocytes in dogs after exposure to radiation

Table 2: Changes over time of bone marrow myelokaryocytes in intact rats during adaptation to high altitude and after exposure to radiation

P66(8/85)\* Davydov BI. Electromagnetic radiation of radio wave frequency (microwaves): Principles, standardization criteria and threshold doses. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3): 8-21; 1985. [47 references; 23 in English]

Radiobiology, Microwaves

Humans

Dosage, Risk

**Abstract:** This paper presents a review of the literature on the subject of microwaves from the perspectives of medicine and biology. It is specifically concerned with establishing microwave safety standards and determining risk levels associated with different microwave doses. The author suggests that in developing standards for microwave exposure, the basic approach used for ionizing radiation can be borrowed. The maximum acceptable dose of microwaves for humans is currently considered to be that level which entails no significant risk of serious adverse medical or genetic consequences. The most important of these are decrease in life span, leukemia and cataracts. Such risks must be assessed through statistical analysis. Determination of acceptable risk levels should proceed by cost benefit analysis. Since benefits will differ for different segments of the population (e.g., population as a whole and workers in industries using microwaves) acceptable risk levels will also differ for different groups. A risk of 1 percent is usually accepted for occupational groups and of 0.1 percent for the population as a whole. There is lack of agreement among nations as to the microwave doses corresponding to a given level or risk. In the USSR the acceptable dose over an 8-hour working day has recently been revised from 10 to 25 mW/cm<sup>2</sup>. While American standards are based on the thermal effects of microwaves, in the USSR standards are based on the pathological effects of various doses. In doing experimental studies to determine acceptable doses, animal data must be extrapolated to human beings. In this extrapolation, it is important to consider parameters such as body weight, body surface area, heart rate, respiration rate, pulmonary ventilation, water metabolism rate, oxygen consumption and basal metabolism. In extrapolating known data, it is essential to distinguish between the effects of short-term exposures to high doses and long-term exposure to low doses.

**Table and Figure Titles:** Table 1: Risk of death associated with various factors for humans (for one person over a year)

Table 2: Major physiological parameters juxtaposed to threshold levels of energy flux density in humans, dogs, and rats

Figure 1: Relationship between risk and benefit

Figure 2: Relation between incident and absorbing doses for frequencies of 2.4 GHz as a function of body weight

Figure 3: Threshold values of energy flux density and absorbed power intensity for humans as a function of duration of irradiation in open space with no reflecting surfaces

P64(8/85) Turdyev AA, Bogdanova-Berezobskaya IG, Dvornikova LI.  
 Criteria for evaluating the radiation tolerance of Testudo  
horsfieldi. Radiobiologiya. XXV(1): 92-95; 1985. [5 references;  
 1 in English] Affiliation: Central Scientific-Research Institute for  
 Roentgenology and Radiology, USSR Ministry of Health

Radiobiology, Radiation Tolerance  
 Tortoises  
 Mortality Rate; Stochastic Processes

Abstract: The steppe tortoise Testudo horsfieldi has been identified as the vertebrate with the highest radiation tolerance. This study was concerned with further investigating the reactions of these tortoises to radiation in a wide range of doses. Sexually mature male tortoises were subjected to irradiation with gamma rays in the spring, summer, fall and winter in doses of 12.9, 18.06, and 25.8 Coulombs/kg. The amount of time required before all the animals irradiated with a certain dosage died varied with the season, with tortoises irradiated in the fall and winter taking longer to die. The authors suggest that, in order to ensure reliability, probability [stochastic] methods should be used to evaluate radiation tolerance. A number of stochastic parameters were calculated for the tortoises at each season. These were: mean lethal dose, susceptibility of single system of the organism; critical threshold for number of affected systems (which, if exceeded leads to the organism's death). These parameters were used to derive a Pearson gamma-distribution for each season. The critical threshold for tortoises was an order of magnitude higher [Note: the author's talk about the obtained value for this parameter as if it is unexpected; however, the unexpected result would be for it to be lower rather than higher. There may be a misprint here.] than the analogous parameter calculated for mammals, while the susceptibility of single systems was computed to be three orders of magnitude higher than that of mammals. Previous work examining the effects of radiation on specific systems of tortoises confirms these calculations. The delayed peak in mortality of hibernating tortoises (those irradiated in fall and winter) is considered by the authors to indicate the operation of factors other than those connected with the bone marrow or intestines. They suggest that the most important of such factors is the destruction of glycogen (the major source of energy for tortoises during hibernation) in the liver.

Table and Figure Titles: Table: Parameters of the modeled gamma-distribution describing the stochastic mortality rate for steppe tortoises as a function of radiation dosage

P64(8/85)

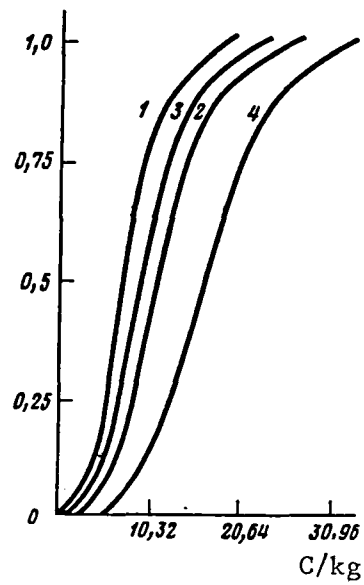


Figure: Probability curves of mortality rate of tortoises irradiated in summer (1), winter (2), spring (3) and fall (4). Abscissa - radiation dose, Coulombs/kg; Ordinate - mortality rate (%)



P65(8/85) Shlumukova IF, Serkiz YaI, Chebotarev YeYe, Pavlenko IO, Shlapatskaya VV, Svirgun VP. The effect of seasonal and diurnal rhythms on the time course of radiation injury. Radiobiologiya. XXV(1): 139; 1985. (Abstract only; paper on file at the All-Union Institute of Scientific and Technical Information, No. 7292-84; 11/13/84.)

Radiobiology, Radiation Tolerance  
Rats  
Circadian Rhythms; Mortality Rate

Abstract: [Translated from Russian abstract]. This study revealed significant differences in the reaction of animals to irradiation during the day and night. The animals were least tolerant of radiation at 09:00 and 15:00-18:00, and most tolerant at 12:00 and during the night. Mortality of a significant number of animals soon after irradiation is characteristic of the winter and early spring. In [late] spring and beginning of summer the responses of albino rats to radiation change and the main peaks in mortality shift to a longer period after irradiation. This paper established the radiation tolerance of albino rats to irradiation with gamma-rays of  $^{60}\text{Co}$  as a function of seasonal and diurnal rhythms for three seasons of the year.

P88(8/85) Grodzinskiy DM, Fialkova YeYu, Gudkov IN. Radioprotective effect of ethylene on gamma-irradiated plants. Radiobiologiya. XXV(2): 212-215; 1985. [10 references; 3 in English]

Radiobiology, Mitosis; Also Botany  
Botany, Pea, Root Meristem  
Radioprotective Agent, Ethylene

**Abstract:** Two-day old pea seedlings were exposed to gamma-irradiation of 3 Gy (Grey=100 rad)/min. up to a dose of 6 to 30 Gy. The seedlings had been kept in an atmosphere containing 2-3 mM/l ethylene for 6 hours prior to and during the radiation exposure. (Previous experimentation had shown that this concentration and exposure time produced the maximum growth inhibiting effect on the root.) The seedlings were then allowed to grow for a period of 10 days, at the end of which the survival rate of the seedlings was assessed on the basis of the browning of the meristem zone, and the values were calculated for LD<sub>50/10</sub> (dose which proves lethal to 50% of the subjects over a period of 10 days) and DMF. [Authors give this supposedly English abbreviation as equivalent to their FID; expansion unknown.] Plants exposed to ethylene were compared to those subjected to the same radiation without the ethylene exposure. The LD<sub>50</sub> for the control plants was 9.7 Gy, while those for the ethylene exposed plants was 22.3 Gy. Thus the radioprotective effect of the gas was calculated at DMF up to 2.4. Number of meristem cells in various stages of mitosis was determined. Exposure to ethylene appeared to be associated with inhibition of the transition between the G<sub>1</sub>/S and G<sub>2</sub>/M phases of mitosis. Ethylene exposure was found to double the length of the mitotic cycle for cells of the meristem, through lengthening the G<sub>1</sub> and G<sub>2</sub> phases by a factor of 3-3.5. The radioprotective effect observed for ethylene exceeds that of any previously discovered factor, with the exception of anoxia. The authors conclude that the radioprotective properties of this gas are partially due to its phytohormonal effects and partially chemical, related to its antioxidizing properties.

**Table and Figure Titles:** Table: Change in the length of the mitotic cycles and its component phases in the cells of the root meristem of pea seedlings exposed to a gaseous medium containing ethylene

**Figure 1:** The effects on the growth of pea seedling roots of exposure to a gaseous medium containing ethylene in concentration of 2.6 mM/l (10 days subsequent to exposure)

**Figure 2:** Survival rate of pea seedlings as a function of gamma-radiation dose in air and in a gaseous medium containing ethylene

**Figure 3:** Changes over time in the components of the cell population in the root meristem of pea plants during incubation of the seedlings in a gaseous medium containing ethylene, and after return to the air

P89(8/85) Kuna P. (Czechoslovakia). Acute toxicity and radioprotective effect of gammaphos injected intramuscularly in mice. Radiobiologiya. XXV(1): 59-62; 1985. (13 references; 4 in English)  
Affiliation: Purkinje Medical Research Institute, Czechoslovakia

Radiobiology, Antiradiation Drugs, Gammaphos  
Mice  
Toxicity, Radioprotective Efficacy

**Abstract:** This study compared the acute toxicity and radioprotective effects of gammaphos administered intraperitoneally and intramuscularly to mice. In addition two preparations of gammaphos, were compared, one standard and the other of 98% purity, synthesized in the author's laboratory (Purkinje Medical Research Institute, Czechoslovakia). The radioprotective effect of gammaphos was also compared to that of cystamine. Acute toxicity was initially determined by administering 400-900 mg/kg intraperitoneally to seven groups of mice (N=75). The acute toxicity of the two preparations was then compared by administering 400-900 mg/kg intramuscularly to 120 mice. The magnitude of the lethal dose and relative toxicity was determined through logarithmic analysis of the number of deaths in the 48 hours following the injection. The mice were irradiated with gamma rays at a dose of 0.391 Gy(one Grey=100 rad)/min up to a dose of 13 Gr. Protective agents were administered 15 minutes before irradiation. The criterion for the radioprotective efficacy was the survival rate of the mice in the 30 days following irradiation at the absolute minimum lethal dose or multiple doses for determining  $LD_{5/30}$  (the dose at which 5% of subjects die over a 30 day period),  $LD_{50/30}$ , and  $LD_{95/30}$  and relative efficacy of the irradiation. The acute toxicity of intraperitoneally administered gammaphos was found to be  $LD_{50}=790$ . The acute toxicity of the standard gammaphos preparation was 13% higher than that of the specially prepared gammaphos for all LD levels when both were administered intramuscularly, ( $LD_{50}=764$  and 890 respectively). The radioprotective effect of a dose of 100mg/kg gammaphos injected intramuscularly was approximately equivalent to a dose of 150 mg/kg cystamine. When protected by gammaphos the death rate of the mice increased linearly with the logarithm of the radiation dose. Increasing the intramuscular dose of gammaphos from 100 mg/kg to 200 and 300 mg/kg increased its radioprotective effect substantially. No differences were found in the radioprotective efficacy of intramuscularly and intraperitoneally administered doses.

**Table and Titles:** Table 1: Acute toxicity of preparations of gammaphos injected intramuscularly, mg/kg

Table 2: Radioprotective efficacy of gammaphos and cystamine given intraperitoneally before irradiating mice at dosage of 7 Gy

Table 3: Comparison of the radioprotective efficacy of gammaphos and cystamine administered intramuscularly

Table 4: Comparative radioprotective efficacy of gammaphos (300 mg/kg) administered intraperitoneally and intramuscularly

## MONOGRAPHS

### ADAPTATION

#### ADAPTATION (Also Neurophysiology)

M15(8/85) Soroko SI. Neyrofiziologicheskiye mekhanizmy individual'noye adaptatsii cheloveka v antarktide [Neurophysiological mechanisms of individual adaptation to the antarctic in humans]. Leningrad: Nauka; 1984. [152 pages; 39 illustrations; 5 tables; 343 references]

Affiliation: Sechenov Institute of Evolutionary Physiology and Biochemistry (USSR Academy of Sciences).

Adaptation, Antarctic conditions  
Neurophysiology, Biofeedback  
Psychology, Performance

Annotation: This monograph is devoted to the results of complex ecological and physiological studies of human adaptation to conditions in the Antarctic. Primary emphasis is placed on methods for evaluating the adaptive features of humans and their relation to the flexibility of neurodynamic processes. The principles underlying the reorganization of the integration and analyzer functions of the brain, and perceptual-motor activity during various stages of adaptation are examined. The author advances and justifies hypotheses identifying flexibility of neurodynamic processes as one of the main sources of individual and typological differences in the nervous system, and specifies the role of interactions among the various components of the EEG in mechanisms of self-regulation. The practical significance of these results for medical diagnosis and occupational selection is discussed.

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M25(8/85) Afanas'yev YuA, editor. Izucheniye prirodnikh resursov i okruzhayushchey sredy kosmicheskimi sredstvami [The study of natural resources and the environment from space]. Leningrad: Gidrometeoizdat, 1984. [129 pages]

Affiliation: State Scientific Research Center for the Study of Natural Resources

Biospherics  
Natural Resources  
Environment  
Remote Sensing  
Satellite Data

Annotation: This collection, commemorating the tenth anniversary of the founding of the State Scientific Research Center for the Study of Natural Resources (GosNITsIPR), contains the most important results of research on the problems involved in studying natural resources and environmental monitoring. The work also covers issues related to the development of hardware and the techniques for receiving and processing remote sensing data to be obtained from future space systems.

This collection is intended for scientific workers and specialists in the area of remote environmental sensing.

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## BIOSPHERICS

M26(8/85) Tishchenko AP, Viktorov SV (Kozlov NP, editor). Priroda zemli uz kosmosa [Earth's natural resources from space]. Leningrad: Gidrometeoizdat, 1984. [148 pages]

Biospherics  
Remote Sensing Data  
Vegetation  
Oceanography  
Earth Resources

Affiliation: Various geographical institutes

Annotation: This is the first book of its kind published in the USSR. It was written by specialists in various branches of science and economics. In it, satellite builders discuss the particular design features of spacecraft intended for the study of the natural resources of the earth; engineers describe their instruments, and mathematicians and programmers discuss computer processing of images obtained from space. Experts in agriculture, geology, forestry, oceanology, and hydrology describe how information obtained through remote sensing is utilized in the economy and for monitoring the environment.

This book will help scientists with various areas of expertise gain a better knowledge of the use of remote sensing data for the study of natural resources, to appreciate the achievements in this area and understand its unsolved problems. The reader will find in this work many interesting facts presented in an intelligible manner, and also a large quantity of original space images obtained with Soviet "Meteor" satellites.

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## BODY FLUIDS

M19(8/85) Natochin YuV. Problemy evolyutsionnoy fiziologii vodno-solevogo obmena [Problems in the evolutionary physiology of fluid-electrolyte exchange]. Paper read at the IVth Lecture dedicated to L.A. Orbeli, 29 October 1982. Leningrad: Nauka; 1984. [38 pages; 39 references]

### Body Fluids, Fluid Electrolyte Exchange

Affiliation: I.M. Sechenov Institute of Evolutionary Physiology and Biochemistry, USSR Academy of Sciences

Annotation: This monograph summarizes current thought concerning fluid-electrolyte homeostasis, and the principles governing the formation and activity of the effector organs that regulate volume stability, ion composition and osmotic concentration of fluids within the internal environment. Emphasis is given to a discussion of the evolution of the kidneys and the fluid-electrolyte system.

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BOTANY  
(Also Cytology)

M16(8/85) Sytnik KM, Kordyum YeL, Nedukha YeM, Sidorenko PG, Fomicheva VM. Rastitel'naya kletka pri izmenenii geofizicheskikh faktorov [The plant cell under altered geophysical conditions]. Kiev: Naukova Dumka; 1984. [136 pages; 95 illustrations; 6 tables]

Botany, Lower and Higher Plants

Cytology

Space flight Factors, Weightlessness, Vibration, Magnetic Fields,

Clinostasis

Space Flight Simulation

Affiliation: N.G. Kholodnyy Institute of Botany, Ukrainian Academy of Sciences

Annotation: This monograph describes cellular structure and functioning both under space flight conditions and ground-based simulation of individual space flight factors. The authors demonstrate that the cellular and subcellular changes occurring in plants in response to physical space flight conditions depend on the complexity of the plant itself and the nature of the space environment.

The laws governing the biological effects of acceleration, vibration, magnetic fields of various strengths, micro-gravity and weightlessness are discussed, and future prospects for basic and applied research in the area of space biology are considered.

This monograph is intended for cytologists and plant physiologists specializing in the area of space biology.

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Chapter 7. Biological effects of weightlessness

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## CADIOVASCULAR AND RESPIRATORY SYSTEMS

M18(8/85) Breslav IS. Patterny dykhaniye: Fiziologiya, ekstremal'nyye coctoyaniya, patologiya [Patterns of respiration: Physiology, extreme conditions, pathology]. Leningrad: Nauka; 1984. [206 pages; 7 tables; 65 illustrations; 694 references; ca. 425 in English]

Affiliation: I.P. Pavlov Institute of Physiology, USSR Academy of Sciences

Cardiovascular and Respiratory Systems

Stress

Sleep - Wakefulness

Hypoxia

Hypobaria

Annotation: This monograph is devoted to a relatively new concept in physiology -- that of the respiration pattern encompassing the relationships between the volumetric and temporal parameters of pulmonary ventilation. The neural and biomechanical factors participating in the formation and regulation of the respiration pattern are analyzed, with emphasis on their significance in optimizing the energy consumption of pulmonary ventilation. Individual differences in certain features are considered, as is the reorganization of the respiration pattern in response to factors such as: changes in the gas composition of the air, physical exertion, sleep, certain pharmacological agents, increase in resistance to respiration (particularly during hyperbaria), voluntary changes in pulmonary ventilation, etc. A special chapter is devoted to the significance of research on respiratory patterns to clinical practice.

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GROUP DYNAMICS  
(Also Psychology)

M22(8/85) Nemov RS. Sotsial'no-psikhologicheskiiy analiz effektivnoy deyatel'nosti kollektiva [Social psychological analysis of effective collective activity]. Moscow: Pedagogika; 1984. [200 pages; illustrated]

Affiliation: Scientific Institute of General and Educational Psychology, USSR Academy of Educational Sciences

Group Dynamics, Group Performance

Annotation: This monograph presents a critical analysis of Soviet and foreign research on the effectiveness of group performance from the standpoint of a theory of active intervention in interpersonal relations. It considers the influence of various characteristics of a collective ["collective" here means occupational group] on its job performance and proposes a system of criteria for assessing the effectiveness of a collective. It also offers practical recommendations for increasing the performance level of cooperative activities. This monograph is intended for scientists working in the area of psychology and education.

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## GROUP DYNAMICS

M24(8/85) Shchelgachev RV (editor). Sovershenstvovaniye organizatsii truda i otdykha plavsostava (Sb. nauch. tr.) [Enhancing the organization of work and rest for ships' crews: Collection of scientific papers]. Leningrad: Transport; 1984. [80 pages]

Affiliation: Scientific Research Institute of the Merchant Marine

Group Dynamics, Crew Performance  
Psychology, Work Capacity, Work-rest Cycles  
Environmental Factors, Noise and Vibration  
Personnel Selection

Annotation: This collection is devoted to the organization of labor for a ship's crew in the context of scientific and technological progress in the merchant marine and the improvement of the integrated maintenance system. It examines the social structure of the ship's crew and the conditions under which it works and rests.

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## LIFE SUPPORT SYSTEMS

M12(8/85) Abramov IP, Severin GI, Stolitskiy AYu, Sharipov PKh.  
Skafandry i sistemy dlya raboty v otkrytom kosmose [Space suits and systems for work in outer space]. Moscow: Mashinostroyeniye; 1984 [256 pages; illustrated; 50 references; 4 in English]

Affiliation: Not available

Life Support Systems, Portable Life Support Systems

Habitability and Environmental Effects

Man Machine Systems

Space Flight, Voskhod-2, Gemini, Soyuz-5, Apollo, Skylab, Salyut, Shuttle

Annotation: This monograph describes the basic theoretical principles and methods used in planning and designing systems to support work in space. The main emphasis is on development of space suits and self-contained life support systems. The monograph covers issues relating to development of airlock systems and other equipment supporting extravehicular activity; principles underlying the design of systems for transporting the cosmonauts; and the particulars of testing space suits and associated systems. The configuration and construction of space suits, self-contained life support systems, and cosmonaut transport systems are also considered.

This monograph is addressed to engineers working in the design, production and utilization of flight vehicles, space suits and life support systems.

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## NEUROPHYSIOLOGY

M21(8/85) Arshavskiy YuI, Gel'fand IM, Orlovskiy GN.  
Mozzhechok i upravleniye ritmicheskimi dvizheniyami [The cerebellum and control of rhythmic movements]. Moscow: Nauka; 1984. [ca. 140 pages; 86 illustrations; 576 references]

Neurophysiology, Cerebellum  
Motor Control, Rhythmic Motion

Affiliation: Institute for Problems of Information Transmission,  
USSR Academy of Sciences.

Annotation: This monograph examines the neural mechanisms of the brain which control an animal's rhythmic movements. The main emphasis is on the two most important motor centers - the cerebellum and the spinal cord. The work describes the signals that these centers exchange in the process of controlling movements. It is demonstrated that, in the course of transforming input information into cerebellar output, signals are generated which reflect essential aspects of spinal cord functions. Cerebellar output signals change the transmission coefficient in the descending tracts, which transmit information from the various motor centers to the spinal cord. The hypothesis is advanced that the function of the cerebellum involves coordination of the the various motor interactions.

This book is intended for physiologists, biophysicists, psychologists and computer scientists.

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Chapter 7. The role of the cerebellum in the control of locomotion and the scratch reflex (130)

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## PSYCHOLOGY

M11(8/85) Leonova AB. Psikhodiagnostika funktsional'nykh sostoyaniy chelovek [Psychological diagnosis of human functional states]. Moscow: Izd. Mosk. Univ.; 1984. [200 pages; 39 figures; 23 tables; 350 references; 138 in English]

Psychology, Human Factors  
Human Performance  
Circadian Rhythms

Affiliation: Moscow State University [Author and Book]

Annotation: This monograph represents the first systematic presentation of the subject matter and methods of the psychology of human functional states. Particular emphasis is given to the functional states occurring in the course of job performance. Methods have been developed which make it possible to evaluate the dynamics of fatigue from changes in the microstructure of cognitive processes and multidimensional shifts in symptomatology. The principles underlying design of applied research, preventive measures, and correction of adverse states are demonstrated using specific examples.

This book is intended for researchers and practioners in areas such as human factors engineering, psychology, physiology, and industrial safety, ergonomics, and aerospace medicine.

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PSYCHOLOGY  
(Also Group Dynamics)

M13(8/85) Lebedev VV, Krutov VA. Tekhnicheskaya effektivnost' pilotiruyemykh kosmicheskikh apparatov [Technical efficiency of manned spacecraft]. Moscow: Mashinostroyeniye; 1985. [256 pages]

Psychology, Human Factors  
Man-machine Systems  
Group Dynamics. Crew Performance

Affiliation: not available

Annotation: In this book, Soviet cosmonaut V.V. Lebedev and design engineer V.A. Krutov discuss complex analysis methods for the technical efficiency of manned spacecraft. These methods are based on the utilization of systems of quantitative indices and on mathematical models of the functioning of the spacecraft and take into consideration the major contributing factors and possible flight conditions. This book was based on experience in the development and operation of manned spacecraft.

This book is intended for engineers working in the study, design and operation of spacecraft.

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RADIOBIOLOGY  
(Also Cytology)

M17(8/85) Akoyev IG, Yurov SS. Voprosy biologicheskogo deystviya i dozimetrii tyazhelykh zaryazhennykh chastits i adronov vysokikh energii [Issues related to the biological effects and dosimetry of HZE and high energy hadrons]. Proceedings of: All-Union Scientific Conference with Participation of Socialist Countries, Pushchino; 1984. [ca. 215 pages]

Affiliation: Institute of Biological Physics, Scientific Center of Biological Research, USSR Academy of Sciences

Radiobiology, Hadrons, HZE, Dosimetry  
Cytology, Mammals, Plants  
Perception, Visual sensation  
Space flight, Salyut-6

Annotation: This collection covers the major papers read by scientists from the USSR and other socialist nations at the All-Union working meetings on space radiobiology, held in Pushchino on 1-2 December 1982. The papers were devoted to the following issues: the biological effects of HZE emitted in space and by accelerators; the biological effects of nuclear particles (hadrons emitted in space and by accelerators) capable of participating in strong interactions; the physical description of space radiation; and dosimetry of HZE and high energy hadrons.

Basing its conclusions on the results of research on the radiation factor in space and on juxtaposition of biological data and the physical characteristics of radiation, this book offers the first biophysical interpretation of the effects obtained in space flights and under simulation of space flight conditions by means of accelerators.

Particular emphasis is placed on the ultrastructural effects of HZE and high-energy hadrons when there is strong interaction among them. Specific problems related to radiation safety of space flights with respect to the local radiation factor are discussed. New concepts of space radiobiology and dosimetry of space radiation are advanced. Consideration is given to future prospects for solving the most immediate problems.

This collection is intended for biologists, physicians and physicists interested in the problems of space biology and medicine, and in ensuring the radiation safety of space flights.

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## RADIOBIOLOGY

M23(8/85) Eyduş LKh, Korystov YuN. Kislorod v radiobiologii  
[Oxygen in radiobiology]. Moscow: Energoatomizdat; 1984. [176 pages;  
20 tables; 70 illustrations; 175 references]

Affiliation: Institute for Biological Physics, USSR Academy of  
Sciences.

Radiobiology, Oxygen Effect  
Cytology

Annotation: This monograph examines the major aspects of the participation of oxygen in radiobiological phenomena at all structural levels -- the molecular, cellular and organismic -- of biological subjects. The authors review the most important experimental data and analyze modern concepts of the mechanisms through which oxygen participates in damage and repair of macromolecules and cells. These concepts have been developed during the past 20 years, after the publication of the last reviews devoted to the oxygen effect. Particular emphasis is given to the way the oxygen effect chemically modifies reproductive destruction of cells in radiation protection and heightens damage during radiation therapy. For radiobiologists, radiologists and biophysicists.

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## SPACE BIOLOGY

M20(8/85) Belyayev MYu. Nauchnyye eksperimenty na kosmicheskikh korablyakh i orbital'nykh stantsiyakh [Scientific experiments on spacecraft and orbital stations]. Moscow: Mashinostroyeniye; 1984. [264 pages; 100 references; 7 in English]

Translation of pages dealing with biomedical research, pages 23-25.

### 1.4 Biomedical Experiments

Medical support of manned space flights is performed by a special group which monitors the physiological state of the spacecraft crew and performs the research necessary for predicting human functioning during space flight. From such biological experiments, the specialists obtain scientific data of great significance for long-term manned flights. Many of these scientific results also have fundamental significance for biology in general.

At the present time, such factors as prolonged weightlessness, the combined effects of weightlessness and ionizing radiation, etc. cannot be reproduced on earth. However, such factors are continuously operative on spacecraft. For this reason space flight represents a new and unique opportunity for the study of many questions in biology.

Biomedical experimentation in space makes it possible to study the combined effects of space flight factors on an organism. The limits of tolerance of extremes are established; the reactions of organisms to various types of radiation are investigated; and the reactions of humans to noise and vibrations, and the effects of artificial gravity are also studied. Research on the ecology of closed systems is also important in order to make long-term manned flights possible. This area of study includes, for example, investigation of the production of food on board the spacecraft.

Biomedical research is currently being carried out in manned spacecraft and unmanned satellites, including special-purpose biological satellites. It is characteristic of these specialized biosatellites that all of the design parameters, as well as orbital parameters and launch dates, are subordinated to the requirements of the experiments they carry. In our nation, biological experiments have been conducted, for example, on the "Cosmos-110," "Cosmos-368," "Cosmos-605," "Cosmos-690," "Cosmos-782," and "Cosmos-936" specialized biosatellites, which were launched in 1966-1977.

Biological experiments performed on the "Cosmos-368" satellite were directed toward study of the influence of weightlessness on molecular and genetic processes. (In addition, life support systems were tested during that flight.) The influence of prolonged weightlessness on structural and functional parameters of vital activity processes was studied in experiments performed during the flight of the "Cosmos-605" satellite, which carried 45 rats, tortoises, insects and bacterial cells. Organisms on board the "Cosmos-690" satellite were exposed to graded doses of radiation from

artificial sources of gamma radiation carried on board in order to study the combined effects of prolonged weightlessness and ionizing radiation.

The first space experiments involving comparative study of the influence of weightlessness and artificial gravity produced by the rotation of an onboard centrifuge were performed on the "Cosmos-782" and "Cosmos-936" satellites.

A radiotelemetric system provided continuous monitoring of the state of the experimental animals, and of physical [environmental] conditions on board the satellites during all phases of their flights. After the research plan had been fulfilled, the experimental subjects were returned to earth in a descent module.

At the present time it is not possible to keep biological subjects under constant surveillance when biological experiments are performed on unmanned spacecraft; nor is it possible to make repairs and adjustments on the scientific apparatus.\* (\*Some information about the development of biological subjects during space flight can be obtained through the use of television.) Manned spacecraft do not have these shortcomings. Biomedical experiments have been performed on virtually all of the manned flights in our nation (the "Soyuz" and "Salyut" programs). Here, the majority of the work associated with biomedical experiments has been assigned to the spacecraft crews. During the flight, the cosmonauts periodically perform a visual inspection of the subjects, and photograph interesting phenomena. The activity of the spacecraft crew in conducting biomedical experiments is supported by the usual active participation of specialists on earth, who perform on-line monitoring of the progress of the investigations and give special instructions to the crew. Many biomedical experiments are complex, i.e., the performance of a given manipulation on board the spacecraft is simultaneously accompanied by a control manipulation on earth. In this situation, experimental manipulations are adjusted on the basis of results obtained in both the space and the earth conditions.



## BOOK REVIEWS

### MUSCULOSKELETAL SYSTEM

BR2(8/85) Petrovich YA, Sumarokov DD. Review of: Prokhonchukov AA, Zhizhina NA, Tigranyan RA. Gomeostaz kostnoy tkani v norme i pri ekstremal'nom vozdeystvii [Homeostasis of bone tissue under normal and extreme conditions]. Moscow: Nauka, 1984. In: Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya. 1985(3):89-90.

NOTE: An abstract of this monograph [M9(6/85)] appeared in the previous issue (June 1985) of this digest.

Musculoskeletal System, Bone Physiology  
Space Flight, Cosmos and Salyut-1  
Weightlessness  
Radiobiology

The monograph being reviewed is the result of many years of work on the subject of the pathophysiology of mineral and protein metabolism in the skeletal system performed by the leading specialists of some of our chief institutes. The data presented in this book are of unquestioned current importance since extreme effects (ionizing radiation, weightlessness, acceleration, hypokinesia and other space flight factors), and also laser irradiation, are impinging more and more on human activity. For this reason, it is essential to predict the potentially pathogenic effects of these factors and to learn how to prevent them.

This monograph, 200 pages in length, contains 60 tables, 42 figures and a diagram, all of which are well-executed and significantly facilitate understanding of the text. The bibliography contains 178 Soviet and 100 foreign references.

The book consists of an introduction; [four] sections ("The state of bone tissue under normal conditions," "Changes in bone tissue under simulated space flight conditions," "Changes in bone tissue under [actual] space flight conditions," "General pathogenesis of changes in calcified tissues under the influence of extreme conditions", a conclusion, and a bibliography.

The skeletal system has a number of heterogeneous functions, one of the most important of which is maintenance of homeostasis of mineral components, particularly Ca and P. Considering the role which Ca plays in biochemical and physiological processes at a number of levels, it is difficult to overestimate the significance of the skeletal system in providing high-capacity storage of Ca to ensure Ca homeostasis in the organism as a whole. The idea of the skeletal system as metabolically inert, or even stable, has long been considered outmoded. This monograph emphasizes the lability of metabolism in the skeletal system and the capacity of this system to adapt metabolically to a variety of factors.

The methodological portion of this work is well written and could serve as a manual for novice researchers. Description of the authors' own

research precedes a broader overview, which presents the modern view of the structure, components and metabolism of bone tissue. Particular emphasis is given to the significance of the organic matrix of bone (collagenous and non-collagenous proteins, and lipids) and to bone mineralization. The book includes original diagrams of the structure and organization of bone (pg. 16) and of the functional changes in bone tissue in response to space flight factors (pg. 18). These diagrams represent a large number of aspects of the biochemical, physiological and morphological features of protein, non-organic components and cellular elements.

The mineral composition of bone tissue is extensively discussed in the first section of this monograph. Recently the famous American expert on the skeletal system, Glimcher (a number of whose works are cited in the monograph), expressed doubt concerning the presence of amorphous calcium phosphate in developing bone. However, the authors' own results allow them to refute Glimcher convincingly. In their discussion of the mechanism underlying regulation of mineral metabolism, the authors cite many interesting and important facts, although they fail to mention parotin as one of the hormones. The other divisions of the first section also demonstrate a thorough knowledge of the area. In a number of instances, the authors cite not only results, but also the methods by which these results (e.g., measurement of the microhardness of the bones of the human skeleton) were obtained.

The next chapters discuss the effects on the skeletal system of such extreme conditions as hypokinesia, asthenia, single exposures to high doses of X-rays, multiple exposures to low doses of high- and low-intensity laser radiation, as well as the combined effects of these space flight factors. Unique experimental material, well-chosen methods, and rigorously interpreted results are combined to allow the authors not only to obtain a great deal of extremely interesting data, but also to resolve certain contradictions existing in the previous literature. It is very important that the authors have succeeded in distinguishing the effects of the general stress factors which are unavoidable in space flight from the effects of specific factors indigenous to space, such as weightlessness, cosmic radiation, etc. A number of their results are new in an absolute sense, without precedent in either the Soviet or foreign literature. Many of their results are of general biological significance. For example, they demonstrate that the efficacy of the regeneration processes depends not only on exposure duration, but also on bone regeneration phase.

It is demonstrated that the reactions of the skeletal system to various extreme factors develop according to a single pattern. First, the metabolic rate increases sharply (adaptation phase), then decreases to below baseline level, and, if the force is excessively strong, falls substantially, leading to the destruction of bone (decompensation). Evidently, this pattern is a general one and may be extrapolated to other types of extreme effects. In addition, the authors have discovered a correlation between the intensity of the adverse factor and the relative intensities of the

various phases. Thus, a very high level of an extreme factor may lead to sharp depression or even complete disappearance of the first phase - the adaptation phase.

The book presents in detail data on phosphorous-calcium exchange in bones, and its relationship with metabolism of protein matrices, microelements, glycosaminoglycan, etc. It is argued that phosphate metabolism is more labile than Ca metabolism. Moreover, it is demonstrated that the metabolism of protein-bound phosphate and inorganic phosphate, concentrated in the mineral phase of bone, does not always change unidirectionally. Researchers must consider this finding, especially when they are measuring total phosphates. A major achievement in this monograph is the identification of a number of interrelationships between changes in the protein and mineral metabolisms of the skeletal bones. This is significant not only for space biology and medicine, but also for general medicine in the development of methods for treating bone pathologies. The authors have also established that there are differences in metabolic rate for portions of the skeleton differing in origin and structure.

[A paragraph detailing typographical errors has been omitted.]

The monograph as a whole represents a substantial contribution to osteology and adds much to our understanding of the metabolism of mineralized tissue, under both normal and pathological conditions. It is unfortunate that so few copies, 1700, have been printed.

## NEUROPHYSIOLOGY

BR1(8/85) Shipov AA. Review of: Levashev, MM. Nystagmometry in evaluation of the status of the vestibular function. Series: Problems in Space Biology, Vol. 50, editor V.A. Kislyakov. Leningrad: Nauka; 1984. In: Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(3): 87-89; 1985.

Note: An abstract [M10(6/85)] of this book was published in the last issue (June 1985) of this digest,

### Neurophysiology, Nystagmus, Vestibular Function, Motion Sickness

It is well known that nystagmus of the eye is a vestibular-motor reaction which is significant in the clinical practice of otolaryngology and neurology. Its value in the diagnosis of a number of diseases and also in occupational selection is especially evident now that nystagmus can be recorded graphically and measured quantitatively and accurately. However, the variety of methodological approaches to its measurement, along with the fact that these are not always adequately justified theoretically, makes it virtually impossible to compare the results of the majority of previous investigations. Because of this, it is essential that the following tasks be performed as soon as possible: 1) classification of the features of the nystagmic reaction which are measured in nystagmometry; 2) optimization of existing tests of vestibular function; 3) theoretical justification of empirically derived methods for studying nystagmus; and 4) identification of the information derivable from one or another feature of nystagmus with respect to the diagnosis of various diseases.

The author of this monograph, M. M. Levashov, has devoted many years to the careful study of all aspects of the nystagmic reaction with the goal of facilitating its effective use in clinical practice. In this monograph he accomplishes the tasks listed above to a significant extent. His book summarizes not only his own results, but also data obtained by Soviet and foreign investigators over a a period of many years.

The monograph is well-organized and consists of an introduction, four self-contained chapters, and a conclusion.

In the introduction, the author provides a general definition of the topic area he has selected -- nystagmometry. In this area, he includes both theoretical and applied investigations (physiological, clinical diagnostic, aerospace, cybernetic) using nystagmometry. These not only study the same phenomenon -- nystagmus, but also share a common quantitative approach. In vestibulology (which is only one of the possible applications of nystagmometry), nystagmus is studied in order to gain knowledge about the vestibular system. The author discusses the basic features and properties of vestibular nystagmus; the use of nystagmus as a means of analyzing spatial orientation and statokinetic stability in humans; interactions between the visual and vestibular systems, and among various portions of the

labyrinth; and analyzes the influence of extralabyrinthean factors on vestibular reactions. In other words, he describes the nystagmus as studied in experimental and theoretical nystagmometry. However, nystagmometry can also be used to solve applied problems, such as the development of quantitative methods for differential diagnosis, professional selection, and evaluation of therapeutic measures. The ultimate goal of this kind of research is the establishment of standards for identifying the normal and pathological states of the vestibular system and, where pathology is indicated, further specifying and refining the diagnosis (local or widespread pathological process, degree of vestibular dysfunction, etc.). To solve applied problems in nystagmometry, as the author states, it is essential not only that empirically derived research techniques be theoretically justified and that vestibular tests be optimized, but also that a number of engineering problems (e.g., calibration of vestibular stimulation, reliable recording of nystagmus, automated processing of numerical data, etc.) be solved.

From the above, the reader will have gained a clear idea that, of the broad range of problems related to nystagmometry, this monograph examines only those which can serve as sources of new information about the functioning of the vestibular apparatus and about the interactions of the vestibular system with other sensory systems. In addition, it covers problems related to increasing the effectiveness of vestibular diagnosis, with particular emphasis given to tests for identifying hidden dysfunctions. An attempt is also made to define the direction of future nystagmometric research.

Chapter 1 introduces the reader to tonic and rhythmic vestibular reactions. A major portion of the chapter is devoted to rhythmic nystagmus, which reflects the interaction between the semicircular canals of the labyrinth. Information is cited about the paths and centers of nystagmus, the slow and fast component systems, the phenomenon of extinction, and the influence of various portions of the central nervous system on vestibulomotor reflexes. Using the example of the interaction between the vestibular and auditory functions, the author makes a strong case for the utilization of nystagmometric features for the differential diagnosis of the level of central nervous system involvement. In this same chapter, he covers the major problems encountered when nystagmometry is used: calibration, recording of rotor nystagmus, creation of vestibulometric tests for quantitative evaluation of the functions of the vertical canals and otolith system, etc.

Chapter 1 ends with a discussion of the significance of quantitative study of nystagmic reactions for research on the mechanisms underlying nystagmus, as well as for the development of new vestibulometric tests and diagnostic techniques.

Chapter 2 covers the use of nystagmometry for studying visual-vestibular integration. Citing physiological experiments on animals, the author demonstrates the close functional connection between vestibular and optokinetic nystagmus. He very convincingly demonstrates that eye movements in response to combined stimulation (vestibular and optokinetic) may form the basis for the development of

new kind of vestibular test. The phenomenon studied using such tests would be the mechanisms underlying the interaction of the vestibular and optokinetic systems which participate in the formation of the adaptive reactions of vestibulo-optokinetic nystagmus.

Chapter 3, the central chapter and the one which is most relevant to applied research, examines the systematization of nystagmometric features. The author demonstrates that, when using nystagmometric features, it is essential to formulate a precise statistical description of the norm, and to determine how nystagmic parameters are distributed. The nontraditional nystagmometric and multidimensional features proposed by the author are of particular interest from the standpoint of applied nystagmometry. In this chapter he also formulates the most important diagnostic principles.

Chapter 4 presents a detailed mathematical model of the bithermal test. The proposed model is used to derive the most promising future directions for the study of the mechanisms underlying the phenomenon of directional dominance in its various manifestations, particularly, in nystagmic extinction. In addition, the use of this model increases the amount of information derivable from the bithermal test and makes it possible to clarify issues (detection of compensation, elimination of pathology, etc.) not addressed in traditional evaluations.

In conclusion, the author considers the prospects for the use of automated systems to record and process nystagmograms and to perform diagnosis. He enumerates the necessary prerequisites for accomplishing these goals, as well as the difficulties involved in this new trend in the development of nystagmometric research.

The monograph is well illustrated, and cites a bibliography of more than 500 Soviet and foreign sources.

M.M. Levashov's book will be of value to a wide circle of readers: clinicians in otoneurology, physiologists, engineers interested in the mathematical description and modeling of biological processes, and specialists in aerospace medicine.

## OTHER CURRENT RUSSIAN TITLES RELEVANT TO SPACE LIFE SCIENCES

We offer a list of titles of Soviet publication articles not selected for abstraction which may be of interest to NASA life scientists. As far as we know, the texts of these articles are available only in Russian at this time.

Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(3); 1985.  
Material not abstracted in this issue of the Digest.

Rudnyi NM. The 40th anniversary of the victory in the Great Patriotic War and the development of aerospace medicine. 4-7.

Program review of sessions on Aerospace Medicine and Psychology presented at the XIV Gagarin Lectures. 89-93. [A description of this conference is given in the June issue of this digest.]

Obituary for Petr Kuz'mich Isakov, Chairman of the Aerospace Medicine Division of the Moscow Physiological Society. 93-94.

Arkhiiv Anatomii, Gistologii i Embriologii [Archives of Anatomy, Histology and Embryology]. LXXXVIII(3); 1985.

Rodionova AV. Age and individual differences in the structure of the aortal valve in humans. 44-52.

Fizicheskoy Kultury [Physical Culture]. 1985(2).

Shape of the sphygmogram of the carotic, radial, and femoral arteries in athletes who have just engaged in exercise at temperatures of 20 and 35°

Fiziologicheskii Zhurnal SSSR imeni I.M. Sechenov [Physiological Journal of the Soviet Union named for I.M. Sechenov]. LXXI(3); 1985.

Lapina IA, Yaichnikov IK, Poltavchenko YeYu. Infralow activity and brain temperature in response to tests inducing emotional stress. 348-354.

Rusin VYa, Nasolodin VV, Vorob'yev VA, Khrustaleva TN. Changes in the microelement components of the blood and internal organs in animals subjected to muscular stress of varying intensity. 377-381.

Baranov YeA, Petrov YeA, Baranov VI. Measurement of oxygen consumption and external respiration parameters of seals (*Uphoca vitulina*) allowed unrestricted swimming in a pool. 389-393.

LXXI(4); 1985.

Minassyan SM, Baklavadzhyan OG, Oganessian AO, Chiflikyan MD. The effect of vibration and noise on the biogenic amines in certain structures of the brain, blood and adrenal glands in rabbits. 439-446.

Osadchiy LI, Baluyeva TV, Sergeyev IV. Factor analysis of factors affecting cardiac output during suppression of the sinocarotoid reflexogenic area. 500-506.

Zver'kova, YeYe. Changes in the general resistance of rats during readaptation following exposure to an altered gaseous medium. 523-527.

Fiziologicheskii Zhurnal (Akademiya Nauk Ukrainskoy SSR)  
[Physiological Journal of the Ukrainian Academy of Sciences].  
31(1); 1985.

Gyulling EV, Mel'nikov OF, Pisanko VN, Olishevskiy EM. The role of the thymus gland in modulation of antibody production occurring in response to a magnetic field. 71-73.

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Ugarova OP. Changes in the concentration of monoamines and 11-oxycorticosteroids in the blood of rats undergoing stress. 224-227.

Gigiyena i Sanitariya [Safety and Sanitation]. 1985(1).

Iyerusalimskiy AP, Lifshits AI, Portnov FG, Shmidt AB.  
Extrapolating electrostatic field values obtained in animal experiments to humans. 89.

1985(2).

Volkhov AA, Markaryan SS. The effect of ship noise on rate of free associations for sailors on a prolonged cruise. 82-83.

1985(3).

Dumanskiy YuD, Karachev II, Ivanov DS. Issues involved in safety regulation of electromagnetic energy generated by television transmitters. 39-42.

1985(4).

Eytingon AI. Predicting the toxic effects of the combustion products of polymers. 20-23.

Shandala MG, Dumanskiy YuD, Tomashevskaya LA, Soldatchenkov VN. Setting safety standards for environmental ultra-high frequency (2750 MHz)pulsed intermittent electromagnetic energy. 26-29.

Gigiyena Truda i Professional'nyye Zabolevaniya [Industrial safety and Occupational Diseases]. 1985(1).

Ivanov VV. Response of the cardiovascular system to tilt tests in subjects with varying physical work capacities. 47-48.



Kardiologii [Cardiology]. XXV(4); 1985.

Il'nitskiy VI. Echocardiograms of young athletes in annual training programs. 60-64.

Megrelishvili GN, Tsagareli ZG, Gogiashvili LYe. Cardiac muscle ultrastructure during experimentally induced myocardial infarction following a program of physical exercise. 89-91.

Kazanskii Meditsinskii Zhurnal [Kazan Medical Journal]. 66(1); 1985.

Vaynshteyn SG, Masik AM. The effect of wheat bran on glucose tolerance test parameters in healthy individuals. 13-15.

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Sudakov KV, Ul'yaninskiy LS. Extra-cardial regulation in emotional stress. 3-13.

Manukhina YeB. Combined effects of adrenoblockers and stress on contractility of the portal vein in rats. 13-15.

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Kovalev OA, Sherameteyskaya SK, Protasov MB. Regional changes in circulation following massive blood loss and immobilization. 15-18.

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Faysi Ch. Nomograms for identifying the parameters of radiation tolerance. 33-37.

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XXV(2); 1985.

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Orlovskiy AA, Rozhdestvenskiy LM. The role of the hypoxic mechanism in the radiation protection effects of phenylephrine hydrochloride. 227-230.

Gil'yano NYA, Malinovskiy OV, Stepanov SI. On the mechanism underlying the radiation protection effect of cysteamine. 238-241.

Vershinina SF, Konnova LA, Zherbin YeA. The effects of gamma- and gamma-neutron irradiation on the composition of the pool of metabolic amino acids, antiprotease activity of the pool and the longevity of animals. 241-245.

Seriya Biologicheskay [Biological Series]. 1985(2).

Kholodenko BN, Stepanchikova AV, Erlikh LI, Atayllakhanov FI, Zhabotinkiy AM, Pichugin AV. The role of the 2,3-diphosphoglycerate bypass in regulation of energy metabolism in human erythrocytes. 196-206.

Nadzharyan TL, Pikovskaya GN, Barsel' VA, Mamayev, VB, Yerovichenkova LA, Yevseyenko LS, Kravchuk IV, Kravchenko IV, Grankova NT, Churkina LM, Makhlin NV. The effect of dubonol on a number of physiological parameters in healthy individuals. 211-219.

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Shkurupiy VA, Kovrigina GG. Structural and quantitative changes in the lysosome apparatus of hepatocytes in mice subjected to stress. 93-98.

Vestnik Leningradskogo Universiteta: Biologiya. (3) [News from Leningrad University: Biology]. 1985(1).

Putilina FYe, Osadchaya LM. The effect of hypoxia and hyperphenylalaninemia on the concentration and interrelationships of oxidized and reduced forms of pyridine coenzymes in the brain. 52-57.

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Translations of recent Soviet publication, including those of interest to specialists in space life sciences, are published by Joint Publications Research Service (JPRS). JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. When ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

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USSR REPORT ON LIFE SCIENCES BIOMEDICAL AND BEHAVIORAL SCIENCES

JPRS-UBB-85-10-L, 22 MAY 1985

Selected Contents:

Transport of Electrons in Biological Systems

(Rubin AB, Shinkarev VP; Book Annotation; 5 pages)

Enhancement of Crop Yields by Ionizing Radiation

(Newspaper Article; 1 page)

Guidelines for Setting up Experiments Dealing with Development of Models of Complicated Operator Actions

(Zarakovskiy GM, Rysakova SL, et al. Journal Article; 15 pages)

Law of Mutual Adaptation of Man and Machine

(Venda VF; Journal Article; 12 pages)

Investigation and Modeling of Infectious Process

(Blyuger AF, Book Annotation and Chapter Synopses; 12 pages)

Pharmacological Correction of Fatigue

(Bobkov YG, Vinogradov VM, et al; Book Annotation; 3 pages)

JPRS-UBB-85-011-L, 28 MAY 1985

Selected Contents:

Adaptation of Organisms to Conditions of Far North

(Book Annotation; 4 pages)

Molecular Mechanisms of Radiation Sickness

(Romantsev YeF, Blokhina VD, et al.; Book Annotation; 3 pages)

OTHER TRANSLATED TITLES

JPRS-UBB-85-012-L 26 JUNE 1985

Selected Contents:

General Patterns of Sensory Processes During Exposure to Extreme Stimuli (Medvedev VI, Gibadulin TV, et al; Journal Article; 7 pages)

Homeostatic Processes in Isolated Systems and Body  
(List of Titles of Conference Papers; 11 pages)

Effect of Endogenous Processes of Formation and Growth of Gas Bubbles on Safety of Decompression (Nikolayev VP; Journal Article; 6 pages)

JPRS-UBB-85-13, 19 APRIL 1985

Selected Contents:

Magnetocardiograph More Sensitive than EKG  
(Newspaper Article Excerpt; 1 page)

Effects of Hypoxic Hypoxia on Rat Lymph Node Ultrastructure  
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JPRS-UBB-85-017, 7 June 1985

Selected Contents:

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Anatomy of Stress  
(Rylov A; Journal Article Abstract; 1 page)

Turnover of Chromatin-Bound and Membrane Lipids From Liver and Thymus of Gamma Irradiated Rats (Kaznacheyev YuS, Kolomiytseva IK, et al.; Journal Article Abstract; 1 page)

JPRS-UBB-85-018 28 JUNE 1985

Selected Contents:

Bio-Engineering and Plant Growth  
(Lepikov A; Newspaper Article; 3 pages)

Speech Analysis for Assessing Pilots' Working Fitness  
(Dvigantsev S; Journal Article; 2 pages)

Formation of New Microvessels in Skeletal Muscles of Rats Exposed to Hypobaric Hypoxia for One Week (Kondashevskaya MV, Koshelev VB, et al.; Journal Article Abstract; 1 page)

## OTHER TRANSLATED TITLES

Effects of Immobilization and High-Altitude Adaptation on Energy Metabolism in Rats (Sutkovoy DA, Baraboy VA; Journal Article Abstract; 1 page)

Effects of Blood Volume Overload on Myocardial Ultrastructure in Relation to Adaptation to High Altitude Hypoxia (Kadyraliyev AK, Tilis AYU; Journal Article Abstract; 1 page)

Cardiorespiratory Function and Work Performance During Adaptation to Industrial Labor in Midalpine Conditons (Mambetaliyev BS, Akynbekov KU; Journal Article Abstract; 1 page)

Structural Changes in Thyroid Due to High-Altitude Adaptation in Kirghizia (Lyamtsev VT, Razumovskiy, et al.; Journal Article Abstract; 1 page)

Methodologic Approaches to Prediction of Functional Status of Body Exposed to Unfavorable Environmental Factors (Shpilevskiy EM, Lugovskiy VK, et al.; Journal Article Abstract; 1 page)

Effects of Physical, Chemical or Biological Factors on DNA Replication in Mammalian Cells. Part 2. Recovery of DNA Complex, Nucleoid and DNA Replication After Gamma Irradiation (Synzynys BI, Kiseleva, et al.; Journal Article Abstract; 1 page)



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16. Abstract  This is the second issue of the bimonthly digest of USSR Space Life Sciences. Abstracts are included for 39 Soviet periodical articles in 16 areas of aerospace medicine and space biology and published in Russian during the first half of 1985. Selected articles are illustrated with figures from the original. In addition, translated introductions and tables of contents for 14 Russian books on 11 topics related to NASA's life science concerns are presented. Areas covered are: adaptation, biospherics, body fluids, botany, cardiovascular and respiratory systems, cybernetics and biomedical data processing, gastrointestinal system, group dynamics, habitability and environmental effects, health and medical treatment, hematology, immunology, life support systems, metabolism, musculoskeletal system, neurophysiology, psychology, radiobiology, and space biology. Two book reviews translated from the Russian are included and lists of additional relevant titles available either in English or in Russian only are appended.					
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