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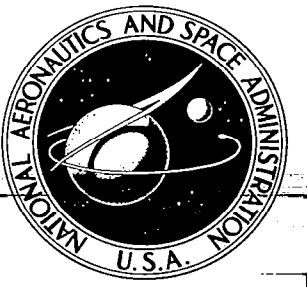

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SOVIET SPACE BIOLOGY AND MEDICINE

by David Wood and Elena Fortunatow

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INTRODUCTION

This review of U. S. S. R. literature on space biology and medicine was initially sponsored by the United States Air Force and was completed under funding provided by the Scientific and Technical Intelligence Center, Department of the Navy. It consists of a commentary and 327 abstracts (divided into 12 topical sections), plus five additional references based on Soviet literature from October 1967 to February 1969. Reference numbers in the commentary cite the consecutively numbered abstracts or the additional references. The work was performed by David Wood and Elena Fortunatow, of the former Aerospace Technology Division of the Library of Congress. Variations in appearance of certain sections arose from the use of multiple inputs from a number of sources. Although it has made no contribution to the preparation of the review, NASA is with the permission of the funding organizations incorporating the review in its scientific and technical information system, and making copies available to the aerospace biomedical community.

Part I

COMMENTARY

Section 1. Acceleration

The section dealing with acceleration stress studies contains 31 abstracts, 10 of which involve experimentation with human subjects. Of these 10 abstracts five deal specifically with the effect of angular acceleration upon the vestibular analysor.

A series of experiments performed by F. A. Solodovnik, L. M. Vorob'yev, and G. F. Khlebnikov [30] was designed to study the effect on man of rotation about two mutually perpendicular axes. This study indicated that a cosmonaut should avoid movement of his head in the sagittal plane when working in a rotating spacecraft. In this study and in another performed by V. G. Bazarov [5], test subjects sat in a rotating chair and tilted their heads in varying ways, depending on the nature of the experimentation. Bazarov, a major in the Medical Service, exposed test subjects to 180°/sec angular velocity for 5--7 min episodes. He concluded that this type of testing is sufficient for pilot screening to reveal vestibulosympathetic instability, and that fatigue is a significant factor in rotation tolerance.

One of the two studies by Lt. Col. S. S. Markaryan included in this section is of particular interest [20]. Young men were subjected to very brief episodes of high angular velocity (up to 900°/sec) with high onset rates to determine the effect of intense rotation at varying angles of exposure on pilots during ejection from aircraft. Markaryan concluded that the receptors of the frontal semicircular canals are less sensitive than others. In both of these studies, Markaryan concluded that the intensity of nystagmus resulting from G-loading is directly proportional to the magnitude of the acceleration applied [19, 20].

A. S. Barer participated in the work of two groups of scientists performing acceleration stress studies. In a study conducted by Barer et al. [4], the ability of subjects to operate a system by using only the fingers at accelerations of up to 18 G's was investigated. Barer also performed tests to study the human response to the landing impact. Subjects were placed in a specially contoured couch and exposed to stresses of up to 40 G's for 0.03 sec with an onset rate of 5000 G/sec. Among the responses observed were a drop in arterial pressure, an increase in respiratory rate, bradycardia, erythruria, and an increase in glutamino-alanine and glutamino-aspartic transamine in the blood [3].

G. P. Mirolyubov, et al.[22] also carried out tests to determine the effects of landing impact. These tests were designed to simulate the soft landing of a spacecraft with a side wind. Descent rates of up to 8--10 m/sec were found to be feasible with the shock-absorber system employed.

M. M. Korotayev and A. I. Grigor'yev investigated the effect of acceleration on kidney function. Stresses up to 10 G's were applied in three separate exposures. Microhematuria was observed in the test subjects and was described as being possibly due to intrarenal circulatory or increased renal vascular permeability [14].

Twelve of the articles included in this section deal with functional, histological, and morphological changes in the viscera and physiological systems of various animals.

Ye. F. Kotovskiy and T. V. Speranskaya investigated the effects of G-loading on the livers of dogs and monkeys in two separate studies [17,18]. They discovered water and protein metabolism disorders in the liver as well as such vascular changes as congested hyperemia and dystrophic manifestations in monkeys [17]. In dogs, the areas of blood effusion were found to be infiltrated with leukocytes and macrophages as early as 1 hr. after centrifugation (3--12 G's). Adaptive responses were apparent after repeated exposure [18].

Vascular hemodynamics in the eye of the rabbit after G-loading were studied by E. S. Kotova and Ye. A. Savina. High acceleration was found to produce circulatory disorders and increased permeability of the optic vascular system, which persisted for several days [16].

Eight of the abstracts included in this section outline studies of the effect of G-loading on the functioning and morphology of some facet of the brain or nervous system. D. I. Medvedev found that acceleration of up to 12 G's causes morphological changes in the precoronary region of the canine cerebral cortex which are generally associated with carotid inhibition [21]. V. Ye. Potkin demonstrated the important role of the central nervous system in regulating the secretory activity of the small intestine in dogs [26]. L. A. Andrianova recorded pronounced changes in the neurosecretory activity of the frontal hypothalamus in rabbits after G-loading [2].

B. M. Savin used electroretinography to study visual analysor disorders in cats exposed to acceleration of up to 22 G's [27]. I. A. Bulygin and O. E. Sokolovskiy of the Institute of Physiology, Belorussian Academy of Sciences [AN BSSR], recorded electrical responses of motor neurons of the postmesenteric sympathetic ganglion of dogs and cats to differentiate the effects of centrifugal and centripetal stimuli [6].

Nembutal-anesthetized white rats were used in a study performed by L. D. Klimovskaya and N. P. Smirnova to study perceptual and transmission disorders between the cerebellum and the muscle receptors. Their findings show that acceleration alters the electrical activity of the cerebellar cortex by depressing its response to neural stimulation. This result was compared with the similar response observed upon high-frequency

stimulation of the mid-brain's reticular formation. This latter phenomenon can be obviated with administration of chlorpromazine, while the former apparently cannot [10].

Development of the vestibular-oculomotor function was studied in rabbits by Ye. N. Kosmarskaya and Ye. G. Balashova, members of the Department of Brain Development with Congenital and Hereditary Diseases, Institute of Pediatrics, Academy of Medical Sciences [AMN] USSR, Moscow. In this study they subjected rabbits ranging in age from 10 days to maturity to G-loading and then recorded the resulting nystagmus [15].

Ye. D. Klimenko, G. V. Chernysheva, and V. Ye. Potkin discussed the effects of acceleration and administration of cholesterin on the canine cardiovascular system in a paper presented in the Bulletin of Experimental Biology and Medicine by V. V. Parin. The organizational affiliation listed for the researchers is the Laboratory of Morphology and Laboratory of Biochemistry of the Institute of Normal and Pathological Physiology, AMN SSSR. The study revealed the formation of thick plaques in the intima and of focal lipoidosis in the aortic walls and small arteries of the kidneys and thyroid glands. Biochemically, myocardial sarcoplasmatic proteins were seen to increase by about 25% in the left ventricle. ATP-ase activity of myosin increased by 74% in the left and by 42% in the right ventricle. Other arteriosclerotic manifestations were also evident [9].

Ye. Ye. Simonov and V. A. Korzhen'yants used enzymatic blood tests to evaluate the degree of trauma suffered by animals exposed to impact stresses. Rapid changes were observed in enzyme activity (especially in that of aminotransferase and aldolase) which indicate that the tests performed by these scientists could serve as indices of the severity of trauma in such cases or as the basis for biochemical criteria for tolerance to impact stress [29].

The effect of transverse acceleration on canine kidneys was studied by P. V. Vasil'yev, et al [31]. Exposure of up to 12 G's for 1 min caused increased saluresis and kaluresis, but little osmotic diuresis. These changes were attributed to neurohumoral rather than morphological changes.

Yu. N. Korolev exposed dogs to single and multiple episodes of transverse G-loading to study the effect of such stress on the lungs. Changes on the vascular system and parenchymatous structures of the lungs were observed; the changes proved to be reversible [13].

Interesting research into the effect of transverse acceleration on the lymphatic system was performed by Yu. N. Afanas'yev and Yu. V. Makhovtsev [1] using both mice and dogs. Repeated accelerations caused destruction of lymphatic system cells, inhibited mitosis, reduced the size of the lymphoid follicles, and sharply increased the size of reactive centers and the lymphoblast count. Definite changes were also observed in the spleen.

S.S. Markaryan and V. G. Petrukhin studied the general pathomorphological effects of negative (craniocaudal) G-loading in dogs [24].

N. V. Korneyeva and A. S. Ushakov studied the effect of acceleration on acetylcholine metabolism in the brain and heart of guinea pigs [12] and in the blood of rabbits [11].

The compensatory processes involved in hemodynamic changes were studied by Ye. B. Shul'zhenko and T. V. Sebekina utilizing some rather intricate procedures involving mechanical inactivation of 71.4% of the lung tissue and sinocarotid denervation during centrifugation. The indices studied included cardiac contraction rate, left and right ventricular pressures, aortic pressures (systolic, diastolic, and pulse pressures), minute-volume,and Maxwell's peripheral blood resistance. The overall response to acceleration stress was seen to be divided into two discrete phases corresponding to the initial and latter periods of acceleration [28].

L. V. Pastushenkov, a captain of the Medical Service, tested the effectiveness of the sulfur-bearing compounds allisothiuronium, methylisothiuronium, ethylisothiuronium, propylisothiuronium, ethylthiourea, and guanylthiourea in increasing the resistance of mice and rats to acceleration. Some of these compounds were used with some success by the Germans many years ago in attempts to increase tolerance to radiation, but they were replaced by cysteamine and other compounds found to be more effective. In the study in question, the test animals were rotated at LD_{50} G-loads to determine the effectiveness of the compounds administered at the doses employed. Guanylthiourea was found to be the most effective of the substances used, but all except methylisothiuronium increased tolerance by at least 10 G's when given in large doses [23].

Section 2. Weightlessness

This section treats topics involving weightlessness during actual spaceflight as well as during parabolic or ballistic flights. The reason for this is that 19 of the 25 articles cited in this section stem from a single source: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-Biological Studies During Weightlessness) Moskva, Izd-vo "Meditsina", 1968. This volume was edited by the eminent Soviet bio-medical specialists V. V. Parin, I. I. Kas'yan, O. G. Gazenko, P. V. Vasil'yev, Ye. M. Yuganov, P. K. Isakov, and V. I. Yazdovskiy. In addition, these personalities often teamed up with other researchers in writing the articles included in this collection. Other contributing researchers include the following: A. B. Voskresenskiy, D. G. Maksimov, V. I. Kopanev, P. V. Vasil'yev (also included in the section on acceleration), G. V. Altukhov, V. Ye. Belay, A. D. Yegorov, A. I. Mantsvetova, I. P. Neumyvakin, V. F. Orlova, V. A. Trubnikova, I. M. Freydberg, Ye. A. Ivanov, V. A. Popov, L. S. Khachatur'yants, Yu. M. Volynkin, I.T. Akulinichev, I. S. Balakhovskiy, I. G. Popov, G. I. Pavlov, D. V. Afanas'yev, N. N. Gurovskiy, A. I. Konovalov, B. A. Yakubov, L. A. Kitayev-Smyk, G. M. Belyakov, V. S. Kunznetsov, and P. A. Korzhuyev. No organizational affiliations are listed for the above-enumerated researchers. A different source, [45], however, indicated that P. A. Korzhuyev was with the Institute of Evolutionary Animal Morphology and Ecology, AN SSSR, Moscow (Institut evolyutsionnoy morfologii i ekologii zhivotnykh AN SSSR).

Seven of the articles from Medico-Biological Studies During Weightlessness deal largely with the cardiovascular system and blood during short-term weightlessness and actual spaceflight. G. V. Altukhov et al. studied the heart rate and systolic index for cosmonauts Nikolayev, Popovich, Bykovskiy, and Tereshkova without being able to draw any definite conclusions concerning the effect of weightlessness on cardiodynamics [32]. V. V. Parin et al. compared EKG and EEG data from simulated weightlessness and acceleration with these EKG and EEG data obtained in orbital flights. In the same study, they sought to determine the capacity of test animals to adapt to these factors [49]. I. I. Kas'yan et al. investigated blood circulation during weightlessness. They found no general correlation between observed decreases in cardiovascular function and the duration of exposure to weightlessness, but rapid normalization of the cardiodynamic indices was concluded to stem largely from the humoral compensatory arc, which is stimulated by both weightlessness and acceleration [42]. I. I. Kas'yan et al. also studied effects of spaceflight on the cosmonauts involved in the "Voskhod" space mission [33, 41, 51, 52].

The remaining articles in this section are more generalized. They treat topics dealing with neural compensatory responses and mechanisms, with man's work efficiency in space, and with the effect

of weightlessness on the neural analysors and on motor coordination.

I. I. Kas'yan et al. presented an article entitled "Basic problems in the study of weightlessness." This is one of a number of review articles which summarizes much of both Soviet and Western biomedical research in the area of weightlessness. The findings of this research are viewed critically and an attempt is made to draw conclusions and to spot trends pertinent to the effect of weightlessness on man and animal [53]. I. I. Kas'yan and V. I. Kopanev reviewed Soviet and American literature published from 1964 to 1965 dealing with the physiological aspects of weightlessness [40]. These same authors also reviewed the literature with respect to the body's compensatory and adaptive responses to weightlessness [39].

L. A. Kitayev-Smyk reported on his studies performed aboard laboratory aircraft during parabolic flights [43]. The contents dealt largely with spatial illusions and vestibulo-autonomic responses; both men and women were tested. (See also [44] and [97] for other work by this author.)

I. I. Kas'yan teamed up with various groups of scientists to produce three articles concerning the response of man to weightlessness and acceleration. It should be noted here that in short-term weightlessness experiments during parabolic flight, G-loading is usually an unavoidable phase of the experimental cycle. Thus, many of these articles evaluate the physiological response to acceleration as well as to weightlessness. In [37], Kas'yan et al. found the effects of zero-gravity and acceleration to be different, supposedly because of the opposed directions of venous pressure changes in the right auricle. Also, return venous flow to the heart is decreased due to the reduced tonic stress of the skeletal muscles during weightlessness. The article compares the relative functional state of other physiological systems under the influence of G-loading as opposed to zero-gravity. In Kas'yan et al. [55], mice were subjected to centrifugation aboard laboratory craft in parabolic flight to determine the minimum fractional G-load necessary to allow essential motor functions. The authors concluded that affected motor function displayed by intact test animals stems from disorders in analysor interaction, which is triggered from within the vestibular analysor. I. I. Kas'yan and Ye. M. Yuganov et al. [56], tested human subjects during short-term weightlessness to determine their sensory responses and to clarify how voluntary acts are affected. Coordinated, rhythmic motor activities, such as those involved in writing, were not greatly affected by either G-loading or zero-gravity. Test subjects experienced no real difficulties in the intake of solids, semisolids, or liquids.

Another study employing handwriting analysis to determine zero-gravity coordination is found in A. I. Mantsvetova et al. [47].

Here, cosmonaut logbook entries made while in orbit were compared with control writing samples. Deviations were determined to be caused by unusual writing conditions, rather than central nervous system disorders. The cosmonauts' writing movements were found to become more coordinated as their missions progressed.

Similarly, the performance of assigned tasks during spaceflight was found to require less time as the length of exposure to zero-gravity increased. This study involving the Voskhod-1 and -2 cosmonauts was conducted by Ye. A. Ivanov et al. [38]. They detected irregularities in report language stereotype, telegraph send-key spacing, etc. The authors listed heart rates for the various cosmonauts and, interestingly, evaluated the EVA work efficiency of Leonov at 39.7% qualitatively, as compared to 57--60% during final aircraft training flights. His movements were 20--30% slower during EVA than during training. Leonov's maneuvers during EVA are discussed as well as the importance of trainers and simulators in his overall proficiency. Many other topics, such as motor response latency and visual acuity, are treated in this article [38].

Borshchevskiy et al. [34], conducted research on the effects of weightlessness on speech control without detecting any outstanding deviations which would impede voice communication during weightlessness.

Yu. G. Nefedov, M. N. Gurovskiy, A. D. Yegorov, B. B. Yegorov, A. A. Kiselev, S. O. Nikolayev, and A. P. Polyakova conducted a study of the canine cardiovascular system during the 22-day spaceflight of the Kosmos-110 biosatellite. Tables listing the cardiodynamic recordings made for the dogs Veterok and Ugolek were included in this abstract [48]

An article by M. D. Venttsel', A D. Voskresenskiy, and N. A. Chekhonadskiy reflects the strong interest of Soviet space physicians in the application of methods of mathematical analysis in the solution and study of biomedical problems [50]. These authors employed correlational analysis in a study of EKG R-R intervals recorded for the Voskhod-1 cosmonauts. Some slow-wave deviations felt to be the result of fluctuations in the activity level of the central part of the sympathetic nervous system are described [50].

Ye. M. Yuganov and V. V. Aleshin conducted research into the efferentation of the vagus nerve in intact and labyrinthectomized animals during short-term weightlessness. In intact animals, vagus electrical activity was found to remain relatively stable during horizontal flight and acceleration, but to decrease sharply with the onset of weightlessness. Labyrinthectomized animals, on the other hand, displayed no significant change in neural bioelectrical activity during zero-gravity [54].

In articles dealing with the effects of weightlessness, mention is made of the use of artificial gravity to counteract the deleterious

effects of weightlessness upon the body's physiological systems. Ye. M. Yuganov and G. I. Pavlov [57] studied the electrical activity of the skeletal muscles, heart rate, and respiration of dogs to arrive at a value for the force of gravity sufficient to obviate the effects of weightlessness on motor responses. They arrived at a value of 0.28 -- 0.37 G (the value arrived at by American researchers is 0.277 G for both man and animals) as the G-load at which muscular bioelectrical activity normalizes [57]. Mention of the use of artificial gravity may also be found in [53] in this section and in [106] in the Combined Factors section.

A. I. Gorshkov described an otolithometric study wherein a chair that could be driven with constant linear acceleration was employed. The chair was mounted in a laboratory airplane for tests during short-term weightlessness. On earth, otolithic sensitivity was found to be 0.01--0.005 G; this value was seen to increase in every case during weightlessness. Tests were also carried out to determine normal and zero-gravity otolithic galvanic threshold sensitivity [36].

L. A. Kitayev-Smyk, referenced earlier in this section, ran a study on oculographic illusion during short-term weightlessness. This involved the illusory movement of afterimage phenomena from light stimuli at the onset of weightlessness [44]. (See also [97] under Combined Factors.)

The final article in this section describes a study in which men were required to exert a constant force against a hand lever during short-term weightlessness. Biopotentials of the hand muscles were recorded; it was found that these potentials increased by 100-150% during weightlessness, but remained essentially unchanged during G-loading. The results of this study, conducted by M. A. Cherepakhin [35], were said to contradict those of Yuganov et al. as described in the text of the abstract.

An extremely interesting article by Soviet cosmonaut A. Leonov is treated in some detail in this commentary since no abstract was available at the time of report preparation. The article is entitled "Man in Space" [330]. In it Leonov discussed his extra-vehicular activity (EVA) during the flight of Voskhod-2. In training for the flight, he underwent a course of special physical exercises, parachute training, and EVA simulation aboard airborne laboratories in parabolic trajectory flight. As a result of this training, he claims that he did not experience the natural emotional stress upon leaving the spacecraft, and that his main psychophysiological indices (EEG, EKG, respiration) failed to reveal any significant deviations. For spatial orientation of the cosmonaut during EVA, a coordinate frame of reference was established during training. The coordinate system is characterized by the assumption that the spacecraft is always "down", a notion which became instilled in the cosmonaut as the training program progressed. Other reference points in the system were the sun and earth. (It should be noted that Ye. A. Ivanov et al. [38], indicated that Leonov oriented himself in space with respect to the Voskhods two axes.) Simulators were designed in order to represent

every possible variation of the cosmonaut's position with relation to these three bodies. The cosmonaut effected EVA by passing headfirst through the airlock hatch at a 45° angle to its main axis with his arms extended to protect his face plate. In one instance during EVA, the cosmonaut experienced rotation about his longitudinal and transverse axes. He was unable to stop the rotation by body movements alone. Finally, his safety cord pulled up short and he stopped his spinning. Throughout this episode, however, he felt that the spacecraft was relatively down, even when he could not see it. This awareness did not come automatically in spite of his extensive training, but only after careful consideration of the path he had traveled to arrive at the point and position in question. It was helpful to be aware of the positions of the sun, Earth, and spacecraft relative to each other. The safety cord was also a helpful indicator when stretched tight. The cosmonaut proposed that some type of device be supplied which would always establish "down".

Complications arising when work on more than one craft is required can perhaps be solved best by assigning each craft its own coordinate system. Psychologists have shown the process of transference from one coordinate frame of reference to another to be extremely complex. On Earth, man forms his concepts of spatial relativity on the basis of vestibular, proprioceptor, dermal, mechanical, interoceptor, and optical analysor activity. In space, he must rely largely on the optical analysor, which brings about a restructuring of the central nervous system's system of orientation acquired through the ages.

The cosmonaut also discussed the illusion which he experienced in space whereby the brighter stars seemed to be closer than the dimmer stars in contrast to the situation on Earth, from which all stars seem to be fixed equidistantly. Soviet psychologists have explained that because no atmospheric absorption of light occurs, the range of relative stellar magnitudes is increased, thus promoting the illusion. This illusion, however, does not affect the cosmonauts' ability to orient himself in space.

Section 3. Noise and Vibration

This section contains a total of 32 abstracts treating noise and vibration as individual and combined stresses. Thirteen abstracts deal with noise alone. These fall into three general categories, i.e., noise level tolerance, the physiological effect of noise, and protective devices.

N. M. Paran'ko and V. F. Vyshchipan (both of Krivoy Rog), who are affiliated with the Institute of Industrial Hygiene and Occupational Diseases (Institut gigiyeny truda i profzabolevaniy), conducted a study to establish man's tolerance limits for some medium - and high-frequency noises. They detected a number of functional changes in the central nervous system during their tests [75].

N. I. Ponomareva and V. Ye. Ostapkovich,both of Moscow and the Institute of Industrial Hygiene and Occupational Diseases, AMN SSSR, performed a series of audiological examinations on 1000 industrial workers to determine hearing loss due to occupational noise [77].

A rather detailed study into the tolerance of high-frequency industrial noise was performed by I. I. Ponomarenko on adolescents. This affiliation is given as the Moscow Scientific Research Institute of Hygiene im. F. F. Erisman (Moskovskiy nauchno-issledovatel'skiy institut gigiyeny [76].

S. V. Alekseyev of the Sanitary Hygienic Medical Institute of Leningrad (Sanitarno-gigiyenicheskiy meditsinskiy institut) studied the effect of 65-90 db noise over three octaves on the functional state of the central nervous system, auditory analysor, and cardiovascular system [58]. With Ye. Ts. Andreyeva-Galanina and A. V. Kadyskin of the same city and institution, he suggested standardizing the techniques for studying physiological injury due to noise [59].

The effect of noise on the adrenal cortex, thyroid gland, and higher nervous activity in white rats was studied by T. S. Barutkina, T. T. Zarbaylo, M. I. Mityushov, A. N. Panov, V. V. Rakitskaya, and Ye. V. Sokolova [60]. Noise was found to have a stimulatory effect on the adrenal cortex. This lasted for 8 days; a slight increase in protein-bound iodine in the blood was also detected [60].

N. N. Kudryavtseva of the Laboratory of Experimental Pathology of the Central Nervous System, Department of Applied Neurophysiology, Institute of Experimental Medicine, AMN SSSR, used dogs to investigate changes in the EEG due to noise stimulation [70].

A very significant study was conducted by a number of scientists of the Institute of Medico-biological Problems, Ministry of Public Health

SSSR (Institut mediko-biologicheskikh problem MZ SSSR). In the Prof. F. D. Gorbov Laboratory of this institute, V. I. Myasnikov, O. P. Kozerenko, I. Ya. Yakovleva, E. I. Matsnev, I. P. Lebedeva, V. N. Nesterenko, and Ye. Z. Tambiyev studied the effect of 75--78db noise ranging from 2,000--12,000 Hz on human sleep in an attempt to determine the physiological basis for the injurious effects of noise. Considerations were made of the various types of sleepers; in general, two types of sleepers were recognized, namely, sound sleepers and light sleepers. The response to noise was quite disparate in these two groups. The frequency range of the noise selected was similar to that encountered by cosmonauts on space missions, and these researchers discussed the unpleasant sensations experienced by the cosmonauts in the light of their findings [73].

Autonomic nervous system injury and histomorphological changes in the brains of rats were the subjects of a joint research study by the Soviets and East Germans. The team was composed of S. Nichkov, G . N. Krivitskaya, and U. Gnuchtel from the following organizations: Institute for Corticovisceral Pathology and Therapy, Berlin-Buch, directed by Dr. R. Baumann, German Academy of Sciences, Berlin; Institute for Brain Research AMN SSSR, Moscow (Institut für Hirnforschung der Akademie der Medizinischen Wissenschaften der UdSSR in Moskau) [74].

V. I. Ponomar'kov, A. Yu. Tysik, V. I. Kudryavtseva, A. S. Barer, V. K. Kostin, V. Ye. Leshchenko, R. M. Morozova, L. V. Nosokin, and N. I. Frolov found blister-like hemorrhages up to 3 mm in diameter under the pleura and on the thoracic surface of the right lung in dogs exposed to noise louder than 126 db; this db level was found to be the critical threshold for pathological changes. EEG and EKG data were also recorded. The emphysematous changes were persistent [79].

It is of interest here to note that A. S. Barer is also active in studies dealing with acceleration stress and weightlessness. He is referenced under those headings in this report.

I. K. Samoylova and K.A. Zaytseva of the Institute of Evolutionary Physiology and Biochemistry im. Sechenov, AN SSSR (Insitut evolyutsionnoy fiziologii i biokhimii AN SSSR) tested recognition of sound stimuli on the basis of probability [81].

R. Tomanek of Prague and the Otolaryngologic Laboratory, Czechoslovakian Academy of Sciences (Otolaringologicheskaya laboratoriya) headed by Academician Przhetsentel, studied autonomic nervous system tonus and auditory threshold changes in man after exposure to noise [85].

Lt. Col. A. Gromov, an engineer, and Maj. V. Kuznetsov, an engineer and Candidate of biological sciences, presented a number of designs for protective earmuffs, some of which employed a carefully measured quantity of liquid in a small chamber for sound attenuation. These earmuffs attenuate noise from 130 db to 100 db, and they are very light [65].

The distribution of vibration throughout the human body was studied by E. I. Denisov and Ye. I. Sergeyev of the Institute of Industrial Hygiene and Occupational Diseases, AMN SSSR (Institut gigiyeny truda i profzabolevaniy AMN SSSR). Test subjects were required to grasp a handle vibrating at various frequencies and to exert up to 10 kg pressure on it [64].

N. I. Ponomareva, whose work was cited earlier in this report, along with L. G. Okhnyanskaya and N. A. Nikiforova of the Institute of Industrial Hygiene and Occupational Diseases, AMN SSSR, Moscow, studied the functional state of the vestibular analysor in men exposed to vibration. Results of nystagmic recordings were evaluated [78].

T. G. Yakubovich of the Department of Labor Hygiene, under the direction of Prof. Ye. Ts. Andreyeva-Galanina (referenced earlier in this section) of the Leningrad Medical Institute of Sanitation and Hygiene (Kafedra gigiyeny truda Leningradskogo sanitarno-gigiyenicheskogo instituta), detected changes in the concentration and distribution of glycogen in the livers of animals exposed to vibration. B_1 and C vitamins were found to normalize this disorder [88].

In a study conducted by M. B. Rappoport and G. A. Pasternak of the Institute of Industrial Hygiene and Occupational Diseases, rabbits exposed to horizontal vibration (2 Hz; 0.25 G) for 3 hr displayed dystrophy and necrosis in neural cells (brain, spinal cord, etc.), proliferation of glial and hystiocytic cells, lymphoid infiltration, generalized visceral hyperemia, and focal hemorrhages. Increased succino-dehydrogenase and cytochrome-oxidase activity was also noted [80].

An experiment involving radioisotope tagging of methionine with S^{35} to study the metabolism thereof in the central nervous system was carried out by M. Yurchak (Jurczak) of Warsaw at the Military Institute of Aviation Medicine under the direction of Prof. Dr. K. Ostrowski (Wojskowy Instytut Medycyny Lotniczej). Chronic, repeated exposure to vibration resulted in markedly decreased S^{35} incorporation and metabolism [67].

The Hungarian physicians T. Gati, J. Sos, T. Zelles, and P. Keszler of the Institute of Pathophysiology, University Medical School, Budapest, found that the tensiogenic effect of vibration (leading to hypertension) in rats varies directly in severity to the amplitude and frequency of the vibration applied [89]. These same researchers, with the exception of T. Zelles, teamed up with L. Teglassy and E. Kocsis to study the mechanism of the inhibiting effect of vibration on gastric secretion [68].

K. Ya. Shishlovskaya of Moscow and the Institute for Hygiene of Water Transportation (Institut gigiyeny vodnogo transporta) performed an experimental study on the changes of cardiodynamic indices in men exposed to 20-Hz vibration of varying amplitude. She detected disorders in the neurohumoral compensatory arc which regulates vascular tone.

EKG changes were slight. She suggests that this type of data may be used in arriving at human tolerance limits for vibration [82].

N. A. Makarenko of Krivoy Rog and the Institute of Industrial and Occupational Diseases (Institut gigiyeny truda i profzabolevaniy) studied changes in the autonomic functional state of test subjects exposed to vibration. The indices used in this interesting study were the hematic concentration of acetylcholine, epinephrine and norepinephrine, the activity of true cholinesterase, urinary catecholamine elimination, and circulatory changes in the fingers (minute-volume). In some individuals, the increases in neural tone generally observed were such that they impeded the normal homeostatic mechanisms, which could, in turn, lead to neuroendocrine and humoral interaction and subsequent autonomic decompensation. This was reflected in repeated, temporary pallor of the fingers [72].

Two other abstracts in this field are included which may be of interest [66, 69]. They deal with the effects of long-term exposure to vibration on various groups of industrial workers.

The final portion of this section cites studies made of the combined effects of vibration and noise.

Z. Bzhezin'ska (Z. Brzezinska) of Warsaw, Poland, and of the Center for Experimental and Clinical Medicine, PAN, Warsaw, directed by Prof. Z. Ruszczewski (Centrum Medycyny Doswiadczalnej i Klinicznej) and the Cadre of Industrial Physiology headed by Dr. St. Kozlowski (Zespol Fizjologii Pracy) found that the concentration of acetylcholine in the brains of rats exposed to vibration and noise decreased gradually, while acetylcholinesterase activity and the ability of the brain to biosynthesize acetylcholine increased. She expressed her gratitude to Dr. W. Missiuro for his supervision [63]. This same researcher achieved analogous results in a similarly conceived study reported in the same issue of Acta physiologica polonica [62].

A. F. Lebedeva studies the changes in myoelectrical activity in rats exposed to noise (75db)and vibration (50 Hz, 1 mm amplitude separately or in combination) [71].

Disorders in protein, fat, and carbohydrate metabolism were detected in white rats after exposure to combined noise and vibration. Hyperglycemia and hypercholesterolemia were in evidence. This study was conducted by G. I. Bondarev, Ye. N, Aronova, D. A. Mikhel'son, and L. Ya. Skuratova of the Institute of Hygiene of Water Transportation (Institut gigiyeny vodnogo transporta) [61].

G. Ye. Sviderskaya of the Laboratory of Nerve Activity Development of Animals in Ontogenesis of the Institute of Evolutionary Physiology and Biochemistry im. I. M. Sechenov, AN SSSR, Leningrad (Laboratoriya razvitiya nervnoy deyatel'nosti zhivotnykh v ontogeneze Instituta evolyutsionnoy fiziologii i biokhimii AN SSSR) studied the effect of noise

and vibration on the motor activity of chick embryos. The greatest inhibitory effects are observed on the 12--14th days when auditory structures are beginning to function [84].

A study was conducted by A. M. Tambovtseva of the Moscow Scientific Research Institute of Hygiene im. F. F. Erisman (Moskovskiy nauchno-issledovatel'skiy institut gigiyeny) on the effects of vibration and noise on protein metabolism in excavating-machine operators [86]. Two other similar articles are included to round out this section [83, 87].

Section 4. Combined Factors

The 17 abstracts in this section fall logically into two main groups: dynamic and kinetic factors combined with radiation and dynamic and kinetic factors without radiation (dynamic factors combined with altered gas media are treated last).

The eminent Soviet space physicians V. V. Antipov and B. I. Davydov are co-contributors to two articles cited in this section. For years they have been involved in research to establish the way in which dynamic stresses, e.g., acceleration, alter radiation injury in animals. They have advanced several hypotheses concerning the extrapolation of their experimental findings so that they may be used in establishing human tolerance limits and contours. A study conducted by these two researchers in league with E. F. Panchenkova, P. P. Saksonov, and G. A. Chernov [92], is more or less a sequel to work reported earlier at the 18th Congress of the International Astronautical Federation held in Belgrad, 25--30 September 1967. In the earlier paper, exposure to G-loading was reported to increase the resistance of mice to radiation, while in the present paper, G-loading was found to intensify some components of radiation injury in rats and in dogs [92]. Mice and rats exposed to both G-loading and mechanical vibration were observed to be more resistant to radiation than those exposed to radiation alone. After exposure to these dynamic factors, leukopenia in dogs was less pronounced. Changes in other indices of radiation sickness and injury were noted.

Antipov and Davydov worked with Ye. A. Abaturova and N. G. Demochkina on a study of biochemical changes in mice exposed to G-loading after irradiation [90]. G-loading intensified a number of carbohydrate metabolism disorders.

V. V. Antipov, P. P. Saksonov, V. G. Petrukhin, N. A. Gaydamakin, and V. S. Shashkov studied the effect of gamma and proton radiation combined with dynamic factors (vibration and acceleration) on the hematopoietic tissues of mice [96]. Lymphatic structures were also examined. Changes due solely to the two types of radiation were monotypic, but gamma-radiation damage proved to be severe. Vibration and acceleration stresses applied to the test mice both before and after irradiation were seen to alter the course of recovery from radiation sickness [96].

Two of the abstracts in this section deal with actual spaceflight experiments. O. D. Anashkin performed an exhaustive study on the coagulatory system of the blood of the dogs Veterok and Ugolek after their 22-day flight [91], N. I. Nuzhdin, who is a Corresponding Member of the Soviet Academy of Sciences, and R. L. Dozortseva investigated the effects of radiation and spaceflight factors on a variety of winter barley. Air-dried seeds were launched into space aboard the Voskhod-1 biosatellite. The radioprotective effects of cysteine were also studied [102].

N. A. Gaydamakin, who appeared earlier in this section, N. N. Dobrov, N. I. Yevepchuk, V. A. Kozlov, and S. G. Kul'kin made a study

of the hematological and pathomorphological effects of simulated space-flight factors and ionizing radiation [95]. It is of interest here that ACTH was administered to create the effect of functional stress in lieu of the conventional exposure of the animals to acceleration and vibration, and particularly since the components of injury of these two factors are at least somewhat disparate in nature [95].

A. F. Lazar' of the Department of Roentgenology and Radiology, and Department of Pathological Physiology, Kiev Medical Institute, conducted a study to ascertain the role of the adrenosympathetic system of the regulation of vascular permeability upon exposure of rabbits to radiation and/or acceleration [99]. Noradrenaline concentration increased in the blood and brain of the rabbits exposed to irradiation, and adrenaline concentration increased in the adrenals. On the other hand, these indices remained unchanged when the rabbits were first exposed to G-loading. Since vascular permeability is an important component of the hemorrhagic syndrome during radiation sickness, the findings of this study may suggest the mechanism by which acceleration offsets (to some degree) the effects of exposure to ionizing radiation [99].

M. G. Prives, who is the head of the Department of Normal Anatomy, First Leningrad Medical Institute im. Academician I. P. Pavlov (Kafedra normal'noy anatomii I Leningradskogo meditsinskogo instituta), A. K. Kosourov, and A. A. Aleksina conducted an x-ray study of rabbits exposed for prolonged periods to hypobaric conditions, G-loading, and hypokinesia [104]. Conditioning by exposure to G-loading in the centrifuge proved to be beneficial.

A. D. Voskresenskiy, whose work was cited earlier under Weightlessness, and B. F. Asyamolov immobilized dogs in plaster casts. The dogs were subjected to acceleration and orthostatic tests. Cardiodynamics were recorded by catheterization of the right auricle [93].

G. P. Mikhaylovskiy, N. N. Dobronravova, M. I. Kozar', M. M. Korotayev, N. I. Tsyganova, V. M. Shilov, and I. Ya. Yakovleva studied the immunological capabilities of the human body after 62 days of hypokinesia (bedrest). The indices employed in this study were hematic properdin concentration, lysozyme activity of the saliva, the phagocytolytic activity of neutrophils, and bactericidal properties of the skin. Some of the test subjects performed exercises to determine the effect thereof on immunobiological regulatory mechanisms. The serious disorders in immunoreactivity were only partially offset by exercise [101].

A Trud article (no author or organization given) with the title "How to Overcome Weightlessness" describes the favorable effects of centripetal acceleration of even tenths or hundredths of a G on test subjects exposed to zero-gravity and hypokinetic stresses [106]. This article was mentioned earlier in regard to weightlessness along with the conjecture that future Soviet manned space missions will feature orbital craft to which a slight spin will be imparted to help stabilize

vestibular response and statokinetic factors in the human body [106]. Presumably, this could be done with the current Soyuz-series spacecraft. Provisions other than those currently employed would have to be devised to orient the craft's solar battery panels with relation to the sun, but this appears to be the only difficulty at first inspection.

L. A. Kitayev-Smyk, whose work was cited earlier in the section dealing with weightlessness, conducted a study into the visual illusions experienced by man during exposure to weightlessness and weightlessness combined with angular and Coriolis acceleration [97].

An article by F. P. Kosmolinskiy considers sensory deprivation to be the result of insufficient external and internal afferentation, which occurs during exposure to hypokinesia and zero-gravity. He emphasizes the stress that takes place when sensory deprivation is replaced by strong or excess afferentation, such as that occuring during an emergency or special task assignment [98].

The biomechanic aspects of simple human movements of the hand and arm during exposure to weightlessness and G-loading were studied by L. V. Chkhaidze, I. A. Kolosov, V. I. Lebedev, I. F. Cherkirda, A. V. Yeremin, A. D. Burchuladze, and V. I. Stepantsov [94].

A. R. Mansurov conducted an x-ray study on flight personnel to determine the effects of acceleration and hypobaric conditions over extended periods of time. Affections found were inceptional pulmonary fibrosis and emphysema with some enlargement of the heart [100].

The following two articles were felt to be of particular interest, for the experimental findings of the two respective groups of authors are glaringly contradictory. P. V. Vasil'yev et al. themselves point this out in the second of the two articles cited here. The area of endeavor is the effect of exposure to increased pCO_2 on resistance to and recovery from G-loading injury.

In the first article, V. P. Zagryadskiy and Z. K. Sulimo-Samuyllo contend that functional changes observed after accelerating rabbits at levels up to 7 G's are more pronounced after exposure to an atmosphere with 3--5% CO_2 [105].

As no abstract of the second article mentioned above was available for inclusion in this report, it is treated in some detail in this section.

Doctor of Medical Sciences P. V. Vasil'yev and N. N. Uglova began their paper by citing the work of other Soviet researchers wherein indications were found that adaptation to hypoxia increases tolerance to hypoxic and circulatory forms of hypoxia, as encountered in test subjects during G-loading. They also cited Zagryadskiy et al. who found that

exposing man and animals to increased pCO_2 for 2--4 hr lowered their resistance to high temperatures, physical exertion, and G-loading and impeded respiration at reduced pressures. Vasil'yev et al. then described a series of experiments designed to determine the effect of atmospheric composition on resistance to G-loading and to determine the feasibility of utilizing this method for increasing an organism's nonspecific resistance. The three series of experiments with 282 white mice and 15 rats were performed involving the following factors: adaptation to intermittent, gradually increasing hypercapnia; adaptation to intermittent, gradually increasing hypoxia; and adaptation to intermittent, gradually increasing hypercapnia and hypoxia. Blood studies (hemoglobin and differential white count) were performed. The test animals were exposed to transverse G-loading (4.2 m radius centrifuge for rats, 4.7 m radius centrifuge for mice). The onset and braking gradients of the G-loading were both 1 G/sec. Mice were centrifuged at 45 G's twice for 10 min with a 10-min interval between the first and second episodes. Rats were centrifuged at 20 G's for 1 min; the G-loading was then increased until one of the three rats being centrifuged began to display cardiofunctional disorders. The effectiveness of the adaptation was evaluated on the basis of survival and on the nature of the cardiofunctional disorders manifested. In the first series of experiments, CO_2 concentration was increased in discrete steps to 12%. Adaptation was effected at 5, 10, and 12% levels. Temperature was at 22 to 25°C. These conditions were maintained for 6--8 hr daily except Sundays. Growth in the test was seen to be inhibited. In the test animals, the hemoglobin was seen to decrease slightly rather than increase. The erythrocyte and reticulocyte count generally increased. No statistically verified positive results were obtained after centrifugation. In the second series of experiments, ambient air O_2 was first decreased to 13.6% and then in discrete steps to 8.6% on the 11th and 12th days. Chamber temperature was gradually increased from 19 to 28±2°C. These conditions were maintained for 6--8 hr daily except Sunday. Growth in the test mice and test rats was seen to be retarded with relation to that of controls during the same period. In the test mice, the amount of hemoglobin and erythrocytes increased, accompanied by moderate reticulocytosis. Analogous findings were listed for the rats, including eosinopenia which indicated functional stress. Centrifugation was performed on the 4th, 10th and 17th days after adaptation. Three of the 5 control rats died, while only 2 of the 10 test rats died. Adaptation increased the survival rate by a factor of 2. Analogous results were recorded for the white mice. The most indicative results for mice occurred on the 10th day after adaptation. In the third series of experiments, O_2 concentration was altered as in the second series of experiments; CO_2 concentration was increased to 5±1% from the 4th to the 13th days of the experiment. Maximum temperature in the chamber was 28°C. "Mature" mice were used in this series; a 9.5% decrease in weight was recorded. Hematic indices remained generally unchanged, except for the reticulocytes count, which decreased. The survival rate for test animals was 37% and 44.7% higher than that for controls on the 4th and 10th days after adaptation, respectively. The author concluded that adaptation to hypoxia intensifies the resistance of mice to transverse G-loading, that addition of

CO_2 to the O_2-poor atmosphere used for adapting the mice to hypoxia does not affect the degree of this intensification, and that the general resistance of the adapted animals bears no strict correlation with hemoglobin indices [332].

The eminent Soviet space physicians, V. V. Parin and I. M. Khazen, discussed morphological and functional changes in animals exposed to acceleration, hypoxia, and other stress factors in the final article cited here. This article reflects the continued interest of the Soviets in serotonin and its presence in the various tissues as an index of the response to stress [103].

Section 5. Hypodynamia

Insufficient motor activity seriously affects mental efficiency, physiological functions, and biochemical processes, and reduces the resistance and the work capacity of the organism.

Experiments conducted by L. R. Iseyev and Yu. G. Nefedov showed that even partial hypodynamia reduced the tolerance to physical stress and caused significant changes in the oxygen balance of previously well-trained individuals [119].

Effects of strict and partial hypodynamia on the cardiovascular and respiratory systems were studied by P. V. Buyanov under both normal and reduced barometric pressure at normal pO_2 [109]. N. Ye. Panferova and V. A. Tishler worked on the effects of bed and chair rest on cardiac dynamics and arterial tone [129, 128], while R. M. Bayevskiy and his co-workers investigated the cardiac self-regulatory function during hypodynamia [151]. In an experiment where the circulatory condition approximated that during weightlessness by means of a constant horizontal position, V. S. Georgiyevskiy, L. I. Kakurin, and V. M. Mikhaylov observed a detraining of the cardiovascular system [116].

Changes in fat metabolism, creatine excretion, and diuresis [125], as well as nitrogen elimination [132] were studied in subjects exposed to prolonged restriction of movement. Additional aspects of the syndrome of hypokinesia, such as dehydration, higher electrolyte elimination and signs of osteoporosis were mentioned by L. I. Kakurin [120].

Biochemical and immunological studies revealed the effect of hypodynamia on the reactivity of human organism [162, 113]. The coagulability of blood also appeared to be affected by hypodynamia, reaching its highest value on the 8th, and the lowest value on the 28th day of experiment [115].

Neurological changes caused by hypodynamia were manifested in changes in the sleep pattern and the emotional state, disturbances of motor coordination, and decrease of mental efficiency, [113, 127, 131, 155, 156, 178].

Irregularities in daily fluctuations of pulse, respiration rate, arterial pressure, and body temperature are also attributed to the effect of limited muscular activity on the nervous system [176].

A group of scientists including V. V. Portugalov, O. G. Gazenko, Ye. I. Il'ina-Kakuyeva and V. B. Malkin, who are known to be related to the space flight program, as well as another group consisting of I. V. Fedorov, Yu. I. Milov, V. N. Vinogradov, and L. A. Grishanina, conducted animal experiments to investigate physiological and cytochemical reactions to hypodynamia as a stress factor [130,114].

Morphological and metabolic changes, as well as decrease in tolerance to transverse acceleration, and physical stress were observed in animals subjected to protracted hypodynamia [134]. N. A. Agadzhanyan and G. V. Machinskiy observed a considerable decrease in altitude tolerance in animals exposed to hypodynamia [107]. The effect of hypodynamia and isolation on mortality, food and water intake, as well as the peculiarities of the reaction of immobilized and isolated animals to barbamyl by itself or in combination with human somatotrophic hormone were also investigated [126].

Many studies concentrated on the investigation of physical exercise as a counter measure against hypodynamia and on the development of proper sets of exercises of various types.

A. V. Korobkov and B. A. Dushkov emphasized the importance of adequate physical exercise for compensating for the detrimental effects of weightlessness and hypodynamia, increasing the adaptive capacity to environmental changes and altered circadian rhythm, and improving the emotional condition. They also found that the effect of altered diurnal rhythm [18-hr. day] on muscular strength and endurance can apparently be counterbalanced by adequate organization of motor activities [154].

In a number of experiments, effects of hypodynamia were counterbalanced by physical exercises, although the subjects performed them without interrupting bed-rest [110, 117, 118, 122, 132].

L. I. Kakurin found that a 62-day bed-rest, even when compensated by exercise, still caused dehydration, an increase in electrolyte excretion, and calcium loss. In addition, he found a decline in muscle tone and an increase in pulse rate and systolic volume even at rest [120]. To determine whether insufficient compensation in such cases is due to insufficient volume and intensity of physical exercise, M. A. Cherepakhin conducted similar experiments. He found that exercises favorably affected the mineral levels of bones and the immunological properties of the organism [111]. He also noted a considerable increase in muscular strength, orthostatic resistance, static and dynamic endurance, and resistance to acceleration [111,112].

Experiments with animals proved that static and dynamic training increased the resistance to acceleration especially when combined with moderate hypoxia [299]. Another study showed that physical training of animals caused a threefold increase of running endurance under hypoxic conditions and after exposure to acceleration, although the capacity to survive under the stress of these factors was not increased [291].

Properly selected and organized exercises are recommended for use in spaceflights in a paper by Korobkov and Dushkov [123]. M. A. Cherepakhin suggests that special attention be given to endurance exercises to prevent disturbances of the autonomic system. Static exercises are

recommended to preserve resistance to acceleration [111]. S. G. Zharov designed special regimens of motor activity and respiratory gymnastics for use in hypodynamic conditions [121].

During experiments with pure oxygen atmosphere conducted by A. V. Korobkov, S. G. Zharov, A. A. Korobova, and L. A. Ioffe, the subjects performed special exercises composed by F. M. Gorskiy, Yu. A. Sandalov, and V. K. Khukhlayev. During these exercises various methods of breathing were used: regular, interrupted, and "wave-type" developed by A. V. Korobkov [262].

Special sets of exercises were also introduced to improve the general condition of the subjects in the course of long experiments in small isolated chambers [118, 119].

A comparative experiment conducted by A. V. Korobkov, L. A. Ioffe, and other scientists revealed that the training of weightlifters developed a better tolerance to hypodynamia than that of the runners [124].

An author certificate has been issued to V. N. Vinogradov for a method for prophylaxis of hypodynamia based on orthostatic loads corresponding in force and direction to terrestrial gravitation [133].

Section 6. Closed Cabin Ecology, Personal Hygiene, and Alimentation

Experiments have shown that prolonged confinement in sealed chambers results in physiological shifts of the same kind as those caused by hypodynamia. In addition to physical exercise, countermeasures which achieved an improvement of the general physical condition of subjects included intensive decontamination of the cabin air, UV-irradiation of the skin, more frequent washing, and an increased use of vitamins. It is recommended that these measures be taken into account in designing work-rest and alimentation schedules, life support systems, and extravehicular space suits [118, 119].

Since physical fatigue resulting from isolation, sensory deprivation, monotony of the environment, hypodynamia, and hygienic discomfort is accompanied by a decrease of immunological resistance and bactericidal capacity of the skin, methods have been developed to reduce the danger of contamination in the cabin [113, 120, 145, 165].

Two basic sources of toxic substances in sealed cabins are synthetic materials and metabolites of living organisms. Since standards of maximum permissible concentrations established for industry are obviously unsatisfactory for continuous exposure, studies in this field are recommended [137].

Experiments in which body washing was restricted, resulted in impetigo on covered as well as on uncovered and washed parts of the body. To increase the resistance of the organism, improvements in diet, schedule, and regulation of the microclimate are suggested. Use of bacteriostatic and bactericidal cloth for underwear is also considered [141].

Specifications for preparations intended for personal hygiene in sealed cabins and a method for objective evaluation of the qualities of tooth paste have also been developed [139, 135].

Nutrition also presents problems in unusual conditions. During some experiments consisting of confinement to small rooms, the subjects received mostly dehydrated food. Most of them lost weight, and showed an inhibition of pancreatic function [162]. Pronounced changes in the secretory function of the stomach with prolonged, post-experimental persistance were noted in similar experiments [143]. Observation of submarine personnel during cruises showed a depression of digestive leukocytosis due to appetite reduction, heart burn and constipation, psychic factors, and fatigue [138].

To prevent high nitrogen elimination and negative nitrogen balance (resulting from prolonged restriction of movement and nervous tension), exercises, B-vitamins, high protein content of the diet, and anabolic medication are recommended [132]. Changes in water requirement and balance, electrolyte elimination, and calcium metabolism

resulting from prolonged horizontal position (weightlessness simulation) require the use of drugs in addition to physical exercise [120]. Despite a high intake of vitamin C, its excretion was greatly reduced when an exposure to acceleration followed bed-rest. The B_1 and B_6 vitamin requirements also increased [140].

A normal diet was compared to a diet adjusted to the metabolic processes in an experimental 7-day bed-rest without isolation. The results proved that the specially balanced diet led to lesser metabolic changes upon transition from activity to hypodynamia [144].

A mathematical method has been developed for the selection of diet components from products available in space flights considering their caloric value, composition, and plant or animal origin [136].

Section 7. Biorhythms

Extensive research in the field of biological rhythms and adaptation to altered diurnal schedules is conducted in the USSR in connection with the spaceflight program. A group of scientists who work in close collaboration includes F. P. Kosmolinskiy, head of the editorial board of the bimonthly publication Kosmicheskaya Biologiya i Meditsina (Space Biology and Medicine) and three members of the editorial board: N. N. Gurovskiy, A. V. Korobkov, and Yu. G. Nefedov. Other members of the team are: B. A. Dushkov, L. R. Iseyev, S. A. Kosilov, M. I. Kozar', Ye. M. Krutova, G. Manovtsev, V. M. Shilov, A. A. Veselova, and some less familiar scientists [149, 154, 155, 156, 163, 164, 165, 179, 182]. Another team of co-authors includes R. M. Bayevskiy, S. A. Chernyayeva, V. I. Kudryavtseva, Ye. V. Kukolevskaya, G. A. Nikulina, N. Ye. Panferova, S. D. Polozhentsev, V. A. Tishler, and some other names [150, 151, 152, 176, 177]. The third group consists of O. N. Kuznetsov, V. I. Lebedev, A. N. Litsov, and G. F. Khlebnikov [166, 167, 170, 171].

Designing of adequate work and rest schedules for prolonged spaceflights, according to N. N. Gurovskiy, is complicated by the uniqueness of the situation and by the fact that ground experiments cannot fully simulate the physiological and psychological conditions of a spaceflight [159]. A general article by F. P. Kosmolinskiy and B. A. Dushkov reviews the available information on various work-rest schedules and the effects of various space flight factors which have to be considered in designing rational cosmonaut work schedules [164]. B. S. Alyakrinskiy, also a member of the editorial board of Kosmicheskaya Biologiya i Meditsina, evaluates the results of experiments with altered circadian rhythm, and recommends directions for further development of research [147]. In another article, he discusses the factors affecting the designing of work-rest schedules for spaceflights and enumerates the conditions which are necessary for a successful adaptation [148].

Some studies concentrated on the daily fluctuations of certain functions or capabilities. The diurnal periodicity of the cardiac activity was studied by R. M. Bayevskiy, Ye. V. Kukolevskaya, and V. A. Tishler [151]. N. Ye. Panferova and V. A. Tishler investigated the daily fluctuations in human orthostatic resistance [177]. Diurnal variations in altitude tolerance of rats were studied by N. A. Agadzhanyan and A. M. Rafikov [146], and diurnal changes in radiosensitivity were studied on mice by S. S. Kuznetsova [168].

Several factors have been found to influence the biorhythms. V. Lebedev, Candidate of Medical Sciences, points out that biorhythms are related to the magnetic field of the Earth [169]. An experimental study made by N. Ye. Panferova revealed that hypodynamia affects the daily rhythm of body temperature, pulse and respiration rates, and arterial pressure, although the shifts in these parameters are not correlated with each other [176]. S. G. Kharabuga investigated the

effects of muscular activity on the daily rhythm of motor and sympathetic functions[160]. Experiments conducted by A. N. Litsov proved that isolation does not influence the diurnal dynamics of physiological functions and work capacity [170]. A study conducted on personnel stationed in Antarctica and exposed to conditions of altered light, as well as to partial hypodynamia and isolation, indicated that biological rhythms were determined, in these conditions, by the daily schedule [153].

Since rational composition of work-rest schedules can facilitate man's adaptation to isolation in restricted space, the effects of various schedules were investigated.

M. A. Gerd studied human work capacity during various periods of the day. Lowered work capacity during periods of wakefulness which coincided with the night hours did not improve with the duration of the experiment. The author attributed the decrease of work capacity to the disturbance of the daily rhythm [157].

V. I. Myasnikov observed the physiological and neuropsychological effects of various schedules. He concluded that the duration and depth of sleep is decisive for the success of any schedule [173].

Experiments with normal, inverted and rotated 24-hour schedules showed that the inverted schedule caused more pronounced disruptions than the rotated schedules [175, 113, 161].

Some other studies which included experiments with 24- and 18-hour schedules and evaluated the results on the basis of the condition of cardiovascular function, neuromuscular activity, mental efficiency, phagocytic reaction, lysozymic saliva activity, and general mental and physical capability, invariably showed moderate changes in 24-hour experiments, and pronounced deviations in 18-hour schedules [149, 179, 182].

Several schedules composed of 6-hour and 3-hour periods of sleep, rest, and work caused a 3--4-fold higher Kimbarovskiy reaction, and a 3--10-fold lower result of the lysozymic test which correlated with the obvious fatigue of the subjects [165].

An experiment conducted by Bayevskiy and his co-workers consisted of a stay in uncomfortable conditions (high temperature, humidity and CO_2 content) while observing a schedule composed of 4-hr periods of rest, sleep, and work. The results proved that an interference with the rhythm of the biological clock considerably reduces the resistance of mechanisms which regulate physiological functions [150].

A. N. Litsov identified three basic stages of adaptation to altered diurnal schedules: the initial steps (retention of the old rhythm), the apparent adaptation (appearance of the new rhythm), and the true adaptation (fixation of the new rhythm). He also noted that various functions required different periods of time for adaptation.

He concluded that adaptation depends on the degree of deviation from the normal day, distribution of the periods of work and rest, and organization of activities. An evaluation of adaptation should be based on the dynamics of physiological functions, on work capacity, and on quality of sleep [171].

M. A. Gerd, who conducted experiments imitating certain features of a spacecraft with a three-man crew, observed that the initial reaction to altered schedule was followed first by adaptation and then by fatigue [158].

Kuznetsov, Lebedev, Litsov, and Khlebnikov emphasized the importance of one-person experiments because in group experiments the individual adaptability might be influenced by personal interrelations. They also recommended standardization of experimental conditions and tests to facilitate the evaluation of results, and suggested methods for avoiding influence of unusual experimental conditions on the adaptation to altered ciradian rhythm [167].

Bayevskiy and his co-workers observed two types of reaction to altered schedules. For some individuals the synchronization of certain physiological indices was restored after a period of desynchronization; in some others desynchronization persisted. Since this reaction apparently correlates with individual tolerance to adverse factors, the authors recommend the use of altered schedules as a functional test of the resistance of regulatory mechanisms [152, 150].

Kuznetsov, Lebedev, and Litsov attribute the adaptation to psychological rather than to physiological factors. They state that subjective awareness of the task, elaboration of a plan of action, and the volitional decision to follow it, as well as daily execution of this decision, are the main factors influencing the adaptation [166]. The importance of the positive attitude of the subject is also emphasized by S. I. Stepanova. An individual approach in each case and a selection of free time tasks which would be of interest to the subject are recommended [180]. V. I. Myasnikov observed that a "free schedule", where the subject planned his time and slept as much as he needed resulted in a much more rapid and painless adaptation [174].

The use of hypnosis, electrosleep, and drugs is suggested by S. A. Kosilov and B. A. Dushkov to facilitate adaptation to altered schedules, and especially to overcome the effects of weightlessness and emotional tension in spaceflights [163]. Other authors, recommend the autosuggestion which permits easy and very rapid adaptation to new conditions even in individuals with low adaptability [181].

In designing of work and rest schedules it is necessary to consider that a prolonged sojourn in a small room adversely affects muscular strength, motor coordination, the cardiovascular system, the analytical and synthetical functions of the higher sections of the CNS, as well as the oxygen balance, tolerance to physical stress, and biochemical and

immunological aspects of the organism [155, 156, 178, 118, 119, 162], although adequate exercise can apparently maintain the muscular force and work capacity at a satisfactory level [154, 123].

Observing of schedules is not recommended in emergency situations, when the CO_2 content may be high in the cabin atmosphere [183].

Section 8. Energy Conservation

The importance of sleep for the general physical condition, work capacity, and adaptation to altered circadian cycle has been emphasized in many papers.

V. I. Myasnikov points out the duration and depth of sleep as the main factors which determine the effectiveness of any work-rest schedule (173) and describes the beneficial effect of an additional 1—1 1/2 hrs of sleep in adaptation to altered diurnal rhythm (174). It was noted that daytime sleep remained superficial even after normalization of its duration (171). The installation of soundproof sleeping compartments was suggested to facilitate sound sleep of spacecraft crew members (169). R. M. Bayevskiy, Ye. V. Kukolevskaya, and V. A. Tishler evaluated the depth of sleep during isolation and hypodynamia, and indicated mechanisms by which it is determined (151).

Means for improving or inducing sleep have also been investigated. It was observed that special physical exercises introduced along with other hygienic means during the 4th month of experimental confinement in a small chamber contributed to the normalization of sleep, as well as to the improvement of the general condition of the subjects (119).

V. L. Marishchuk recommends muscle relaxation exercises which in combination with autogenous training successfully induce sleep even after or during emotional stress (207). Application of auto-massage, complete relaxation, and detachment from the current activity before sleep are suggested by B. S. Alyakrinskiy (148). Other authors state that persons trained in autosuggestion can fall asleep and awaken at set times in unusual circumstances (181).

The use of hypnosis, electrosleep, and drugs is recommended by S. A. Kosilov and B. A. Dushkov as means for facilitating adaptation to the working conditions in spaceflight which are aggravated by weightlessness and emotional tension (163). Although the application of electrosleep has not yet been reported in connection with space-oriented experiments, **the possibility of its use is interesting.**

An article by V. M. Andreyeva and Ye. I. Sorokina reveals that in Moscow research on electrosleep is being conducted at the Central Scientific Research Institute of Health Resorts and Physiotherapy (186). Various electrosleep devices are already produced by a Moscow factory for medical equipment, and further improvements are expected from new models (202).

In Kiev, research in electrosleep and electroanesthesia is conducted by K. A. Ivanov-Muromskiy, Head of the Laboratory of Neurobionics of the Institute of Cybernetics of the Ukranian Academy of Sciences, and by O. N. Luk'yanova, K. I. Kuz'mina, and V. I. Lavrinenko

who are working at his laboratory. In a paper by Ivanov-Muromskiy various possibilities of non-surgical application of electroanesthesia are enumerated and electrosleep is recommended as a countermeasure against radiation (195).

Investigations in the field of electrosleep and electroanesthesia are also conducted at various institutions in Czechoslovakia (192, 193).

Studies on the effect of soporific drugs under various circumstances showed a different reaction to barbamyl in immobilized, isolated, and control animals. A synergistical action of barbamyl and human somatotropic hormone was also noted (126).

A potential method of energy conservation in spaceflights is hypothermia. P. V. Vasil'yev and G. V. Glod tested various measures to prevent the reflex reaction of the animal organism to cold. Although the authors state that present results can serve only as approaches to methods for hypothermia, they feel that artificial cooling could be applied in spaceflight. They consider that a state of artificial hibernation would be the best solution (201).

The condition of various physiological functions during hypothermia was investigated in animal experiments. The nitrogen metabolism of the brain during hypothermia was studied in normal atmosphere and in hyperoxic medium (191). Changes in the oxygen metabolism of the brain during hypothermia were evaluated in accordance with the cerebral electric activity in atmospheres with various oxygen content. It was found that hypothermia produces a higher tolerance of the brain to hypoxia, that hypothermia does not cause cerebral hypoxia, and that during hypothermia the O_2 content of the ambient medium does not significantly influence the bioelectric cerebral activity (185).

Other studies dealt with summation of unconditioned reflexes (199) and the functional state of the cardiovascular system (198) during hypothermia. The activity of the adrenal glands (190) and the effect of the adrenocorticotropic hormone and hydrocortisone on nonconditioned interoceptive metabolic reflexes (188) were also investigated. A correlation was observed between the reaction to noradrenalin and the highest survival rate at low temperatures (184). The volume of blood plasma was studied at various levels of hypothermia (187). Another study revealed that hypothermia increases the resistance against certain chemicals (200). Species-specific differences were observed in various rodents during repeated exposure to hypothermia and subsequent recovery (194), and brain metabolism was studied during hibernation and waking from it (196).

An article by M. M. Derkovskiy reveals that experimental clinical investigation of brain hypothermia is conducted at the Institute for Clinical and Experimental Surgery of the Ministry of Health of the RSFSR. Equipment developed for this purpose and the theoretical basis for its operation are described (189).

Section 9. Selection and training

The usefulness of electroencephalography in the selection of cosmonauts is pointed out by O. G. Gazenko, V. S. Gurfinkel', and V. B. Malkin, since it is indicative of the subject's emotional reactivity and of his sensitivity to hypocapnia, hypoxia, vibration, and acceleration. During training, the EEG can be used for evaluation of the resistance and adaptability of the individual to various stress factors (314).

R. M. Bayevskiy and O. P. Kozerenko described a method based on evaluation of cardiac function, by which the ability of an individual to adapt to weightlessness can be predicted from his performance during orthostatic tests, especially after a period of hypodynamia (204).

Statokinetic stability and ability to sleep readily are also recommended as selection criteria (317, 148). In crew selection, psychological compatibility should be given special attention (206).

Various aspects of cosmonaut training are discussed in available material. I. I. Tikhomirov, who participated as a physician in Soviet antarctic expeditions, recommends Antarctica for cosmonaut training. The similarity of unusual conditions in Central Antarctica (such as temperature, solar radiation, isolated existence of a small number of persons) to those in space (for example, moon), makes Antarctica appear as a natural laboratory where capacities can be tested and physical and psychological adaptation acquired (331).

Another possibility is underwater training. Experiments conducted in a specially designed pool containing a model spacecraft were aimed at training in various extraterrestrial activities including leaving and reentering the craft, movement and coordination, repair works, and rescue operation. A positive effect of the underwater training was observed in coordination tests during subsequent parabolic flights (203).

A device for simulating decreased gravitation in terrestrial conditions has been designed by V. A. Bogdanov, V. S. Gurfinkel', and V. Ye. Panfilov (205).

Ye. M. Yuganov and A. I. Gorshkov described a training program designed to decrease the sensitivity to Coriolis acceleration. Positive results observed from the 10th day increased up to the 30th day, after which no further improvement was achieved. The acquired resistance lasted for two months (208).

Training for the improvement of statokinetic stability and nervous system lability is recommended by G. L. Komendantov and V. I. Kopanev among other measures for prevention of motion sickness in cosmonauts (317).

P. V. Vasil'yev and N. N. Uglova suggested physical training under periodic moderate hypoxia to increase the cosmonaut's tolerance to space flight conditions (299).

Special physical training consisting of voluntary tensing and relaxing of various groups of muscles, which is described by V. L. Marishchuk, enables a person exposed to emotional stress to control the external manifestation of emotions, induce normalization of physiological functions, and retain fine motor coordination and high mental efficiency. Combined with autogenous training, muscle relaxation is effective also in inducing sleep during or after emotional stress (207). The capacity for complete relaxation and detachment from the current activities are also stressed by B. S. Alyakrinskiy as essential conditions for good sleep during spaceflights (148).

Another paper proposes autosuggestion as a powerful means for controlling physiological functions (181). B. S. Alyakrinskiy emphasized psychological training as a factor influencing adaptation (147), while F. P. Kosmolinskiy considers the instruction of cosmonauts about the possible symptoms of sensory deprivation an important preventive measure (206).

Training for medical aid is also foreseen in the cosmonaut training program (323).

Section 10. Altered Gas Environment

Extensive studies are conducted in the USSR on the effects of altered gas media on living organisms. These studies entail mechanisms of adaptation, means for increasing tolerance, as well as specific and nonspecific training.

A group of scientists who work in close collaboration (220, 224, 248, 269, 270, 271, 272, 274, 296, 297, 298, 299) includes O. G. Gazenko, Corresponding Member of the Academy of Sciences USSR, V. B. Malkin, Doctor of Medical Sciences, P. V. Vasil'yev, Doctor of Medical Sciences, F. V. Babchinskiy, G. D. Yukhnovskiy, Ye. V. Loginova, N. A. Roshchina, N. N. Uglova, and several others. Although no affiliation is given in their articles, a number of them are known to be related to the spaceflight program. A member of this group appears also as a coauthor with A. S. Kaplanskiy and G. N. Durnova (258) who together with V. V. Portugalov and G. M. Kopylova are identified as members of the Institute of Biomedical Problems of the Ministry of Health USSR, in Moscow (280, 257).

The name of P. V. Vasil'yev also appears in connection with A. R. Kotovskaya, R. A. Vartbaronov, and S. F. Simpura (263).

No affiliation is provided for N. A. Agadzhanyan and his coworkers: M. S. Gayevskaya, V. M. Zemskov, I. R. Kalinichenko, M. F. Kolesnikova, A. V. Sergiyenko, L. M. Slez, and others (211). The only indication appears in a paper presented by N. A. Agadzhanyan, A. M. Rafikov, and A. V. Sergiyenko at the Third Conference of Physiologists of Central Asia and Kazakhstan, which identifies them as scientists from Moscow (212).

Another group of scientists who work at the Pavlov Institute of Physiology of the Soviet Academy of Sciences in Leningrad includes A. G. Zhironkin, Doctor of Biological Sciences and Head of the Laboratory of Respiration Physiology, I. S. Breslav, A. M. Shmeleva, G. V. Troshikhin, and a few others (236, 237, 287, 308, 309).

Members of the A. A. Bogomolets Institute of Physiology of the Ukrainian Academy of Sciences, Kiev, under the direction of Professor N. N. Sirotinin, Active member of the Soviet Academy of Medical Sciences, conducted studies in the Caucasus mountains for many years. In 1967, a new laboratory of the institute was erected at the Elbrus mountain, 5595 m above sea level. P. V. Beloshitskiy, Candidate of Medical Sciences; V. I. Kanileyko, Senior Scientific Member; L. Serova, Candidate of Biological Sciences; and G. A. Leont'yeva are mentioned as active members of "Operation Elbrus-67" (286, 328).

Most papers of this section deal with problems connected with hypoxia. Changes in blood under the effect of hypoxia were given much attention.

Several scientists, including members of the I. P. Pavlov Institute of Physiology and A. A. Bogomolets Institute of Physiology investigated the hemopoietic activity of the blood serum in persons with chronic hypoxia, and the effect of hypoxia on blood serum proteins in animals (306, 304, 244).

Other authors studied changes in blood observed during various stages of adaptation to high altitudes (230), polycythemia at various altitudes (227), erythropoiesis in alpinists after descent (300), changes in erythrocyte osmotic resistance (225, 226), and some biochemical processes in erythrocytes (289, 283). Changes in peripheral leukocytes during acclimatization to high altitudes (232) and lymph circulation and lymphogenesis under hypoxic conditions (221, 222) were also investigated.

V. B. Malkin discussed the importance of the role of the cerebral cortex, cerebellum, adrenal cortex, and pituitary gland in the development of adaptation to hypoxia (269). Other authors investigated the interrelationship between cortical and subcortical structures in reaction to hypoxia (251) and the role of some subcortical structures in adaptive processes (246).

Adaptive changes in the cerebellum and the spinal motor structures (248), and changes of the electric activity of the visual cortex and thalamus (305) during hypoxia were the subjects of other studies.

Autonomic functions were compared in children staying at high altitudes for short and long periods, and in native children (295). Metabolic processes in the brain (282) as well as the effect of ascorbic acid on oxidizing phosphorylation in cerebral mitochondria (247) were studied under hypoxic conditions.

A number of authors studied various physiological functions during hypoxia, such as venous pressure and circulatory rate (253), blood circulation in the peritoneum during acute hypoxia (209), respiratory function in chronic arterial hypoxemia (301), and absorption of amino acids from the small intestine (215).

V. V. Portugalov, A. S. Kaplanskiy, and G. N. Durnova from the Institute of Biomedical Problems of the Soviet Ministry of Health studied the histological changes in the internal organs of mice resulting from exposure to simulated altitudes (280).

V. P. Dudarev from the Department of Pathology of Hypoxic and Hyperoxic States of the A. A. Bogomolets Institute of Physiology studied the role of the thyroid gland in adaptation to hypoxia (245) and the role of the thyroid and adrenal glands in the changes in blood serum proteins during hypoxia (244).

Other papers described the phospholipid metabolism of endocrine glands during acute or chronic hypoxia (252) and changes in the activity of lactate dehydrogenase and its isoenzymes in blood and various organs at various steps of adaptation to hypoxia (275).

A Polish paper points out the relationship between physiological disruptions caused by high-altitude conditions and the psychic reactions to changes in meteorological conditions (266).

Perspiration evaporation under low atmospheric pressure was studied on subjects dressed in partial pressure suits and pressure helmets and exposed to simulated altitude (238).

A. S. Kaplanskiy and his co-workers from the Institute of Biomedical Problems investigated the effect of hypoxia on the immunity of experimental animals (257, 258).

The function of the visual analysor was studied under normal and low barometric pressure with a low carbon monoxide content in the atmosphere (310), and the effect of frequent divergent changes in barometric pressure on human performance was tested on flight personnel (261).

Another paper presented variation pulsograms as a simple method for evaluation of the condition of humans exposed to acute hypoxia (256).

Some articles deal with mechanisms involved in shifts caused by hypoxia, such as mechanisms changing the cardiovascular activity and respiration (217, 218), mechanisms of motor hypoxemia (228), compensatory mechanisms observed during acute cerebral hypoxia (279), and neurohumoral mechanisms of adaptation to alpine climate (214).

Some of the papers presented at the Third Conference of Physiologists of Central Asia and Kazakhstan, held in Dushanbe in 1966, reflect studies conducted on native population concerning blood morphology (229, 260) and age-determined variations in lung capacity (213).

Other studies deal with a comparison of the hematopoietic properties of serum and urine from natives and newcomers (231), and with the observation of physiological changes and mental efficiency of the temporary inhabitants of high altitudes (281).

Various methods of adaptation to hypoxia are discussed in some other papers. A comparison is made between gradual and sudden exposure to high altitudes (288), between various "ascent" rates (240), between adaptation in the mountains and in the barochamber, and between continuous and intermittent adaptation (297).

The effect of adaptation to hypoxia on tolerance to acute hypoxia and other stresses was tested on mountain climbers and healthy subjects who had no previous experience in the mountains. It was concluded that adaptation to high altitudes increases the tolerance to hypoxia (220, 271, 272), decreases the tolerance to high temperatures (271, 272), and provides for a better resistance to acceleration stress (272, 263). Animal experiments showed that the ascent rate to simulated altitudes influenced the results in subsequent tests of acceleration tolerance (303).

Tests on tolerance to exertion hypoxia conducted with trained and untrained natives of Pamir showed the favorable effect of alpine conditioning and the importance of training in the development of hypoxia tolerance (254). Tests with animals adapted to hypoxia (with or without physical training) showed an increased and longer lasting resistance to acceleration in trained animals (296). Passive adaptation to hypoxia significantly increased the tolerance to overexertion, although adaptation combined with physical training showed better results (298). It was also observed that muscular training at high altitudes increases the tissue resistance (235).

Experiments with constant or variable values of altitude and physical load proved that although tolerance to hypoxia and physical exertion increased after all experiments, only the one with variable conditions increased the tolerance to high temperatures. Apparently the effect of a diversity of factors of varying strength is beneficial for non-specific training (223). Physical training under optimal conditions increased the tolerance to hypoxia and acceleration, but better results were achieved after training combined with moderate hypoxia (299).

Physical training under normal atmospheric conditions considerably increased the performance capacity under hypoxic conditions, or after exposure to acceleration, but did not influence the survival time under these stress factors (291).

Possibilities of increasing the tolerance to hypoxia by pharmaceutical means were also investigated. Observed results largely depended on the administered dose and sometimes on the ascent rate and experimental conditions.

Tolerance to hypoxia was increased by certain hormone preparations (212), some neuroplegic, gangliolytic and adrenolytic agents (267), two derivatives of the gamma aminobutyric acid (278), and cystamine and its derivatives (249). The latter also increased the resistance to acceleration and reduced the oxygen consumption and the oxygen pressure in the brain (249).

Potassium permanganate successfully normalized the condition of animals in the state of respiratory standstill caused by inhalation of carbon monoxide (239). Hydroquinone proved to be effective for prophylactic and therapeutic use against hypoxemia, but due to its toxicity, the search for other substances is desirable (302). Increased sensitiveness to caffeine in altitude-adapted animals indicated that doses of caffeine which are therapeutic under normal atmospheric pressure can be toxic at higher altitudes (210).

Experimental use of some other drugs led to a better understanding of the role of the reticular formation in resistance to hypoxia (270) and clarified the role of adaptive mechanisms (241).

A. G. Zhironkin and I. S. Breslav described experiments in which men and animals were given a choice between normal air or hypoxic, hyperoxic, and hypercapnic gas mixtures. They also discussed some mechanisms governing the choice reactions (308). Experiments conducted by F. V. Babchinskiy, G. D. Yukhnovskiy, and V. B. Malkin demonstrated that adaptation to hypoxia produced a nonspecific increase in tolerance to high temperatures, and decreased the tolerance to pure oxygen and to mixtures of high concentrations of CO_2 with oxygen. Adaptation to oxygen or hyperoxic mixtures also resulted in decreased tolerance to hypoxia (224).

Some articles present studies on blood circulation under hypoxic and hyperoxic conditions (290, 284). Another paper describes the dependence of brain temperature on the oxygen partial pressure during normal external temperature. It also mentions that deviations from optimal surrounding temperature aggravate the effects of hypoxia or the toxic oxygen effect (216).

Inflight processing of additional information by pilots subjected to hypoxia or oxygen under excess pressure was studied. The results showed that the effect of hypoxia increased with its duration, while exposure to oxygen caused adaptation resulting in better performance than during control flights (233). In some experiments the subjects were exposed to low barometric pressure with normal pO_2 (109, 324).

The possibilities of decreasing the toxic effect of carbon dioxide were also studied. The authors investigated the so-called "reverse" effect of CO_2, and pointed out the importance of certain vitamins and nonspecific training, including hypoxia and acceleration (307). The nature of hypocapnic apnea was also studied (243).

A detailed study of the effects of high oxygen concentrations on the animal organism was conducted by N. A. Agadzhanyan and his coworkers (211). Some other authors investigated the effect of hyperoxia

on thoracic organs (274), circulation (285), erythropoiesis (287), and the effect of various oxygen concentrations combined with physical stress and high temperature on human thermo-regulatory functions (277).

The effect of oxygen poisoning on the nitrogen metabolism of the brain was also described (250). I. S. Breslav and his co-workers studied the effect of pure oxygen on erythropoiesis (236). The effect of oxygen breathing under excess pressure on enzyme activity in the brain and liver was investigated in animal experiments (292). The development of bacterial flora in the nasal and oral cavities was studied on pilots breathing oxygen under normal and higher pressures (255). Considerations about the therapeutical use of hyperbaric oxygen appeared in a Czech military medical publication (242).

Prolonged human experiments with pure oxygen atmosphere under reduced barometric pressure showed that such conditions do not impair the general well-being and the working capacity (262). The effect of such an atmosphere on the metabolism was studied in animal experiments (293).

Experiments with helium mixtures were conducted by the Zhironkin group from the Pavlov Institute of Physiology in Leningrad (309, 237), and by co-workers of Agadzhanyan, Yu. V. Krylov (264) and V. S. Kuznetsov (265). V. S. Kuznetsov refers (329) to his work with I. Ya. Borshchevskiy, who, with Yu. V. Krylov, participated in experiments conducted by N. A. Agadzhanyan and another Kuznetsov, whose initials are A. G. (234).

I. S. Breslav and Ye. N. Salatsinskaya studied human reaction to nitrogen and helium gas mixtures containing varying O_2 and CO_2 concentrations, and evaluated the observed preferences (237). A. G. Zhironkin and G. V. Troshikhin investigated the functions of the central nervous system in animals exposed to hyperoxic helium and nitrogen atmospheres for a considerable time. In the analysis of the results they emphasized the importance of thermal conductivity of the gases (309).

V. S. Kuznetsov studied the speech function in an $He-O_2$ medium (265), and Yu. V. Krylov investigated the function of the auditory analysor in various atmospheres including a $He-O_2$ mixture (264).

Some other papers deal with respiratory physiology (259, 268) and with a comparison of the dynamics of the cardiovascular, respiratory, and motor functions during physical exertion (273).

Section 11. Medical Monitoring and Biotelemetry

In a review article dealing with human achievements in space, Academician V. V. Parin emphasizes the psychological and social components of man's well-being in space, along with the biological aspects, and regards the mastering of space as attainable only by means of synergy of man and automaton (318).

An article by V. V. Parin, Ye. B. Zakrzhevskiy, and R. M. Bayevskiy deals with illnesses which may occur during interplanetary spaceflights and may be of endogenous nature, or caused by living conditions or by spaceflight factors. Probabilities for the appearance of various medical situations will have to be determined by mathematical methods and a physician will have to participate in the flight. All kinds of medical equipment will also have to be carried on board (320).

Another article presents a mathematical method for determining the probability of occurrence of diseases in spaceflight, depending on its duration and on the number of crew members. Statistical data from an Antarctic expedition serve as basis for the calculations (323).

O. G. Gazenko, V. S. Gurfinkel', and V. B. Malkin have studied the importance of EEG measurements in space medicine. Electroencephalography reveals the sensitivity, endurance, and adaptability of the subject to various adverse factors, as well as his emotional reactivity, and is most useful for medical monitoring under space or other extreme conditions, since it can indicate the development of pathological conditions and evaluate the level of sleep or wakefulness (314).

In another paper V. V. Parin, R. M. Bayevskiy and Yu. G. Nefedov discuss improvements in medical monitoring which will be necessary in extended space flights. An autonomous system will be needed which will be able to diagnose and forecast medical events. An on-board computer for the evaluation of the condition of the crew and of the life support system will also be required. The existing methods will have to be modified for maximum simplicity and dependability. Sensors for recording various physiological parameters have been designed to be built into the cosmonaut couch and clothing. Methods for evaluating coordination, psychological condition, air contamination, and precritical medical condition are also required for prolonged spaceflights (319).

Attempts are being made to find optimum methods for immediate automatic processing of physiological data on-board the space craft and for direct or intermediate storage of information (316). A miniature telemetric device for electromyographic transmission (312) and a contactless electronic device for studying the reactions of human organism (315) are described.

Section 12. Exobiology and Spacecraft Sterilization

Academician A. Imshenetskiy stated that although no extraterrestrial life has as yet been detected, experiments with microorganisms conducted at the Institute of Microbiology of the USSR Academy of Sciences in an artificial Mars chamber prove that some microorganisms can survive and even reproduce under conditions approximating those on Mars (324). Similar results are reported by L. Lozina-Lozinskiy, Doctor of Biological Sciences, whose affiliation is not given (325).

Methods for sterilizing spacecraft to prevent propagation of terrestrial life forms on other planets are described by Imshenetskiy (324) and other authors (145).

Imshenetskiy also suggests that in order to determine the presence of life, a biological laboratory would have to be set up on the surface of the planet (324).

Professor V. Troitskiy, Doctor of physico-mathematical sciences and Director of the Gorkiy Scientific Research Institute of Radio Physics, is optimistic about the possibility of the existence of extraterrestrial life on some of the planets whose age approaches that of Earth (327). He even admitted the possibility of existence of extraterrestrial civilizations and makes some suggestions for sending and receiving radio signals (326).

Part II

ABSTRACTS

SECTION 1. ACCELERATION

1.

AUTHOR: Afanas'yev, Yu. N.; Mashkovtsev, Yu. V.

ORG: none

TITLE: Condition of the lymphoid organs of animals upon single and repeated acceleration stresses

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 288-298

TOPIC TAGS: lymphatic system, biologic acceleration effect, spleen, histology, mitosis, dog, mouse

ABSTRACT: The lymphoid follicles and the reticulo-endothelium of the lymph nodes and spleen and the structural-contractive apparatus of the spleen of dogs subjected to chest-back acceleration stresses (single 8 units for 3 min, or 12 units for 1 min, or repeated 3-12 unit accelerations) were examined. Sections were prepared from the ventral and dorsal ends of the spleen and from lymph nodes of the left and right inguinal regions. The areas of the reactive centers, the nitotic index, and the number of destroyed cells were determined 1 hr and at periods 1-60 days after acceleration. The mesenterial, caudal, paraaortal lymph nodes and spleen of mice subjected to acceleration stress of 36 units for 2 min after injections (3 or 2 days, or 6 hrs prior) of Trypan Blue were also examined. Acceleration tended to lower the mitotic activity. Single acceleration did not cause significant cell destruction, but repeated action increased cell destruction with most pronounced extent 30 min after stress. Reduction in size of lymphoid follicles was noted 1 hr after stress. Repeated accelerations caused sharp increase in size of reactive centers and in number of lymphoblasts. All of these returned to normal in 30-60 days. Single acceleration caused dystrophic changes in smooth muscle cells; repeated stresses caused hypertrophy of the remaining muscle elements in the capsule, trabecula and vessels. Thus acceleration stresses cause definite histostructural and functional shifts in the lymph follicles, activity of the reticulo-endothelium of the lymphoid organs and structural-contractive apparatus of dog spleen. The shifts are due to series of changes in the organism arising during the experiment--hypoxia, change in neuro-endocrine regulation, redistribution of blood-forming elements. Changes in the reticulo-endothelium and in the lymph follicles indicate mobilization of the organism's protective forces during the action of acceleration stress. Orig. art. has: 7 figures.

2.

AUTHOR: Andrianova, L. A.

ORG: none

TITLE: Effect of transverse acceleration on the neurosecretory function of the frontal hypothalamus

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 28-32

TOPIC TAGS: rabbit, biologic acceleration effect, brain, gland, neuron, cell physiology, neurophysiology

ABSTRACT: Thirty-six male rabbits weighing 3.2-3.4 kg were exposed to transverse acceleration of 10 g for 4 min on a centrifuge. Secretory activity of the neurons of the supraoptic and the paraventricular nuclei of the hypothalamus was determined 15-20 min, 3 hrs, 1 day and 3 days following acceleration action. After animals were killed by air embolism, the brain was removed and fixed in a 10% formaline solution for histochemical analysis. Neurosecretion was determined according to V. F. Mayorovaya's modification of Gomori's method and also A. L. Polenov's modification of the method. A quantitative evaluation of the functional state of the neurons was based on examination of seven fields of vision for the paraventricular nucleus. The total number of cells was counted, and cells were classified according to three functional states: type I--cells are in a state of rest or beginning of synthesis and contain little secretion; type II--cells contain considerably more neurosecretory granules; type III--cells contain neurosecretory granules in the cytoplasm and ectoplasm. The neurosecretion formed by the supraoptic nucleus of the hypothalamus is believed to be an antidiuretic hormone and an index of frontal hypothalamus activity; the index can be determined by the antidiuretic activity of the blood plasma. Findings show that a pronounced shift of the neurosecretory function of the frontal hypothalamus nuclei appears 15 min after acceleration of animals. At this time neurosecretion is intensified in the neurons of the supraoptical and paraventricular nuclei and also the antidiuretic activity of the blood plasma increases. The number of type III cells increases and the number of type I and type II cells decreases. Three hours after acceleration the neurosecretory function of the neurons starts to become normal. At this time type I cells are mostly found, with a slight increase of type II cells, and type III cells are reduced. The functional rearrangement of the neurosecretory activity of the hypothalamic nuclei under transverse acceleration conditions can be considered a compensatory adaptive reaction for maintaining a balance between the body and the environment and contributing to body resistance against the acceleration factor. Orig. art. has: 2 tables and 1 figure.

3.

AUTHOR: Barer, A. S.; Gozulov, S. A.; Degtyarev, V. A.; Kostin, V. K.; Tardov, V. M.; Elivanov, V. A.; Yakovleva, E. V.

ORG: none

TITLE: Reaction of the human organism to landing stress

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 140-145

TOPIC TAGS: space medicine, stress load, anthropomorphic seat, spacecraft seat, landing impact, spacecraft personal equipment

ABSTRACT: Eleven subjects were used in 90 experiments to determine human endurance of landing stress, and the reaction of the organism to this type of effect. Two series of experiments were made. In the first series the stress was in the head - pelvis direction. In the second series transversely directed stress (chest - back) was used. The simulated landing was conducted in a special chair mounted on a platform. The stress was recorded by an accelerometer. The condition of the organism was determined from the EKG, arterial pressure, ballistocardiograms, respiration, etc. To distribute the pressure along the body equally and to increase body resistance, the chair was contoured to the individual. During the investigation the stress was slowly increased. The endurance limits were determined by the appearance of untoward subjective sensations (pain, etc.) and by changes in electrophysiological, clinical, and clinical-biochemical indicators. In the first series of experiments, pain appeared as the longitudinal stress reached 22 units. The duration of the stress was 0.04 sec and the rate of increase was 3000—4000 units/sec. In the second series of experiments the endurance limits were reached at a stress of 35—40 units with stress time of 0.03 sec and with a rate of increase of 5000 units/sec. The more typical changes in objective indicators occurred in the cardiovascular system. At 1-5 sec prior to the stress the pulse frequency reached 110-115 beats/min and remained at this level in the first seconds following the stress; after 2—5 min it returned to normal. The EKG indicated that it corresponded to the pulse frequency. In these experiments a decrease in blood pressure from 130/65 to 80/30mm was observed. Respiration rate increased sharply following the stress and in some cases remained elevated for 3—4 min. Other symptoms were bradycardia, appearance of erythrocytes in the urine, and an increase in the activity of glutamino-alanine and glutamino-aspartic transamine of the blood. The contouring of the chair to the individual increased resistance to landing stress. [LS]

4.

AUTHOR: Barer, A. S.; Yeliseyev, A. S.; Panfilov, V. Ye.; Rodin, S. A.

ORG: none

TITLE: Man-operator under acceleration conditions

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 54-58

TOPIC TAGS: man, acceleration simulation, biologic acceleration effect, man machine system

ABSTRACT: With man acting as part of a man-machine system in space flights, it is highly important to know how efficiently he can operate under acceleration conditions. From a physiological and engineering point of view, the following assumptions were made: 1) it is necessary to ensure optimal conditions for withstanding acceleration in a space vehicle; 2) the indicator system in a space vehicle should be sufficiently informative to take into consideration the changing state of man and especially his analyzer systems; and, 3) manual controls should ensure simple and reliable transmission of command signals to the performing mechanisms. The present study was carried out to check these assumptions. Subjects who were trained under normal conditions were placed in a centrifugal chamber at an 80° angle to the acceleration vector. Light and acoustic systems of indication were used. The acoustic system was the second system for acceleration of 1-12 g and was the main system for higher acceleration. Manual controls were placed in such a way that they could be actuated with the touch of a finger. The problem of the human operators was to maintain the signals at a zero position in carrying out a given program. Change of command signals, operator movements, parameter changes of the control system and physiological indices of the operator were recorded with electronic equipment. Findings show that with acceleration up to 8 g the subjects operated the manual controls for a given program as efficiently as under static conditions. With acceleration of 10-12 g, performance of the operators was impaired but was still within the range of permissible deviations. Actually the performance of operators was satisfactory up to 18 g. With unexpected failure of the visual indicator system under acceleration conditions of 10-12 g, the quality of performance tended to worsen. However, a comparison of parameters under these conditions with those without failure of the visual indicator system showed that there were no statistically reliable differences. With unexpected failure of the acoustic system, quality of performance was not lowered up to 12 g;, but, with acceleration of more than 14 g, subjects were unable to perform the given program. Compared with literature data, study data show that man's reserve capabilities are considerably greater when optimal conditions for withstanding acceleration are ensured. The controls correspond to the functional capacities of the subject and the indicator systems take into account the change of the analyzer systems under acceleration conditions. Orig. art. has: 2 figures.

5.

AUTHOR: Bazarov, V. G. (Major, Medical service; Candidate of medical sciences)

ORG: none

TITLE: Investigation of vestibular analyzer function using the uninterrupted cumulative effect of Coriolis acceleration

SOURCE: Voyenno-meditsinskiy zhurnal, no. 8, 1968, 44-47

TOPIC TAGS: biologic acceleration effect, Coriolis force, acceleration test, pilot selection, selection rule

ABSTRACT: A test was conducted on 227 healthy 18—40-yr-old men in order to investigate the application and advantages of the Continuous Cumulative Coriolis Acceleration (CCCA) method, developed by S. M. Markaryan and his coworkers in 1966. The subject, who was seated in a chair rotating with a velocity of 180°/sec, alternately inclined his head 30° to the right and to the left from the vertical axis. He completed each head inclination in 2 sec; the test lasted 5—7 min. The objective symptons of motion sickness (perspiration, paleness, gagging) were considered primary, while subjective feelings (onset of swinging sensation, feeling of warmth, nausea) were considered of secondary importance. The results were evaluated according to K. L. Khilov's chart. For the evaluation of methods, the subjects were also tested by V. I. Voyachek's OR_{10} method and on the Khilov swing. Of the 44 subjects who showed second- and third-degree vestibular-sympathetic reactions after the CCCA test, the majority were persons with insufficient flight experience; two were pilots with previous records of increased vestibular sensitivity, and nine were pilots with no records of vestibular instability. They had never before been tested for tolerance to Coriolis acceleration. A second test showed the same results though OR_{10} and swing tests provoked no reaction, thus proving that the CCCA test reveals hidden vestibular-sympathetic instability. During the CCCA test, 98.1% of the subjects experienced a swinging illusion after 15—150 sec, and 86.7% felt a warm sensation in the hands, chest, and forehead after 30—180 sec. The time of onset of these sensations can be used as an additional criterion. Among the 44 subjects whose objective symptons indicated a second- or third-degree reaction, 12 did not admit nausea. Since the subjects sometimes try to hide their reactions, it is recommended that the evaluation be based mainly on the objective symptons using subjective accounts as additional information. A CCCA test longer than 5—7 min would be useful only for selection of candidates for some special purposes. The CCCA was also used to check flight personnel. Thirty-nine of the 43 experienced pilots tested did not show any disturbances during the OR_{10} test; however, 4 others became motion sick during the first minutes of the test due to insufficient rest after night duty. After 8 hr of sleep, these pilots passed the test satisfactorily. This shows that the CCCA method reveals temporary vestibular-sympathetic instability caused by fatigue. The CCCA method is recommended as an additional test for flight personnel selection. Orig. art. has: 2 tables. [EF]

6.

AUTHOR: Bulygin, I. A. (Academician AN BSSR); Sokolovskiy, O. E.

ORG: Institute of Physiology AN BSSR (Institut fiziologii AN BSSR)

TITLE: Features of electric reactions of motor neurons of a sympathetic ganglion to centrifugal and centripetal stimulation

SOURCE: AN BSSR. Doklady, v. 11, no. 12, 1967, 1122-1125

TOPIC TAGS: cat, neuron, sympathetic nervous system, adrenal gland, biopotential

ABSTRACT: Literature data indicate that centrifugal stimulation is related primarily to the stimulation of cholinergic sympathetic preganglionic neurons and to a lesser degree to the adrenergic preganglionic neurons, and that centripetal stimuli are transmitted primarily or exclusively by the adrenergic sympathetic afferent fibers. The authors showed in earlier experiments on the postmesenteric sympathetic ganglion (PSG) of dogs and cats that the threshold of centrifugal influences on the smooth muscles of the urinary bladder is considerably lower than the threshold of centripetal influences on this organ; also, the motor reaction as well as the ganglionic neuron shifts of noradrenalin and adrenalin are more clearly expressed in the first than in the second case. To test these conclusions, electric reactions of tne motor neurons of the PSG were recorded directly using leads from the central end

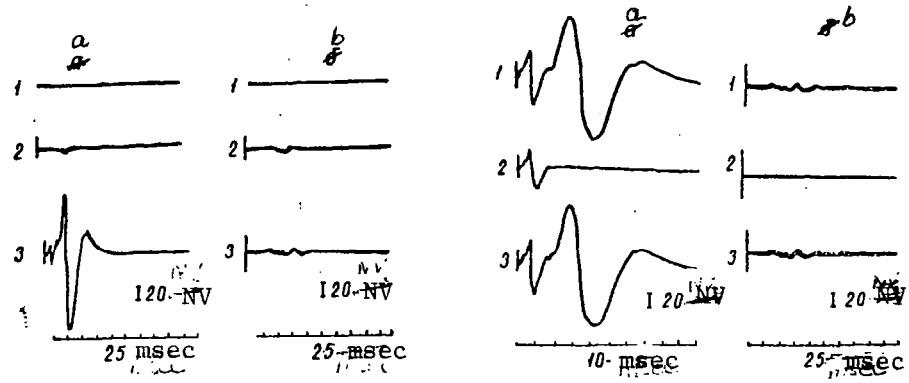


Fig. 1. Electric reaction of the central end of a hypogastric nerve of a cat to single stimulation of: a) the preganglionic neuron stem (PSG); and, b) central part of another hypogastric nerve.
1--background recording; 2--threshold reaction (threshold current strength for a - 0.25 v and for b - 1.5 v); 3--supramaximal stimulation (current strength for a - 2 v and for b - 5 v). Vertical line at the left of the electrogram is the moment at which the single electric shock was applied.

of one of the hypogastric nerves; the reactions were induced by electric stimulation of the peripheral end of one of the preganglionic neuron stems (centrifugal stimulation) or the central end of another hypogastric nerve (centripetal stimulation). The experiments were made on cats under ether or urethane anesthesia and stimulation was produced by single square pulses of 1-msec duration and an amplitude of 0.1—5 v. Findings show that the thresholds of the electric reactions of the hypogastric nerve with stimulation of the preganglionic neuron stem is much lower than with stimulation of the other hypogastric nerve; the figures for the first are 0.1 to 0.25 v and for the second are 1 to 4 v. In both cases the thresholds appear in 25.30 msec (see Fig. 1). In additional experiments the effects of ganglionic blocking agents such as pentamine on electric reactions, and also of adrenolytics, were studied. The study shows that the electric reactions induced by stimulation of the preganglionic neurons (centrifugal influences) are characterized by a much lower threshold and stronger reactions to supramaximal stimulation than stimulation of the visceral afferent sympathetic fibers (centripetal influences). With stimulation of the preganglionic neuron stems, both the cholinergic and adrenergic fibers are excited; but, with stimulation of the visceral afferent sympathetic fibers, mostly the adrenergic fibers are excited, and they secrete a lesser quantity of noradrenalin into the ganglionic neuron synapses than in the first case. Orig. art. has: 2 figures. [06]

7.

AUTHOR: Gordeyeva, N. P.; Il'yanok, V. A.

ORG: Institute of Higher Nervous Activity and Neurophysiology AN SSSR, Moscow (Institut vysshey nervnoy deyatel'nosti i neyrofiziologii AN SSSR)

TITLE: Changes in frequency spectra of biocurrents in various brain parts due to vestibular and optical irritation

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 5, 1968, 539-544

TOPIC TAGS: rabbit, acceleration, vestibular stimulator, light radiation effect, EEG, central nervous system

ABSTRACT: Tests were conducted in rabbits provided with monopolar electrodes in the optic, parietal and motor parts of the brain. Results of these tests were compared with earlier findings in humans. In four experimental series, the animals, fastened to a seat on a rotatory disk, were 1) rotated in the dark; 2) in light; 3) immobile while the light rotated, or 4) exposed to disk and light rotation. Pre-experimental frequency variations in the midbrain reticular formation involved mainly low frequencies (2 and 5 Hz), similar to changes observed earlier in humans. Other brain parts also showed 5 Hz frequency variations, predominant in the motor part, less so in lateral and visual cortex. Vestibular irritation caused changes in all

Fig. 3.

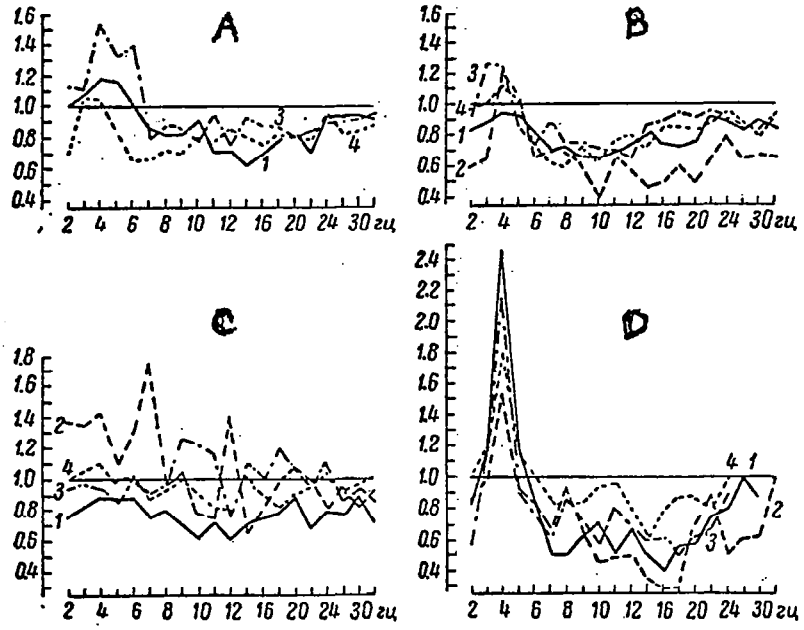


Fig. 3. Changes in frequency spectra of biocurrents in the rabbit brain under the effect of vestibular and optokynetic irritation.
A) during rotation in the dark; B) in light; C) rotation of the light bands; D) simultaneous effect of rotation and moving light bands.
Abscissa: frequency of biocurrents (in Hz); Ordinate: mean value of potentials based on pre-experimental values of the same frequencies.
1-3) occipital, parietal and motor part of the cortex; 4) midbrain reticular formation.

cortical parts under study, seen particularly in amplitude increase of slow and some decrease in rapid waves; frequency was decreased except for the 3-6 Hz range. The same effect was observed under light, but optic irritation caused a sharp depression only in the visual cortex. Simultaneous vestibular and optic irritation caused uniform frequency changes in all cortical parts under study, consisting in depression except for the 4 Hz waves. Results of the four test series are shown in Fig. 3. It was concluded that 1) a comparison between human and rabbit brain currents reveal their configurational similarity. As frequency increases, amplitude first decreases, then increases and finally decreases gradually. However, in contrast to humans, rabbits show higher amplitudes at lower frequencies with a maximum around 5 Hz, and low differences in the spectra of the various brain regions, which is apparently related to the simpler structure of their brain. 2) Vestibular and optokynetic irritation causes amplitude decrease at all frequencies, except for delta waves which show increased values, and 3) it may be concluded from an analysis of authors' findings and literature data that prolonged effects of vestibular and optokynetic irritation result in deterioration of the functional state of all rabbit brain parts, and of its reticular formation. Orig. art. has: 3 figures.

8.

AUTHOR: Kabakchiyev, K.--Kabakchiev, K.; Minkovskiy, L.--Minkovski, L.

ORG: AMNII/Commanding Colonel L. Yanchev

TITLE: Resistance to radial accelerations among pilots of Bulgarian Air Force.

SOURCE: Voenno-meditsinsko delo, no. 1, 1968, 49-54

TOPIC TAGS: man, radial acceleration, biologic acceleration effect

ABSTRACT: Three groups of Bulgarian Air Force pilots consisting of 44 healthy pilots, 38 pilots with syncopic episodes during the last 3-4 yrs and 11 pilots with some functional deviation were exposed to radial acceleration of 4, 5, 5.5, 6, 6.5 and 7 g on an originally constructed Bulgarian centrifuge. Blood pressure, pulse, visual disturbances and the appearance of a blackout served as indices. Findings show that the healthy pilots of the first group display good resistance to radial acceleration and blackout appears at 5.96 g. Pilots of the second group also display good resistance and blackout appears at 5.8 g. Apparently the resistance of these pilots is not affected by past syncopic episodes in their life. The relatively small number of subjects in the third group prevents the authors from drawing conclusions on the resistance of pilots with different diseases. Orig. art. has: 2 tables and 2 figures.

9.

AUTHOR: Klimenko, Ye. D.; Chernysheva, G. V.; Potkin, V. Ye.

ORG: Laboratory of Morphology/Scientific Consultant and Corresponding Member AMN SSSR, A. A. Sokolov'yev/ and Laboratory of Biochemistry/ Head--Professor V. M. Rubel'/ Institute of Normal and Pathological Physiology/ Director--Coresponding Member AMN SSSR, Professor A. M. Chernukh/, AMN SSSR, Moscow (Laboratoriya morfologii i laboratoriya biokhimii, Institut normal'noy i patologicheskoy fiziologii, AMN SSSR)

TITLE: Morphological and biochemical changes of the cardiovascular system in dogs with hypercholesterinemia following the action of repeated radial acceleration

SOURCE: Byulletan' eksperimental'noy biologii i meditsiny, v. 65, no. 3, 1968, 32-36

TOPIC TAGS: dog, cardiovascular system, biologic acceleration effect, cholesterol, heart, cholinesterase, protein synthesis, morphology

ABSTRACT: Literature data show that administration of cholesterin to dogs followed by repeated radial acceleration over a prolonged period of time affects the small arteries of the heart, kidneys and thyroid gland. For a more detailed study of morphological and biochemical

changes, experiments were staged on adult dogs. Four animals receiving cholesterin (2 g/kg) for 4-5 months and two animals not receiving cholesterin were subjected to repeated radial acceleration of 8 g for 3 min periods with intervals of 1 day up to 2-3 months over periods up to 2 years. Four animals were administered cholesterin, methylthiouracil and vitamin D_2 and one animal was administered only cholesterin (see table). Animals with arteriosclerosis induced according to L. A. Shekun's modification of Steiner and Kendal's model served as controls. Morphological changes of the aorta, small arteries of the thyroid gland, large coronary arteries and small branches of the coronary artery (papillary muscle) were investigated using various histological and histochemical methods. Following removal of the heart from animals under ether narcosis and processing of heart tissue in a cold room (±2°), biochemical determinations were made including fractional composition of proteins of the myocardium and myosin content, ATP-ase activity of actomyosin and myosin, level of free sulfhydryl groups, and cholinesterase activity. Findings show that in dogs receiving cholesterin and subjected to repeated radial acceleration thick plaques are formed in the intima, and focal lipoidosis is found in the aorta walls and small arteries of the kidneys and thyroid gland. Lipid infiltration is preceded by an accumulation of interstitial

Morphological changes of vessels in dogs with experimental hypercholesterinemia subjected to repeated acceleration

Animal name	Condition of experiment	Amount of cholesterin for the entire period (in grams)	Duration of experiment (in months)	Blood pressure at end of experiment (in mm)
Knave	Repeated radial acceleration and cholesterin	2880	12	170
Nora		2881	12	174
Lad		1610	19	174
Pirate		6240	25	-
Gray	Repeated radial acceleration	-	10	154
Jack		-	24	150
Charcoal	Cholesterin, methylthiouracil and vitamin D_2	5860	6	150
Playmate		8250	12	150
Rex		8700	12	150
Lad		22920	35	110
Lis	Cholesterin	3170	9	150

Morphological changes of vessels in dogs with experimental hypercholesterinemia subjected to repeated acceleration

Animal name	Morphological changes				
	Aorta	small arteries of the kidneys	small arteries of the thyroid gland	large coronary arteries	small branches of the coronary artery
Knave	+	+	-	-	+++
Nora	+	+	-	+	++
Lad	-	-	-	-	+
Pirate	++	+	+	+	++++
Gray	+	-	-	-	++
Jack	-	-	-	-	±
Charcoal	+	±	±	-	+
Playmate	++	++	++	++	-
Rex	+	+	-	-	±
Lad	++	++++	++++	++	+++
Lis	+	-	-	+	-

Symbols: + accumulation of interstitial substance in the intima and pulverulent lipid infiltration;
- absence of changes;
± thickening of vascular wall and accumulation of interstitial substance;
++++ expressed changes in the form of arteriosclerotic plaque.

substance in the intima with increase of its acid mucopolysaccharides (see table). Biochemical investigations of the myocardium show that the level of the sarcoplasmatic proteins in the left ventricle increases from 8.5-8.7 mg of nitrogen per gram of moist tissue to 10.7-11 mg following repeated radial acceleration. The levels of total nitrogen, myofibrillar proteins and actomyosin in the left and right ventricles do not change. The myosin level increases slightly in the left ventricle. ATP-ase activity of myosin increases by 74% in the left ventricle and by 42% in the right ventricle. The total number of free sulfhydryl groups of myosin increases by 57% in the left ventricle and by 22% in the right ventricle. The level of myosin sulfhydryl groups capable of forming bonds with ATP increases by 30-33% in the ventricles. Cholinesterase activity of the myocardium increases twofold. Thus, animals receiving cholesterin and subjected to repeated radial acceleration display changes characteristic for the arteriosclerotic process, with most changes in the intramuscular branches of the coronary arteries. It should be noted that more pronounced arteriosclerotic changes are found in animals receiving a larger dose of cholerterin together with methylthiouracil and vitamin D_2 (see table) and not subjected to radial acceleration. The paper was presented by Academician V. V. Parin. Orig. art. has: 1 table and 1 figure.

10.

AUTHOR: Klimovskaya, L. D.; Smirnova, N. P.

ORG: none

TITLE: Some data on the mechanism of perceptional disorders in the cerebellum with exposure to acceleration

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 29-33

TOPIC TAGS: rat, cerebellum, biologic acceleration effect, neuron, biopotential, electrocardiography, midbrain

ABSTRACT: In earlier studies the authors found that 10-G acceleration induced a functional disorder of the cerebellar afferent systems related to the motor analyzer, specifically with perception and transformation of signals from the tendon and muscle receptors. To elucidate the mechanism of the disorder, experiments were made on white rats under the influence of nembutal (40 mg/kg intraperitoneally). The tibial or sciatic nerve was stimulated with single square pulses of 0.5-msec duration. A steel needle was inserted through the skull into the Culmen monticuli area, and the induced potentials preamplified on an Al'var electroencephalograph were recorded unipolarly on a Diza indicator. Then the animals were exposed to 10-G transverse acceleration on a centrifuge for a 4-min period. In analyzing the data, two basic phases of induced potentials in the cerebellum were considered: the positive and negative phases. According to present concepts, the negative phase is the result of a synchronous discharge of Purkinje cell bodies, and the positive phase is related to the depolarization of dendrites. Potentials were recorded for each animal before, during, and after acceleration. Findings show that acceleration affects the electric activity of the cerebellar cortex by depressing its response to stimulation of the nerve. During rotation, both phases of the induced potential decrease significantly with threshold stimulation and with maximal stimulation. After the centrifuge stopped, amplitude of the potential was gradually restored. Various literature sources suggest that excitation of nonspecific structures of the reticular formation of the brainstem may play a role in depressing the cerebellar potentials. To test this hypothesis, a second series of experiments was carried out on 50 rats in which the reticular formation of the midbrain was exposed to high-frequency stimulation. It was found that effects similar to those of the first series can be produced. In additional experiments it was found that aminazine (chlorpromazine) alleviates the effects in the second series, but not in the first series, in which the effects are induced by acceleration. Apparently, the genesis of depression of cerebellar activity with acceleration is complex. Possibly, in addition to the reticular formation, depression of cerebellar activity with acceleration may involve direct entry of excess afferent impulsation into the cortex, hemodynamic shifts, functional disorders of external respiration and the purely physical effect of acceleration on the nerve cells. Orig. art. has: 3 figures. [06]

11.

AUTHOR: Korneyeva, N. V.; Ushakov, A. S.

ORG: none

TITLE: Effect of transverse acceleration on acetylcholine content and cholinesterase activity in the blood of experimental animals

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 5, 1967, 34-38

TOPIC TAGS: rabbit, transverse acceleration, central nervous system, biologic acceleration effect, acetylcholine, acetylcholinesterase, cholinesterase

ABSTRACT: Tests were conducted in rabbits subjected in the centrifuge to a single transverse, frontal acceleration of 8 g for 7-10 min. Blood was taken from the animal's ear vein and tested 10 minutes and 6, 24, 72, and 120 hours after the acceleration. Acetylcholine (AC) was determined by contraction of the leech muscle, cholinesterase activity by the S. R. Zubkova and T. V. Pravdich-Neminskaya technique. A hematocrit was also done. AC was found to increase sharply right after the exposure (from 0-0.6 to an average 0.38-0.96, in two instances close to 3 and 4 μg%), decrease steeply thereafter to zero and return to normal on the 5th day. Cholinesterase activity remained almost unchanged, with only a slight increase on the third day. Acetylcholinesterase decreased somewhat immediately after and on the third day. The hematocrit showed no changes. All values had returned to normal after 120 hours. It was concluded that these data point to a rather long-lasting disturbance of cholinergic mechanisms which are known to play a role in neural conduction; this disturbance is particularly apparent in the lack of correlation between AC rise and cholinesterase activity. Orig. art. has: 1 table and 1 figure.

12.

AUTHOR: Korneyeva, N. V.; Ushakov, A. S.

ORG: none

TITLE: Certain aspects of acetylcholine metabolism in the brain and heart of guinea pigs exposed to angular accelerations

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 33-37

TOPIC TAGS: angular acceleration, acetylcholine, guinea pig, acetylcholinesterase, brain, heart, biologic metabolism

ABSTRACT: The effect of 6 hr. exposure to angular acceleration of 1.5 g on free and bound acetycholine content, and on the specific (cholinesterase) and nonspecific pseudocholinesterase) activity in the heart and brain tissues of guinea pigs was investigated. Acetycholine and the cholinesterase activities were determined 10 min, and 24, 72, and 120 hrs. after exposure. The greatest changes were in the bound acetylcholine in both organs: its content increased sharply in 10 min, decreased to a minimum in 24 hrs. (heart) or 72 hrs. (brain) and returned to normal 120 hrs.

after exposure. The free acetylcholine content in both organs decreased slightly by the end of 24 hrs., but also returned to normal 120 hrs. after exposure. The course of changes in the general, acetylcholinesterase and pseudocholinesterase activities in the heart and brain tissues was different: the overall and the acetylcholinesterase activities in the heart tissues showed a gradual rise and an eventual return to normal 120 hrs. after exposure, while in the brain, it decreased and then returned to normal. The pseudocholinesterase activity in the heart had small alternate increases at 10 min. and 72 hrs., with a low at 24 hrs., and return to normal in 120 hrs. Orig. art. has: 2 figures.

13.

AUTHOR: Korolev, Yu. N.

ORG: none

TITLE: Certain changes in dog lungs caused by the action of single and repeated transverse acceleration

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 271-275

TOPIC TAGS: dog, lung, transverse acceleration, biologic radiation effect, histology, adaptation

ABSTRACT: The effect of single and repeated accelerations on animal lungs was studied, especially to determine the expedience of repeated conditioning action. One group of dogs was subjected to single transverse acceleration, chest-back, of 12 units for 1 min; the other group underwent repeated accelerations increasing from 3-12 units for different time periods. Disturbances in the vascular system were observed 30-60 min after acceleration. In the animals subjected to repeated acceleration there was fresh hemorrhaging, and focuses of blood effusion with hemolyzed erythrocytes, macrophages, and segmentonuclear leukocytes. Sites of connective tissue growth were found more frequently in animals subjected to repeated acceleration, but the productive phase of inflammation was observed only in the first periods. Thus single and repeated accelerations can cause changes in the lung vascular system and parenchymatous structure. Repeated action can cause definite shifts in the organ structure, but these changes are monotypic. The changes are compensated by the organism and undergo reverse development with time: in 15-60 days the histostructures of the lungs recovered. Orig. art. has: 2 figures.

14.

AUTHOR: Korotayev, M. M.; Grigor'yev, A. I.

ORG: none

TITLE: Effect of transverse acceleration on some kidney functions

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 70-75

TOPIC TAGS: man, transverse acceleration, kidney function, kidney function test

ABSTRACT: Tests were conducted on 40 individuals exposed three times to the effect of the following spine-chest accelerations increasing at a rate of 0.2 g/sec: 1) 4 g and 6 g for 120 sec applied at an interval of 5-10 min; 2) 8 g for 60 sec and 10 g for 20 sec. The individuals were tested at intervals of 2-4 days. The following functional criteria were used: rest nitrogen in the blood, blood creatinine, endogenous creatinine clearance, urine concentration and dilution, urine analysis, including the sediment, and diuresis. Venous blood was taken 20-30 min or 3-4 hours after exposure to acceleration. The first two indices remained essentially unchanged, except for some increase of rest nitrogen after 10 g in samples taken after 3-4 hours. Diuresis increased right after the acceleration, due probably to increased glomerular filtration. An increase in erythrocytes in the urine samples collected 4 and 24 hours after each effect and a lesser increase in leukocytes paralleled acceleration values and suggested changes in renal vascular penetrability. Erythrocytes in the urinary sediment increased $1\frac{1}{2}$-$2\frac{1}{2}$ fold in all test subjects after acceleration. In one individual, the increase was greater and persisted for more than a month. He was found to have a papilloma of the urinary bladder. It was concluded that microhematuria following acceleration may be related to intrarenal circulatory disturbances. Studies for microhematuria in checkups of pilots and astronauts should be conducted both before and after exposure to acceleration. Orig. art. has: 3 tables.

15.

AUTHOR: Kosmarskaya, Ye. N.; Balashova, Ye. G.

ORG: Department of Brain Development with Congenital and Hereditary Diseases, Institute of Pediatrics, AMN SSSR, Moscow (Otdel razvitiya mozga pri vrozhdennykh i nasledstvennykh zabolevaniyakh, Institut pediatrii AMN SSSR)

TITLE: Development of nystagmus in rabbits

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 53, no. 12, 1967, 1424-1431

TOPIC TAGS: rabbit, visual physiology, vestibular function, biopotential, electroencephalography

ABSTRACT: Rotational and postrotational nystagmus in rabbits aged 10 days to adult was investigated to determine the development of vestibular oculomotor function. The animals were placed on their stomachs and fixed on rotating platforms; the head of the animal was at the center of the axis of rotation of the platform. Using Barani's methods, rotation was conducted in a dark chamber so that the walls of the chamber were not in the field of vision and stimulation would primarily affect the horizontal semicircular canal. The animals were rotated clockwise for 20 sec at a rate of one rotation/2 sec; after a 5-min interval, they were rotated counterclockwise for 20 sec at the same rate. Nystagmus was recorded on a four-channel Al'var electroencephalograph. The potentials of both eyes were measured separately with point-contact electrodes introduced into the skin near the outer corners of the right and left eyes; a third electrode serving as a second pole was placed under the skin between the eyes. A thick neutral electrode was placed under the skin of the hip. Eye movements were recorded for 20-sec periods before rotation and during the first and second rotation periods. Nystagmograms show that in 10-day-old rabbits, the oculomotor reaction at time of rotation and after rotation is expressed by increased eye muscle tonus or by nystagmoid oscillations of low amplitude and different frequencies. In 17—23-day-old rabbits the response is characterized by a more or less formed nystagmus of a cyclic nature. In 60-day-old rabbits nystagmus is characteristic of an adult animal: duration of rotational and postrotational nystagmus decreases and eye movements are more rhythmic and of the same amplitude, which leads to merging of the cycles. In adult rabbits, two types of rotational nystagmus are found. In the first type, nystagmus is damped before rotation ceases; in the second type nystagmus continues throughout the entire rotation period. The postrotational nystagmus is of shorter duration than a 60-day-old rabbit and the rhythmic eye movements gradually diminish in amplitude. Orig. art. has: 3 figures. [06]

16.

AUTHOR: Kotova, E. S.; Savina, Ye. A.

ORG: none

TITLE: Clinical and morphological characteristics of hemodynamics in the vascular system of the rabbit eye under acceleration

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 38-43

TOPIC TAGS: transverse acceleration, rabbit, oculography, ophthalmology, blood circulation

ABSTRACT: Tests were conducted in 53 rabbits exposed to single or repeated (intervals of 3-7 and 10 days) acceleration of 4-12 g for 1 1/2 to 6 min, then subjected to daily opthalmological examination until return to normal (after 3-11) days). Preliminary tests had established normal values for pressure in the central retinal artery (CRA) and the diameters of retinal vessels. Hypertension was observed shortly after exposure to 4-6 g for varying periods. Pressure in the CRA returned to normal after 10-12 min while retinal veins underwent dilatation. At 8-10 g, the reation differed depending on duration. After 2 min acceleration, some hypertension was observed in two rabbits, none in another two. At 10 g continued for 6 min, 6 out of 8 rabbits showed considerable hypotension, and two died. Arterial and venous dilatation followed after 12-16 min, and retinal bleeding was observed in 3 rabbits during the first hour; these had been exposed to 6, 10 and 12 g for 1 1/2-3 min. Repeated exposure caused cumulative effects in rabbits which had not fully recovered from the first exposure. Morphologic studies were conducted in 38 rabbits exposed to a single acceleration, 12 to double and 10 controls. The animals were divided into 4 groups and sacrificed 1) minutes after exposure; 2) 1/2-3 hours later; 3) a day later, and 4) after double exposure. It was determined that hyperemia depended on the rate and duration of accelerations. At 4-6 g or 8-10 g for 1 1/2-2 min, anemia of retinal vessels and of the vascular layer was observed (considered a sign of spasm); at higher and longer accelerations, there was hyperemia of retinal and ciliary systems, signs of increased vascular permeability and accumulation of fluid between optic nerve fibers. After 1 1/2-3 hours, highly characteristic signs consisted in increased vascular permeability and venous hyperemia. Edema of the optic nerve was rather constant. Permeability of the ciliary body was disturbed due to widening of perivascular spaces and thickening of ciliary branches. Severe changes occurred mainly at 8-12 g and a duration of 6 and 3 min. In cases exposed to prolonged high acceleration, hyperemia and edema of nerve and retina had not yet receded after one day. It was concluded that acceleration leads to disturbances of blood circulation and increased permeability of the optic vascular system, and these persist for several days. While repeated acceleration had no serious sequelae, increase in permeability and disturbed blood circulation were more pronounced after the second exposure. Hypertension in the CRA may be considered a protective adaptation reaction. These findings agree with those found earlier in humans. The methodology used in this study appears suitable for evaluating not only retinal but also, indirectly, brain circulation. Orig. art. has: 3 tables and 3 figures.

17.

AUTHOR: Kotovskiy, Ye. F.; Speranskaya, T. V.

ORG: none

TITLE: Effect of accelerations for maximum period of endurance on the histostructure of the liver of monkeys

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii., v. 6, 1967, 313-318

TOPIC TAGS: liver, monkey, histology, biologic acceleration effect, biologic metabolism, acceleration

ABSTRACT: The effect on the liver histostructure of monkeys subjected to 12 g acceleration for the maximum endurance period was investigated. Maximum endurance, as determined by prolonged holding or termination of breathing, tachycardia or disturbance of automatism function, and irritability and conduction of heart muscle, varied from 1-5 min. Pairs of animals were killed 30 min, and 1 and 3 days after acceleration. Sections of the ventral, central, and dorsal parts of the liver were examined. The acceleration caused changes, mostly of vascular nature. These were manifested in venous congested hyperemia starting from the liver veins. The hyperemia was complicated by dystrophic processes in the vascular wall elements, edema of the connective tissue surrounding the vessels, and development of local blood effusion. Hyperemia was most pronounced in the dorsal section, and blood effusion, caused by rupture of the vessel walls, in the midsection of the liver. These are apparently explained by hindrance of blood shifting in the liver vein system and simultaneous redistribution of blood in the direction of acceleration action. Destructive changes in the vessel endothelium is the cause of thrombosis and vessel rupture and blood effusion caused occurrence of embolism in the liver cells. Vacuolation of the liver cell protoplasm was shown by disturbance of the water metabolism in the liver, and change in the RNA and alpha-amino acid content indicates the protein metabolism underwent some degree of change. The changes were monotypic in all the animals, but increased in extent with length of individual endurance. Orig. art. has: 3 figures.

18.

AUTHOR: Kotovskiy, Ye. F.; Speranskaya, T. V.; Yatskovskiy, A.

ORG: none

TITLE: Effect of repeated accelerations on liver histostructure

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 308-313

TOPIC TAGS: dog, liver, histology, biologic acceleration effect, adaptation, transverse acceleration

ABSTRACT: The histostructure of dog liver was studied after the animals were subjected to repeated transverse chest-back accelerations of 3-12 units at 36-48 hour intervals. Dorsal, ventral, and central sections of the livers were examined 1 hr and at various periods 1-60 days after the animals had been subjected to centrifuging. The repeated accelerations were found to cause changes in the liver vascular system and cells. These changes were analogous to those observed in previous investigations when animals had been subjected to single acceleration. However after repeated accelerations, even in animals killed 1 hr after centrifuging, the area of blood effusion was, as a rule, infiltrated with leukocytes and macrophages. There was no indication of fresh blood effusion. Thus blood effusions were caused by the initial, and not by the later rotations of the animals on the centrifuge. Repeated subjection of animals to accelerations over a period of 2 weeks caused adaptive reactions, reducing the effect of the action of subsequent accelerations up to 12 units. Orig. art. has: 3 figures.

19.

AUTHOR: Markaryan, S. S.

ORG: none

TITLE: Functional interaction of the semicircular canals and the otolith organ

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 176-181

TOPIC TAGS: biologic acceleration effect, nystagmus, proprioception

ABSTRACT: A study was made to determine the effect of stimulation of the otolith organ on the appearance of nystagmic and sensory reactions in man during acceleration in different directions. Subjects lay on their backs or sides with feet directed toward the periphery on a rotating device with their heads in three different positions with respect to the axis of rotation: axis of rotation passing through the head, axis of rotation passing through the chest, or axis of rotation lying outside the head. Electrodes attached to the outer corners of the eyes recorded number and amplitude of nystagmic movements. In all cases, subjects noted a sensation of heaviness in the feet, and of falling feet first. These sensations were exaggerated in those who lay on their sides. Those who were subjected to a negative load in the region of the head (axis of rotation passing through chest) in addition felt that their heads were tilted down and back. Nystagmus appeared in all subjects regardless of position, and was more pronounced under greater loads. It was more pronounced in amplitude, frequency, and duration when subjects lay on their sides. Positive loads tended to cause more pronounced nystagmic reactions, though sensory illusions were similar for both positive and negative accelerations. Orig. art. has: 2 figures and 1 table. [EL]

20.

AUTHOR: Markaryan, S. S. (Lieutenant Colonel, Medical service; Candidate of medical sciences)

ORG: none

TITLE: Effect of rapid rotation on the vestibular reaction

SOURCE: Voyenno-meditsinskiy zhurnal, no. 7, 1968, 53-57

TOPIC TAGS: man, rotation, rotational flow, flow angle, vestibular analyzer, angular acceleration, ejection seat, ejector design

ABSTRACT: In a study on the effect of the angle and magnitude of rotation when the pilot ejects himself in abandoning a plane, tests were conducted on 10 healthy young males, 7 with high and 3 with known low vestibular stability. They were rotated in three different positions: sitting (OY), lying on the back (OX), or on the side (OZ).

Angular velocity amounted to 180-900°/sec, depending on position; time of stop stimulas was 1.6-3 sec and angular acceleration was 112-500°/sec. Criteria were vestibular nystagmus after the stop stimulus (3 sec), pulse, blood pressure, body stability, and the individual's subjective condition. It was determined that tolerance was best in the sitting position; in the others, the men experienced, e.g., a shift in internal organs or difficulty in swallowing. Following exposure, hyperemia of conjunctiva and scleral vessels was observed. At 720-900°/sec, the men felt the typical effects of acceleration. Those with poor vestibular tolerance exhibited severe symptoms after 1-2 rotations which disappeared after 25-40 min but reappeared at the next test. Vestibular nystagmus was found to depend not only on the rate of acceleration and length of effect but also the functional features of reacting receptors in the semicircular canals; these receptors differed depending on the conditions: nystagmus was shorter and had a higher amplitude for OZ than OY while rotation around OX, which irritates the receptors of frontal canal parts, was followed by little nystagmus. Additional studies on the relationship between the various receptors and nystagmus on five men revealed a typical pattern for each. In angular acceleration of 90°/sec^2 lasting 3 seconds, the longest nystagmus was found for irritation of horizontal receptors in the canals, the shortest for that of frontal receptors. Pulse increased by 12 beats/min, systolic pressure by 8-12 mm Hg, and diastolic by 10-15, with return to normal after 30-40 min. It was concluded: 1) that increased angular acceleration results in a sharper nystagmic reaction; 2) under adequate stimulation of the vestibular analyzer, least sensitivity is observed (nystagmography) for receptors of the frontal semi-circular canals; 3) individuals with low vestibular stability fail to adapt to angular acceleration; and, 4) to acquaint pilots with the effects of rotation prior to exposing them to ejection, the author recommends a harmless rotation in the sitting position at a rate of 540-720°/sec, and for spinal and side position a rate of 180/270°/sec, lasting no more than 2-3 sec. Orig. art. has: 2 figures and 2 tables. [WA-22]

21.

AUTHOR: Medvedev, D. I.

ORG: none

TITLE: Morphology and certain histochemical changes in the precoronary region of dog cerebral cortex upon action of transverse accelerations

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 248-255

TOPIC TAGS: transverse acceleration, dog, biologic acceleration effect, cerebral cortex, morphology, histochemistry, brain tissue

ABSTRACT: The effect of acceleration on nerve tissue was examined in this study of changes in the precoronary region of the cortex in grown dogs accelerated (I) at 8 units for 3 min, or (II) at 12 units for 1 min. Sections of various layers of the cortex of dogs killed 1 hr or 1-30 days after the acceleration were prepared for examination by the following methods: hematoxylin-eosin, staining with thionene, staining with Sudan III for fat, development of RNA, and staining with Schiff reagent with periodic acid. The obtained data show that the action of acceleration leads to a series of morphological and histochemical changes in the precoronary region of the cortex. The nature of the changes in both series of tests and the dynamics of their development are essentially the same. But the time factor plays a significant role, and the changes in series I are more pronounced than in II. It is assumed most of the morphohistochemical changes occurring after the acceleration stress are due to development of the inhibitory processess in the cortex necessary for recovery of normal nerve cell activity. The observed changes in the distribution of the thionene-stained substances, the increase in the number of hyperchronic cells, the appearance on the periphery of optically blank spaces, generally correspond to morphological changes associated with carotid inhibition. These observed changes are mostly of a transitory nature, and as a rule disappear 1-2 months after the centrifuging. Orig. art. has: 5 figures.

22.

AUTHOR: Mirolyubov, G. P.; Frolov, N. I.; Lemasov, V. B.

ORG: none

TITLE: Effect of gravity forces on man landing in a cabin depending on the degree of impact shock absorption and on the force of the side wind

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii; v. 6, 1967, 145-152

TOPIC TAGS: man, gravity, landing impact, wind, shock absorber, space flight biologic effect

ABSTRACT: The effects of wind drift, of different types of shock absorbers, and of different body positions of men in a model cabin were studied to help determine limits of human endurance to impact during soft landings of space capsules. Tests were conducted with pneumatic and mechanical shock absorbers with the men in a sitting (20°) or reclining (60°) position in a chair in the cabin landing under quiet conditions and under 36 km/hr winds simulated on the test tower. Arterial pressure, electrocardiogram, and respiration rate recordings were made and reflex level and latent response in motor reaction to light were determined. The maximum landing rate depends on extent and evenness of the damping and on the position of the subject: with even damping over most of the path with the occupant in a reclining position, descent rates of 8-10 m/sec are possible. The greater the tilting of the head and movement of the body the greater the danger of trauma. Comfort in a sitting position is dependent on the care with which the subject is secured with belts. Side supports on the chair can increase the endurance of the subject, when on his side, to landings at 9-10 m/sec. Descent in a reclining position, back first, was somewhat more comfortable than face first descent. Breathing, pulse rate, and blood pressure increased as instant of impact approached; they were highest immediately before and immediately after landing, and normalized in 2-3 min thereafter. Functioning of the cardiovascular system was normal 30 min after landing. Latent motor responses varied almost insignificantly and reflexes were retained after landing. These findings indicate the reactions are emotional and do not depend on forces encountered on landing. A deflection of the electrical axis of the heart observed when the subject landed on his side is believed to be associated with impact stresses. Orig. art. has: 3 figures and 3 tables.

23.

AUTHOR: Pastushenkov, L. V. (Captain of Medical Service)

ORG: none

TITLE: Increasing body resistance to acceleration with pharmacological preparations

SOURCE: Voyenno-meditsinskiy zhurnal, no. 12, 1967, 55-56

TOPIC TAGS: rat, mouse, biologic acceleration effect, organic sulfur compound, drug, acceleration protection

ABSTRACT: Sulfur-containing preparations including allisothiuron, methylisothiuron, ethylisothiuron, propylisothiuron (propylon), ethylthiourea and guanylthiourea (gutimin) were studied to determine their effects on increasing resistance of experimental animals to acceleration. Seven hundred eighty-four male mice and 230 male rats were subjected to acceleration by rotation on a centrifuge with a 10-15-cm radius. A physiological solution was administered to control animals and one of the preparations was administered to the experimental animals. The mice were rotated for 1 min 20 sec and the rats for 1 min 40 sec. For the mice, acceleration ranged from 29 units (460 r/min) to 89.1 units (800 r/min) in the head--pelvis direction, and for the rats acceleration ranged from 25.7 units (480 r/min) to 78.3 units (800 r/min) at the level of the heart. The index for evaluating the protective action of the

Table

Name of preparation	Dose mg/kg	Number of animals	Number of rotations per min	LD_{50} of acceleration in units
Mice				
Control		164	550	41.2
Methylisothiuron	200	44	550	41.2
Allylisothiuron	200	54	610	51.9
Ethyron	200	44	610	51.9
Ethylthiourea	200	52	590	48.2
Propylon	200	40	600	50.3
Gutimin	5	40	610	51.9
"	10	48	700	67.6
"	25	44	700	67.6
"	50	44	750	78.4
"	100	44	770	82.6
"	200	46	820	92.6
"	500	72	730	74.2

Table (cont.)

Name of preparation	Dose mg/kg	Number of animals	Number of rotations per min	LD_{50} of acceleration in units
		Rats		
Control		48	580	37
Gutimin	10	32	770	66.1
"	25	28	840	78.4
"	100	30	820	74.4
"	200	28	790	69.7
"	500	44	740	60.7
Same with enteral administration	100	20	820	74.4

preparations was the acceleration value (in units) at which death was induced in 50% of the animals ("LD_{50} of acceleration"). Experimental data were processed according to Berens in an absolute and integrated form. Findings show that all the investigated preparations increased acceleration resistance of the body by at least 10 units with the exception of methylisothiuron (see table). Gutimin displayed the highest protective action in a range of doses from 5—500 mg/kg. The other preparations displayed a beneficial effect in large doses. The protective action of gutimin is also displayed with enteral administration. Following the experiments, the animals remained under observation for 2 months and no changes in their general condition were found. On the basis of literature data, it appears that when the neuroreflexive mechanisms of compensation prove insufficient with high and prolonged acceleration, the hydrostatic factor assumes the leading role in the genesis of disorders. Under these conditions hypoxia becomes the main cause of death. This conclusion is indirectly confirmed by the fact that gutimin significantly increases body resistance to various forms of acute oxygen starvation. Orig. art. has: 1 table. [06]

24.

AUTHOR: Petrukhin, V. G.; Markaryan, S. S.

ORG: none

TITLE: Pathomorphological changes related to the action of radial accelerations in the "head-foot" direction

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 299-308

TOPIC TAGS: morphology, radial acceleration, biologic acceleration effect, internal organ, heart, brain, dog, blood circulation

ABSTRACT: The effect of accelerations on pathomorphological changes in animals subjected to single and repeated radial accelerations were studied in dogs rotated at accelerations of 0.4-16.2 g, with axis of rotation passing the pelvic region at an angle of 0, 20, or 70° to the axis of the body. Some animals died during test in 1-20 min of acceleration; the surviving animals were killed 30 min to 12 days after the test. Microscopic examination was made of sections of brain, lung, heart, liver, kidney and suprarenal glands. The morphological changes in all animals subjected to single acceleration were the same, regardless of acceleration differences. In animals which underwent repeated accelerations the pathomorphological changes were different, depending on the time lapse between last acceleration and death. When killed during the repeated acceleration test, the changes were similar to those encountered under single acceleration--blood circulation disturbance; hemostasis in right heart cavity, vena cava, liver, and root part of the lungs; blood effusion under soft brain membrane, eye tunic, lungs and sinuses. In animals killed 3 days after acceleration, there were no signs of blood circulation disturbance, and blood effusion and edema were resorbed. But changes (cerebral ventricle dilatation, dystrophic processes in ganglion cells, hypertrophy of heart ventricle, vein thrombosis) continued to develop in the organs, their extent depending largely on acceleration conditions. Radial accelerations over 2.4 g for 20 min cause significant pathomorphological changes in dog organs, and accelerations over 6 g can cause death during test. Each dog's endurance to acceleration is different (but by no more than 1-1.5 g) and depends on rate and duration of acceleration, and angle of body inclination to the axis of rotation (the endurance at 20° is 2.5-3 g greater than at 90°). The basis of all morphological changes due to action of radial acceleration on the organism is the acute disturbance of blood circulation, especially in the lesser circulatory system. Conditions for venous hemostasis and insufficient return to the left ventricular system occur due to decompensation of the right heart ventricle. This in turn leads to hypoxia, especially of the brain and myocardium. These changes are in all probability the main cause of death. Disturbance of brain fluid circulation also plays a part in the mechanism of death. Orig. art. has: 5 figures.

25.

AUTHOR: Polyakov, B. I.

ORG: none

TITLE: Characteristics of autonomic reactions in man during the action of angular accelerations of different degrees and duration

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 165-171

TOPIC TAGS: man, angular acceleration, biologic acceleration effect, autonomic nervous system, vestibular effect

ABSTRACT: The study was conducted to characterize the vestibulo-autonomic reactions of man (change in pulse and respiration rates, arterial pressure) to the action of carefully controlled angular accelerations of different values and duration. Individuals with no previous earaches were rotated on the vestibulometric test stand VK-3 in a light-tight chamber at angular accelerations of 3-5°/sec to the desired angular acceleration of 90, 120, or 180°/sec. The desired acceleration was maintained for 2 min; 5-10 min intervals lapsed between rotations. In the various series of tests conducted the number of subjects in which reliable shifts in autonomic reactions occurred did not exceed 47-50%; reactions in different subjects followed different courses. In all series there was a reduction in pulse and respiration rates and in arterial pressure, but in most cases there was no parallelism in the changes of the individual indexes. Insufficient data was obtained to compare reactions of individuals subjected to rocking. Generally changes in the indexes were registered 20 min after stopping of the chair; autonomic reactions rarely started after 20 or 40 seconds. No correlation could be established between the length or intensity of autonomic reactions and the degree of acceleration or absolute value of stimulation. Reduction in the frequency of reactions to repeated tests is considered due to extinction of orienting reaction. The observed autonomic reactions are the integral effect of the interaction of the autonomic components of vestibular and orienting reactions. The nature of the changes in pulse and respiratory rates and arterial pressure in man subjected to short term unidirectional angular accelerations is not associated with the vestibular resistance of the individual and can hardly be used as its criterion. In order to determine threshold values of angular acceleration for the autonomic reactions the study will need to include a wider range of stimulation and the stimulation gradient will have to be increased more. Orig. art. has: 2 figures and 1 table.

26.

AUTHOR: Potkin, V. Ye.

ORG: none

TITLE: Role of the central nervous system in regulating the secretory activity of the small intestine after action of prolonged transverse accelerations

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 325-328

TOPIC TAGS: central nervous system, dog, transverse acceleration, enzyme, internal organ, biologic secretion, biologic acceleration effect

ABSTRACT: The role of the central nervous system in the secretory activity of the small intestine after radial acceleration was examined in studies on dogs, by comparing the secretory activity of denervated intestinal segments (denervation by the V. N. Shamov and the L. S. Fomina methods), and of isolated intestinal loops. The amounts of intestinal juices and the enzyme activities of enteropeptidase, alkaline phosphatase, amylase, and lysozyme were established 3-4 weeks after denervation, then the animals were subjected to the action of acceleration, 8 g for 3 min, with acceleration increase of 0.2 units/sec. The results were the same regardless of the denervation method. After subjection to transverse acceleration the amount of intestinal juices in the denervated segments decreased, the activity of the lysozyme decreased and the activity of the other enzymes increased. These unidirectional changes are indicative of neurohumoral regulation of the secretory activity of the small intestine. But the absence in change in the amount of intestinal juice obtained from the denervated segment the first day after acceleration, and the significantly less pronounced shifts in the following period, in comparison to secretion of juices and enzymes from the intestinal segment with intact nerve connections, are indicative of the important role of the central nervous system in regulating the secretory activity of the small intestine. Orig. art. has: 1 table and 2 figures.

27.

AUTHOR: Savin, B. M.

ORG: none

TITLE: The question of the genesis of visual disturbances during acceleration

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 155-164

TOPIC TAGS: visual activity, animal biologic acceleration effect, cat, electroretinography

ABSTRACT: Disturbances in the function of the visual analyzer were studied by examining changes in its functional state caused by action of acceleration as recorded by electrodes chronially implanted in the nasal and cheek bones. Unanesthesized cats were subjected to chronic tests in which the electroretinogram and primary responses (PR) to white light stimulation (1 microsec, 0.6 joules) of the outer geniculate bodies, of the upper tubercles of the quadrigeminal bodies, and of the visual cortex were recorded during and at various periods after 20-120 sec accelerations at 1.5-22 units. Changes in the spontaneous bioelectrical activity of different parts of the visual analyzer differed depending on the values and repetition of the accelerations. With accelerations up to 5 units the latent response period was somewhat shortened; with 5-12 units, latent response period increased, especially in the visual cortex and retina; and, with 12-22 units, it increased to almost twice the original value. While acceleration of average value prolongs the latent respiratory period by increasing inhibitory processes in the retinal neurons, greater accelerations caused changes in the functional state of the cortical cells themselves. Unique reciprocal relationships were noted in the changes of the excitability level of the retina and the visual cortex. When retinal responses were weakened, the respiration of the outer geniculate bodies changed little, indicating a transforming mechanism which insured constant excitation intensity upon rapid weakening of afferentation. The nerve structures of the upper tubercles of the quadrigeminal bodies were most resistant to the action of acceleration: these continued to show reaction after repeated accelerations when responses from the visual cortex and the outer geniculate bodies were no longer observed. The results obtained indicate the cortico-retinal nature of disturbances of the action of the visual analyzer upon acceleration. The basis of the disturbance is a retardation of sympathetic transfer, change in the dynamics of the development of the basic nerve processes, and rapid intensification of background activity of the appropriate nerve centers which show a masking effect on reactions caused by adequate stimulation. Orig. art. has: 4 figures and 1 table.

28.

AUTHOR: Shul'zhenko, Ye. B.; Sebekina, T. V.

ORG: none

TITLE: Regulatory mechanisms of hemodynamic shifts with exposure to acceleration (An experimental investigation on a physiological model)

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 25-28

TOPIC TAGS: dog, biologic acceleration effect, pulmonary physiology, reflex activity, heart rate, blood pressure, cardiovascular system, thoracic surgery

ABSTRACT: Earlier investigations by Ye. B. Shul'zhenko showed that with exposure to transverse acceleration anesthetized cats display phase shifts in cardiovascular functions. It was hypothesized that the circulatory-disorder phase connected with reduced arterial pressure at the start of acceleration is determined by neuroreflex effects from receptors in the pulmonary circulation. To prove this hypothesis, experiments were made on dogs serving as a physiological model, and a method was used by which pulmonary circulatory changes could be made comparable to those observed during acceleration. Fifty-eight experiments were conducted on 19 dogs (12-18 kg) of both sexes. Animals under morphine-chloral-nembutal anesthesia were placed on their backs, the thorax was sectioned in layers, and then the lung roots were isolated. Metal clamps were used to inactivate the right lung and the lower part of the left lung, thereby affecting 71.4% of the lung tissue for 30 sec. Another group of animals was exposed to 9-G transverse acceleration on a centrifuge for 30 sec first with intact sinocarotid zones, and then with denervated sinocarotid zones. Indices included heart contraction rate, pressures in the right and left ventricles, pressure in the aorta (systolic, diastolic, and pulse), minute blood volume, and peripheral resistance according to Maxwell. A comparison of data for experiments under conditions of lung tissue inactivation and acceleration discloses unidirectional shifts of the basic hemodynamic indices. These shifts are the result of a circulatory disorder in the lung, stagnation of blood in inactivated lung tissue, increased pressure in the pulmonary artery system, and increased strain in the right ventricle. This type of physiological modeling makes it possible to single out neuroreflex components of hemodynamic shift regulation with exposure to acceleration. These data confirm the hypothesis that in the initial period of transverse acceleration, cardiovascular shifts are determined by the appearance of the "unloading" reflex directed toward the alleviation of the work of the right ventricle. With exposure to acceleration the blood in the lungs is redistributed, thereby increasing its volume, blood circulation is retarded, blood circulation resistance is increased in the pulmonary circulation, and right ventricle strain is increased. These disorders evoke the first reaction of the body directed toward normalization of the hemodynamic shifts. This reaction is characterized by reduced vessel tone and lowered arterial pressure in the initial period of acceleration effect. Further changes of the cardiovascular system include activation of a compensatory reaction whose level to a certain degree depends on afferent impulsation from the sinocarotid zones. Thus, the pathogenetic similarity of hemodynamic shifts under the action of transverse acceleration and inactivation of the lungs confirms the role of vascular reflexogenic zones in the regulatory mechanisms of these shifts. Orig. art. has: 2 figures and 1 table. [06]

29.

AUTHOR: Simonov, Ye. Ye.; Korzhen'yants, V. A.

ORG: none

TITLE: Evaluation of the tolerance of animals to impact accelerations from some enzyme tests of the blood

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 38-41

TOPIC TAGS: acceleration effect, transferase, aldolase, dehydrogenase

ABSTRACT: Results are reported of a comparative analysis of morphological changes and changes in blood enzyme activity following the effect of impact accelerations of landing, causing and not causing a known traumatic effect in white rats weighing from 200—300 g. Animals were placed on a special platform which was lowered at rates of from 2 to 14 m/sec to produce the accelerations, calculated according to the formula $n = V^2/2gS$ where n is the impact acceleration of landing, V is the rate of free fall, S is the course of inhibition, and g is the acceleration (9.81 m/sec). Group I animals were subjected to the effect of impact accelerations with a fall rate of 3 m/sec and acceleration of 410±50 G's. In group II animals, the fall rate was 10 m/sec and acceleration was 465±50 G's; in group III rats, the fall rate was also 10 m/sec, but accelerations were 760±50 G's. Group IV animals served as controls. Morphological examination of the internal organs and blood levels of alanine aminotransferase, aspartic aminotransferase, aldolase and lactate dehydrogenase were assayed 4, 24, and 72 hr after the effect of acceleration. Although a change in enzyme activity was noted after the nontraumatic action of acceleration, this was more pronounced when the effect of trauma was demonstrated by morphological changes. There was a 15—30% increase in enzyme activity in group I rats over control animals, a 20—40% increase in group II animals, and a 45—90% increase in group III animals. Enzyme changes after nontraumatic action of acceleration were weakly expressed, developed slowly, and disappeared rapidly (with the exception of aldolase, no enzyme activity was detected by the end of the 3rd day). When the traumatic effect of impact acceleration was demonstrated, there was a rapid change in enzyme activity (especially aspartic aminotransferase and aldolase) in the first hours after trauma, a tendency for the shifts to be more pronounced with time, and a prolonged period of increased activity. It is suggested that these criteria are important indications of the presence of trauma, and of the degree of its severity. A study of the dynamics of the enzymes are of value for the investigation of the safety of impact accelerations, and as biochemical criteria of tolerance to impact accelerations. Orig. art. has: 1 table and 1 formula. [WA-22] [XF]

30.

AUTHOR: Solodovnik, F. A.; Vorob'yev, L. M.; Khlebnikov, G. F.

ORG: none

TITLE: Mechanism of the stimulation of semicircular canals when rotating a man in two mutually perpendicular planes

SOURCE: AN SSSR. Izvestiya. Seriya biologicheskaya, no. 1, 1968, 78-88

TOPIC TAGS: man, Coriolis force, space flight biologic effect

ABSTRACT: The effect on man of simultaneous rotation in two mutually perpendicular planes is important in the development of astronautics. The present study examines conditions for stimulating the semicircular canals when man is rotated in two mutually perpendicular planes. Rotation was effected in a rotating arm chair (rotation rate 180°/sec) with the subject inclining and straightening his head. The simultaneous combination of these motions causes inertial shifts in the endolymph in the semicircular canals due to inertial Coriolis forces. The effect of rotation with simultaneous inclination of the head on the action of the semicircular canals is the same whether the head only or the head together with the torso incline to a given angle. Mechanics of semicircular canal motion and the origin of forces causing endolymph shift during rotation with simultaneous head inclination are examined in detail. The stimulation rate of the semicircular canals by Coriolis acceleration during rotation and head inclination depends on the rotation rate and the angular rate of head inclination. Nomograms are given for determining the values of Coriolis acceleration according to these rates. Head positioning is significant during spaceflights.. An astronaut should move his head translationally without rotating in a sagittal plane when performing labor functions in a rotating space-craft. Orig. art. has: 7 formulas and 5 figures. [06]

31.

AUTHOR: Vasil'yev, P. V.; Vasil'yeva, V. F.; Zaks, M. G.; Nadtochin, Yu. V.; Sokolova, M. M.

ORG: none

TITLE: Effect of transverse accelerations on kidney function

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 275-282

TOPIC TAGS: biologic acceleration effect, dog, kidney function, transverse acceleration

ABSTRACT: The effect of different accelerations on the functioning of dog kidneys was studied and some of the mechanisms resulting from these shifts were analyzed. The dogs were subjected to front-back transverse accelerations of 5 or 8 units for 3 min, or 12 units for 1 min, acceleration increase of 1 unit/sec. Determinations were made of the diuresis and filtration rates, of the sodium and potassium concentrations and removal, of creatinine concentration, of osmotic free water resorption. Under the test conditions the changes in kidney functioning were temporary, reaching maxima about an hour after the acceleration stress and almost disappearing in the next few hours. From analysis of the results it is believed that the changes (increase in sodium and potassium excretion, little osmotic diuresis) are not due to mechanical or other direct actions on the kidney, but to conditional neurohormonal effects, particularly to the action of the hypothalamo-hypophyseal system. It is therefore presumed that accelerations are not associated with significant changes in kidney function. Orig. art. has: 2 tables and 5 figures.

32.

AUTHOR: Altukhov, G. V.; Vasil'yev, P. V.; Belay, V. Ye.; Yegorov, A. D.

ORG: none

TITLE: Diurnal rhythm of sympathetic functions during spaceflight

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 201-205

TOPIC TAGS: biologic weightlessness effect, manned space flight, circadian cycle, heart rate

ABSTRACT: A study was made of the heart rate and systolic index of cosmonauts Nikolayev, Popovich, Bykovskiy, and Tereshkova during their group flight. It was considered that the heart rate represents the integral response of the organism to the effect of various factors in the external environment, and that the systolic index reflects the functional state of the myocardium. The recorded data were statistically processed and are presented in graphic form. Unfortunately, the effects of spaceflight on these cosmonauts did not produce any uniform changes in the indices under study, and no definite conclusion could be drawn regarding the effects of weightlessness or other spaceflight factors on cardiac function. It was found, however, that the average heart rate tended to be slightly lower during flight. The authors concluded that irregular changes in diurnal rhythms of sympathetic functions do occur during prolonged exposure to weightlessness, and that the mechanism of these changes, while complex, is related to the effects of weightlessness and of nervous and emotional tension. Orig. art. has: 1 table and 2 figures. [EL]

33.

AUTHOR: Balakhovskiy, I. S.; Vasil'yev, P. V.; Kas'yan, I. I.; Popov, I. G.

ORG: none

TITLE: Results of physiological-biochemical study of members of the crew of the spaceship "Voskhod"

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 225-233

TOPIC TAGS: manned spacecraft, spacecraft environment, spacecraft test, space flight biologic effect, flight physiology

ABSTRACT: The purpose of this study was to clarify certain indicators of the condition of the cardiovascular system and metabolism of the cosmonauts during flight. The total irradiation dose did not exceed 0.15 ber and thus could not harm the cosmonauts. Barometric pressure of the cabin air was 762--800 mm of Hg; the temperature ranged from 17 to 22°; the humidity, from 47 to 80%; oxygen content varied from 20 to 22.8%; and CO_2 was from 1.0 to 1.5%. The medical monitoring and physiological investigations can be divided into two groups: 1) radiotelemetric monitoring of the physiological functions of the organism; 2) clinico-physiological investigation by the physician-cosmonaut B. B. Yegorov. Medical monitoring included recordings were periodically made of electro cardiograms, pneumograms, and seismocardiograms for each cosmonaut. In addition, the physician on board observed the condition and conduct of each cosmonaut, especially reflex reactions and accuracy in the execution of certain elements of assigned flight tasks; measuring the maximal and minimal arterial pressure; and taking of blood samples for biochemical analysis. The caloric intake of each cosmonaut during the flight was 3600 kcal. This nutrient material contained 150 g of protein, 130 g fats 430 g of carbohydrates, and vitamins. No disruptions were observed in the cosmonauts health following the flight. However, a series of functional changes were noted in both the cardiovascular and respiratory systems, and also in various phases of metabolism, indicative of a reaction to stress and general fatigue which disappeared within 3--4 days post-flight. The individual characteristic reactions of the cosmonauts to the effects of space flight factors corresponded with the prognosis made on the basis of data collected during preflight training. Orig. art. has: 4 tables and 2 figures. [WA-22] [LS]

34.

AUTHOR: Borshchevskiy, I. Ya; Belyakov, G. M.; Gurovskiy, N. N.; Kuznetsov, V. S.

ORG: none

TITLE: An experiment on the study of the quality of speech reception and transmission under conditions of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 440-442

TOPIC TAGS: weightlessness, speech signal, speech transmission, aerospace communication

ABSTRACT: Four pilots participated in communication experiments during 30—40 sec of weightlessness in an aircraft. During 23 flights, 28 tests were conducted. On-board and ground ultrashortwave radio stations were employed in the experiment. There was simplex communication between the stations on a fixed wave (reception and transmission are conducted alternately). A magnetic recorder, registering the entire cycle of speech transmission and reception, was connected to the input of the ground station's receiver. Speech transmission quality was tested by using a standard phrase — "Skvoz' volnistyye tumany probirayetsya luna". [Abstractor's Note: This Russian sentence was used probably because of repeated consonant sounds.] Speech reception quality was evaluated by accuracy and intelligibility in repeating what had been transmitted from earth. A comparative analysis of speech transmission and reception in flight was made in accordance with the experimental data from tests conducted before, during, and after exposures to weightlessness. The results of this experiment permitted the following conclusions. Weightlessness does not have a significant effect on speech signals transmitted from the ground. In a state of weightlessness, the quality of the pilot's speech is somewhat different from that under usual flight conditions: the speech is rather forced and an increase in intensity of vowel sounds is noted. The frequency spectrum of the pilot's speech during weightlessness is comparable to the spectrum under usual flight conditions. In a frequency range of 100 — 500 or 1000 — 2000 hertz, the spectral components have a corresponding relative excess of 2 — 4 and 2 — 6 decibels. Changes in speech quality during weightlessness are not very substantial and do not exclude the principle possibility of maintaining good communication. Orig. art. has: 2 figures. [AC]

35.
AUTHOR: Cherepakhin, M. A.

ORG: none

TITLE: Maintaining a given static force under conditions of altered gravitation

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 169-175

TOPIC TAGS: gravitation, biologic weightlessness effect

ABSTRACT: An experiment was made in which 18 men, ages 18—43 yr, were required to maintain a given pressure (400 g) on a lever held in the hand during horizontal and parabolic flight. Most of the subjects had previous experience with parabolic flight, and there were several cosmonauts among them (Nikolayev, Bykovskiy, Komarov, Belyayev). During the tests they were exposed to gravitational loads of 2—2.5 G lasting for 10—12 sec, and to weightlessness lasting for 17—23 sec. They had no training in the performance of this test but were simply briefed beforehand on what would be expected of them. It was found that as long as the subjects had visual control over their performance (i.e., could see a meter showing the force applied to the lever), they could easily maintain the required pressure. When sight was excluded, however, there was a tendency for the force applied to be less than required during weightlessness, and greater during excess G-loads. During the tests, biopotentials were recorded from the muscles of the hand. Oscillation amplitude was least during horizontal flight, increased by 100—150% during weightlessness, and was unchanged or increased insignificantly during excess G. Electromyograms recorded from postural muscles in a flight involving three subjects showed a uniform tendency toward decreased bioelectrical activity of these muscles during weightlessness. It was found that generally, the force applied to the lever varied directly with increase or decrease in the subject's body weight, as effected by increased or decreased G-load. Cherepakhin's results contradict previous results of Yuganov et al. [Izv. AN SSSR, seriya biol., 1961, no. 6]. The discrepancies are explained on the basis of differences in training of the subjects and in the experimental methods. Orig. art. has: 2 figures and 1 table. [EL]

36.

AUTHOR: Gorshkov, A. I.

ORG: none

TITLE: Function of the otolith organ during short-term weightlessness

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 46-49

TOPIC TAGS: biologic weightlessness effect, vestibular apparatus, vestibular effect, otolith organ

ABSTRACT: On the basis of ideas presented by Ye. M. Yuganov in 1962, the author developed a method of direct otolithometry, and the necessary instrumentation. The author's test device consists of a chair on a base mounted on a movable truck. A cam drive allows movement of the device at a constant rate of acceleration. The back of the chair, which is fixed horizontally, may be elevated up to 20°. There is provision for secure fixation of the head, trunk, and feet of the subject. The chair may be rotated through 360° in the horizontal plane so that the direction of acceleration relative to the otolith organ may be varied. The motor allows accelerations of 0.01—100 G. There is a control panel from which the device is operated, and at which the physiological functions of the subject are displayed. Two series of experiments were made using this device. In the first, tests of 228 subjects with normal vestibular sensitivity established that under terrestrial conditions, the threshold of otolith sensitivity is 0.01—0.005 G. The second series was carried out during parabolic flights with weightlessness of 25—30 sec duration. The subjects lay in the chair on their backs, with eyes closed and blindfolded. The test device moved along the X- axis of the airplane. Threshold sensitivities were determined for each subject on the ground, then during weightlessness. In all cases (195 tests involving 51 subjects), the threshold increased during weightlessness. Further tests were made tc determine threshold sensitivity of the otolith organ to galvanic current on the ground and during weightlessness. A current of 0.5—6 mamp was used; duration was 3 sec. The minimum current required to evoke a sensation of motion was determined, and was taken as the threshold. In this study 248 tests were made on 22 subjects. Again, it was found that threshold values increased during weightlessness. It is concluded that weightlessness has such a strong stimulating effect on the otolith organ that much greater linear accelerations or galvanic currents than usual are required to elicit otolith effects. Orig. art. has: 2 tables. [EL]

37.

AUTHOR: Isakov, P. K.; Yuganov, Ye. M.; Kas'yan, I. I.

ORG: none

TITLE: Gravitational effects on the formation of organism functions

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 84-88

TOPIC TAGS: man, biologic weightlessness effect, biologic gravity effect, biologic acceleration effect, vestibular analyzer, respiratory physiology

ABSTRACT: The effects of acceleration and weightlessness in forming different levels of organic functions were investigated. Short-term tests under weightlessness (conducted by D. V. Afanas'yev) confirmed that the differential threshold of gravitational force perception is reduced. Accuracy of movements under weightlessness definitely depends on the subject's adaptation to weightlessness. V. V. Usachev showed that changing the weight of the hand by acceleration or weightlessness disturbs the joint function of the skin and motor analyzers. Analysis of data in the literature showed the action of acceleration and weightlessness to be different; one reason is the opposite direction of venous pressure changes in the right auricle. The author proposed that return venous flow to the heart is decreased due to reduced tonic stress of the skeletal muscles. M. I. Bryuzgin found that the pressure in the right ventricle under 3 G chest-back acceleration increased from the initial 10-15 mm level to 20-25 mm; under 6 G, it was 45 mm. G. I. Pavlov found a rapid drop back to 15-25 mm under conditions of weightlessness. Vestibular reaction indices also show the role of gravity in forming different levels of organic functions. Acceleration (of constant or increasing value) causes an active nystagmus reaction, and weightlessness disturbs vestibular nystagmus. The level of gas exchange increases with increasing acceleration--this is believed due largely to change in tone of musculature, although changes in cardiovascular, respiratory, and other systems may also have some effect. G. F. Makarov obtained data on the effect of partial or complete weightlessness (obtained by flights along a ballistic trajectory); oxygen absorption and carbon dioxide expiration levels increased (from 320 to 533, and 260 to 413 cm^3/min, respectively) during weightlessness, and returned to about the initial level after return to normal conditions. Successive experiments revealed progressive reduction in gas exchange level during weightlessness, compared to its initial effect. Study is needed to determine how rapidly a constant level of gas exchange processes can be reached under progressively longer alternate acceleration (of not more than 2 G) and weightlessness. Orig. art. has: 2 tables. [WA-22]

38.

AUTHOR: Ivanov, Ye. A.; Popov, V. A.; Khachatur'yants, L. S.

ORG: none

TITLE: The work performance of a cosmonaut in weightlessness and in supportless space

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 410-439

TOPIC TAGS: biologic weightlessness effect, space biologic experiment, human memory, engineering psychology, astronaut human engineering, man and machine system, visual physiology

ABSTRACT: To investigate man's work capacity in weightlessness during spaceflight and EVA, the following methods were used: psychophysiological analysis of some work operations; investigation of some dynamic characteristics of man included in a model control system with immediate and delayed feedback; evaluation of the particularities of analysis and of the quality of operative memory during work with contours of regular and casual lines; and a biomechanical analysis of the space orientation and motor activity of A. A. Leonov during EVA. Observation on board "Voskhod" and "Voskhod 2" showed that task performance required more time during the early stage of the spaceflight than on the ground or later during the flight. This can be explained by the effect of external inhibition caused by novelty of the situation, along with the effect of weightlessness. Apparently this would not occur if the cosmonauts could become used to weightlessness during training on orbital space stations. During actual spaceflight, the stereotype of the report language which had been used without errors during training, was observed only to 35% due to weightlessness and other spaceflight factors. Radio telegraph communication showed that the transmission of telegraphic signals was irregular in respect to the spaces between the elements composing one sign, and other details. However, a transmission which followed 6—7 hr later was less irregular. The performance of EVA by Leonov and of operations at the controls by Belyayev was satisfactory, but various psychophysiological irregularities were observed, which can be explained by the emotional and physiological stress caused by the unusual feeling of weightlessness. Preparations for EVA started a few minutes after the spacecraft entered the orbit. The cosmonauts' tension showed in the emotional overtones of their radio conversation. Leonov's pulse rate remained 87—90 per minute even when the air lock door was opened, but in the following 6 min it rose to 147—162; on the seismocardiogram the third tone appeared. After his return into the air lock chamber, his pulse rate dropped to 90 within the first

7 min and normalized 4 min later. Respiration and pulse rate continued to correlate perfectly. When Leonov reentered the air lock chamber, he had to turn around several times. He also made rotating movements with his head, and moved energetically in the chamber. This is an interesting illustration of tolerance to multiplane rotation in weightlessness. Leonov did not report any disagreeable feelings of a vestibular nature. Belyayev's highest pulse rate was observed 7 min before the opening of the air lock door, which coincided with the peak of his activities. After the opening of the air lock door, his pulse rate dropped in 5 min to 94 (which is equivalent to that during the ground training) and did not exceed 98 during Leonov's EVA. His respiratory cycle frequency did not correlate with the pulse rate. The highest frequency (32 cycles/min) was observed 10 min before the opening of the air lock door; it then dropped abruptly and did not change until the opening of the door, thus being equivalent to the ground performance (23 cycles/min). The orientation of the cosmonaut in open space was evaluated on the basis of the film taken by an on-board camera, and the radio conversation between the two cosmonauts. The characteristics of the movements during Leonov's moving away from and approach to the spacecraft, as well as their duration, did not differ from the values obtained during training on aircraft, but the mean value of the velocity of the movements was 20—30% lower than the training values. The qualitative evaluation of Leonov's performance in open space equaled 39.7% (ideal performance being 100%), as compared to 57—60% during the last training period on aircraft and 27—28% in the beginning of the training. This proves the importance of training on aircraft attaining weightlessness, and on stands simulating supportless space for the formation of habit of orientation and movement control in open space. The 90° turns were performed by Leonov very well and did not exceed 2 sec, thus emphasizing the habit formed during training to turn while holding the tether close to the mass center of the body. If this detail is not observed, the body can undergo spinning. This happened to Leonov probably because his hand holding the tether was removed from the mass center. The angle velocity of the body rotation around the longitudinal axis was several tens of angular deg/sec, and angular accelerations equaled hundreds of deg/sec in a second. Leonov maintained orientation in space by guiding himself on the two axes of the spacecraft. He mounted and dismounted a movie camera on the spacecraft, maintained radio communication, and made an interesting observation on the effect of his movements on the movement of the spacecraft. The stress caused by orientation and motor activity did not substantially interfere with his other activities. Since the cosmonauts' work has become too complex for direct evaluation, modeling of operator activity is required to disclose the structure of cosmonaut functions in a man-machine relationship under conditions of unaccustomed weightlessness. The growing complexity of modern automatic systems, with their ever more complex data presentation (involving light, sound and other signals) place new demands

on volume, lability and interference tolerance of human operative memory. Dynamics of operative memory were investigated on Voskhod 1 and 2 flights. Tests were conducted with series of cards presenting curves consisting of two equal contours. The errors in the analysis and in reproduction of the contours, and the time needed for the operation composed the quality criteria. After 5—6 training tests the quality of the performance became stable. However, in actual spaceflight the quality of the performance dropped considerably. The performance of B. B. Yegorov, which showed the greatest difference, became increasingly better after 10 hr of weightlessness, thus indicating an adaptation period. During the flight of "Voskhod 2" the effect of weightlessness on the dynamic motor characteristics of the operator was also studied. For the first time, a model control system was used on board to investigate the tracking performance of an operator exposed to spaceflight factors. The most important function of the operator as a link in the man-machine system is his transmissive function. During this test the method of visual indication and graphic recording of the output signals was used, thus permitting the study of the reactions of the operator with immediate and delayed feedback. Test results showed that the performance quality of both cosmonauts was inferior to their pre-start tests, that the spacewalk did not interfere with Leonov's performance, and that the effect of the spaceflight factors was noted especially in work with signals whose frequency exceeded 0.5 hertz. The latent period of motor reactions of Belyayev equaled 175—185 sigmas in the pre-launch period and 300—320 sigmas in spaceflight, while Leonov maintained 180—185 sigmas in training, in the pre-launch period, and during spaceflight. Undoubtedly, the sensory component of the reaction became slower, but was compensated by a more rapid motor component of the reaction due to the lack of gravitation. These experiments lead to the conclusion that human dynamic characteristics do not undergo any substantial changes due to the effect of one-day spaceflight. Human operator control of future spacecrafts intended for maneuvering, docking at space stations, and landing on other planets will be based on the perception of light signals, distinction of visual images, depth vision, visual memory, visual estimation and other capacities of the visual analyzer. During the flights of "Voskhod" and "Voskhod 2" the resolving power of the visual analyzer, the dynamics of the operative visual work capacity, and color discrimination were studied. Visual acuity was tested with the help of Sivtsev's tables (Landolt rings) and line charts. Control tests conducted on 51 persons showed that if a subject's vision was evaluated as 1.0 for each eye according to Sivtsev's tables, it equaled 1.0±0.03 for both eyes according to the line charts. During spaceflights, cosmonauts V. M. Komarov, P. I. Belyayev, A. A. Leonov, and B. B. Yegorov took 16 tests on the resolving power of the visual analyzer. A set of 25 line charts with varied

line density made possible a vision evaluation from 0.3 to 2.2 units. In order to eliminate a possible effect of astigmatism, each chart contained four groups of lines drawn in each group in another direction. The cosmonaut had to observe the charts from a distance of 300 mm, and had to choose those where he could distinguish the direction of lines in each group. In order to separate the effect of weightlessness from other spaceflight factors, these tests were made in an experiment where all spaceflight factors except weightlessness were simulated. The results were considerably inferior to those obtained in optimum laboratory conditions. Analysis of the actual spaceflight experiment proved that weightlessness of one-day duration does not effect the visual acuity. The level of the operative visual work capacity was also determined with the help of line charts. In this test in which the subject had to count the lines, the efficiency of his performance was determined by the type of chart, the number of errors, and the time used. Visual acuity was not involved since all the charts were above the visual acuity threshold. During spaceflight the reliability of the performance of Yegorov was 43% lower than in optimum conditions, while the reliability of other cosmonauts dropped only 19—26%. The accelerated cosmonaut training of Yegorov accounts for this difference. He also selected charts which exceeded his visual acuity threshold by 45%, while the selection of others was 15—25%. In weightlessness the eye mass and the moments of inertia remain unchanged while the coordination of the motor activity of the eye is disrupted. This leads to skipping the closely placed lines. Consequently, disruption of the operative visual work capacity is caused by the effect of weightlessness. The investigation of color perception was conducted with the help of six paper stripes (red, green, blue, light blue, purple, and yellow) and a sheet of black-white wedge-shaped steps of varying brightness. The subject had to compare the color stripes with the black-white wedges and select the one of corresponding brightness for each stripe. During the test on board "Voskhod 2", both cosmonauts showed a 25—26% reduction in brightness perception for purple, light blue, green, and red, while the reduction for blue and yellow did not exceed 10%. No color appeared brighter in weightlessness. The causes of this phenomenon are unclear and need further investigation. Orig. art. has: 18 figures, 2 tables, and 4 equations. [WA-22] [EF]

39.

AUTHOR: Kas'yan, I. I.; Kopanev, V. I.

ORG: none

TITLE: Some physiological mechanisms of the effect of weightlessness on human organism

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 77-83

TOPIC TAGS: biologic weightlessness effect, adaptation

ABSTRACT: A survey of literature shows that during weightlessness some deviations in the sensory, motor, and sympathetic components of the general reaction of the organism were observed, as well as individual varieties in the development of adaptive and compensatory reactions. No theory has yet been composed which would explain the effect of weightlessness on the organism. However, many scientists have investigated the mechanisms of the observed changes. Apparently, the disorders caused by weightlessness can be divided into direct and indirect effects. The direct effect comprises the complex of reactions caused by the disappearance of body weight, which produces shifts in signals originated in receptors sensible to mechanical effects. As a result, blood pressure decreases, blood accumulates in the veins (especially in the upper part of the body), the biomechanics of the external respiration changes (exhalation is produced by muscular effort), motor coordination is disturbed, the secretion of the glands of the digestive tract changes, the afferentation changes due to the decrease of the otolith weight, and conditions for sensory disorders are created. The indirect effect of weightlessness comprises the complex of physiological reactions arising from the functional changes of the central nervous system and analyzer interaction under the effect of unusual afferent impulsation from the mechanoreceptors of the vestibular, interoceptive, motor, and other analyzers. Experiments confirm the principle of the functional interdependence of the analyzers; for example, the vestibulo-sympathetic reactions increase at the stimulation of the proprioreceptors and the visual analyzer. Some experiments also showed an increase of inhibitory processes in the CNS, manifested by an increase of low frequency potentials, an unstable pulse rate, and an apparent disruption of cortical control over sympathetic functions. The tonus of the parasympathetic section of the CNS becomes dominating. The interrelations of the reticular substance and the cerebral cortex probably change under the effect of altered afferentation from the mechanoreceptors, which produces a reduction of the cortical tonus. During spaceflights the effects of weightlessness are combined with the effects of such factors as nervous and emotional

tension, noise, vibration, and others. Nervous and emotional tension, which intensifies the sympathetic influences, must be always taken into consideration during the analysis of obtained data. Adaptation to weightlessness is based on a new functional systematization and on the adjustment of the functions of the central nervous system to this condition. The sensory, motor, and sympathetic components become stabilized on an adequate level. Nevertheless, this adaptive functioning is very unstable, and can be disrupted by any unfavorable factor. This must be taken into consideration during the planning of work and rest schedules for prolonged spaceflights. [WA-22] [EF]

40.

AUTHOR: Kas'yan, I. I.; Kopanev, V. I.

ORG: none

TITLE: Physiological aspects of the problem of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v. nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 94-110

TOPIC TAGS: weightlessness, biologic weightlessness effect, man, physiology

ABSTRACT: This is a review of the Russian and American literature for 1964-65 relating to the effects of weightlessness on the human organism. The physiological aspects (e.g. pulse and respiration rates; cardiovascular, sensory, autonomic, vestibulo-autonomic reactions; and, gas exchange functions) of weightlessness are examined as described in published data obtained from orbital space flights and under laboratory conditions. Literature relating to possible physiological and biological mechanisms of the effect of weightlessness on man and concerning prospects of mastering space is also considered. The authors indicate further studies of the problems of weightlessness should be directed toward correlation of available material and formation of general theoretical assumptions about the effect of weightlessness, and toward a deepened understanding of the functional state of the organism, its biochemical shifts, and determination of changes at the cellular level. Orig. art. has: 2 figures and 3 tables. [WA-22]

41.

AUTHOR: Kas'yan, I. I.; Kopanev, V. I.; Yazdovskiy, V. I.

ORG: none

TITLE: Reactions of cosmonauts under conditions of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968. 52-64

TOPIC TAGS: weightlessness, man, biologic weightlessness effect, cardiovascular system/(U) Vostok manned spacecraft

ABSTRACT: A series of physiological reactions of cosmonauts to short-term (parabolic flights) and long-term (flight in Vostok-type craft) weightlessness are analyzed. During short-term weightlessness (3-6 periods of weightlessness of 35 ± 5 sec duration) the cosmonauts felt no change in their well-being and no spatial disorientation. Movement coordination depended on their position: there was no difficulty when the cosmonaut was strapped in a chair, but when in the free state, he could not write and there was significant reduction in maximum muscle strength due to reduction of tonic stress of the skeletal musculature. Physiological indices reflected individual characteristics of the cosmonauts' reactions. The definite functional changes brought about in the organism's systems (cardiovascular, respiratory) by short-term weightlessness tended to level off and return to their initial level. The long-term spaceflights were characterized, especially in the preflight period, by nervous emotional stress, not specific to cosmic flight. Transition from acceleration to weightlessness was marked by brief spatial illusion, but the cosmonauts were able to carry out planned observations and maintain radio contact. During orbital flight the cardiac contraction rate was reduced, sometimes down to the preflight level, but the pulse rate fluctuated widely. Data on respiration rate was not conclusive. EKG's showed the Q-T interval was longer in the middle and shorter at the start and end of the weightlessness conditions; similar but not as pronounced changes were noted in the P-Q interval. The amplitude of the T spike increased under weightlessness, while the amplitude of the R spike increased in two cases and was lower in one (reasons not clear). Under weightlessness conditions the systolic index decreased gradually, and there was significant fluctuation in this index and in the amplitudes of the T and R spikes and in the P-Q and Q-T intervals.

Changes were noted in the bioelectric activity of the cerebral cortex during flight--there was usually a tendency for high frequency vibrations to replace low-frequency (below 8 Hz) with subsequent reduction in the amplitude of the bioelectric rhythms. The increase in low-frequency potentials in the one case was explained as due to development of inhibiting processes which disturbed cortical control of autonomic functions and caused greater shifts in pulse frequency. The physiological reactions of the cosmonauts under conditions of weightlessness tended to adapt to the unusual conditions: the pronounced initial shifts tended to decrease. During 5 days under weightlessness there were no significant disturbances except in the functioning of the cardiovascular system. Comparison of the short- and long-term effects of weightlessness points out the individuality of the cosmonauts' reactions to weightlessness, and the need for preliminary parabolic training flights in the selection and training of cosmonauts. Orig. art. has: 11 tables and 4 figures. [WA-22]

42.

AUTHOR: Kas'yan, I. I.; Kopanev, V. I.; Yazdovskiy, V. I.

ORG: none

TITLE: Blood circulation under conditions of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 245-259

TOPIC TAGS: biologic weightlessness effect, weightlessness, blood circulation, blood pressure, space biologic experiment, biologic space flight

ABSTRACT: Experimental and literary data have been used to elucidate mechanisms involved in the effect of weightlessness on the blood circulation system. The test animals and humans were divided into three groups according to their physiological reactions: 1) considerable decrease in pulse frequency and blood pressure; 2) without noticeable change in the indices; and 3) with increased pulse frequency and blood pressure. G. I. Pavlov determined that at the onset of weightlessness the level of maximal and minimal arterial pressure decreased by 20—40 mm of Hg, while veinous pressure decreased by 15—25 mm of Hg. At the end of the weightless period, the arterial pressure returned to the original level, and the veinous pressure rose somewhat, but remained below the original level. In anesthetized animals there was

no change in pulse frequency and arterial pressure, thus confirming the role of extero- and interoceptive reflexes and the functional condition of the higher regions of the CNS in the formation of physiological reactions. During horizontal flight, increased pulse rate was noted in most of the subjects, which indicated neuroemotional stress. Weightlessness, at its onset, caused an increase in stress; however, with its continuance the stress decreased, causing a decrease in pulse rate and arterial pressure. The normalization rate in the functioning of the cardiovascular system depended on individual characteristics of the organism. A correlation was noted between the electrocardiogram and pulse frequency parameters. An increase in pulse rate was accompanied by a decrease in the intervals P-Q and Q-T, and vice versa. In cosmonauts during weightlessness the pulse frequency and blood pressure decreased sometimes below the level recorded on Earth. However, it was not possible to correlate the decrease of cardiovascular function with the length of the weightless period. This is due to the attempt of the organism to maintain normal function of the primary organs. It is considered that the delay in adaptation of the cardiovascular system depends on the continuance of formation of new functional systemization of the analyzers participating in the adjustment of the body in space, and also the hormonal deviations. Acceleration and weightlessness appear as strong biological stimulants. In this case, a large quantity of humoral material separates in the blood, thus having a considerable effect on a rapid return of certain indicators to their original levels. Orig. art. has: 6 figures and 10 tables.

[WA-22] [LS]

43.

AUTHOR: Kitayev-Smyk, L. A.

ORG: none

TITLE: Reactions of men during short-term weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 113-119

TOPIC TAGS: man, weightlessness, biologic weightlessness effect, autonomic nervous system, vestibular disturbance

ABSTRACT: Reactions of men to short term weightlessness attained in special aircraft flights were investigated. The reactions of 270 men, 120 of whom had previous flying experience, to 6-12 brief periods of weightlessness (26-30 sec each) per flight were tabulated. In some cases the periods of weightlessness were preceded and/or followed by accelerations of 2 for periods up to 18 sec. Of the men without previous flying experience, 75.7% suffered spatial illusions; in most cases the sensation of direction change lasted 7-30 sec, with the same illusion repeated under repeated tests, but there was little negative emotional

effect; 16% of the cases experienced a feeling of falling or tumbling, fear, disorientation, and even loss of perception for 3-5 sec, followed by elation and other positive emotional feelings; 8% experienced mixed illusions of falling for 5-10 sec and turning over and rising, resulting in negative emotional effects. In repeated periods of weightlessness, the spatial illusions in most cases became less pronounced and finally did not even appear. Vestibulo-autonomic reactions developed in the third-sixth period of weightlessness in many of the test subjects, especially in those experiencing illusions of tumbling or rising; there were no such reactions in those experiencing the sensation of falling, and none in those with no illusions; reactions in those experiencing mixed illusions were more intense and occurred in the second-third period of weightlessness. Thus there is a relationship between the type of optical illusion and the occurrence of autonomic disturbances. Tolerance is determined by emotional and vestibular reactions: very good tolerance is characterized by absence of psychic or autonomic reactions; satisfactory tolerance by slight reaction but almost no change in efficiency; poor tolerance by illusions of falling and/or psychic reactions and a drop in efficiency. In the latter two classes psychic reactions decreased after 1-3 terms of weightlessness and disappeared in 5-20; autonomic reactions decreased after 20-30 periods and disappeared in 40-50. Intolerance of weightlessness was characterized by vomiting, increased perspiration, salivation, reduction in pulse rate, shallow breathing, involuntary urination, fainting, adynamia, and progressive impairment of well-being; the subjects could not withstand more than two flights. 82% of the men with previous flight experience demonstrated excellent tolerance of weightlessness conditions (compared with 17% with no previous experience), only 1% demonstrated poor tolerance. There were isolated cases of illusions and mild nausea. Reactions of women were similar to those of men. The vestibulo-autonomic reactions under weightlessness are connected with conflict between the sensory systems involved in spatial analysis and with reduced vestibular stability under acceleration. Spatial images under weightlessness are formed as result of competing interaction of afferentation from gravireceptors and vision. Spatial illusions formed under short-term weightlessness are useful in predicting the nature of subsequent disturbances. Orig. art. has: 1 table and 2 figures. [WA-22]

44.

AUTHOR: Kitayev-Smyk, L. A.

ORG: none

TITLE: Oculographic illusion

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 175-180

TOPIC TAGS: oculography, illusion, biologic weightlessness effect, flight psychology

ABSTRACT: Three series of tests were conducted in the cabin of a plane flying in a parabolic trajectory; each period of weightlessness lasted 25-30 sec and was preceded and followed by acceleration (2 units, 15-18 sec). The test object used was a cross whose light could be switched on and off. Measurements were taken with an adaptometer. In the first series, the individual looked at a lighted cross throughout the experiment; in the second series this was shown only in horizontal flight and switched off 10 sec before the first acceleration, and the individual, fully in the dark, had to report the after-image; in the third series, the cross scintillated in horizontal flight 10 sec before the first acceleration. Occasionally, the light was switched on again under weightlessness (10th second) or at the first acceleration (7th second). Four individuals participated in the tests. Two experienced no reaction in weightlessness, the other two had psychic reactions. Results were rather similar in all individuals. The cross shifted downward in weightlessness and upward in overload. The after-image assumed a shift in the opposite direction. When the cross was lighted during weightlessness, it was located below the after-image. One individual noted that, upon transition from overload to weightlessness, the cross, viewed throughout the experiment, seemed to move first upwards then downwards. It was concluded that oculographic (cis- and transgraphic) illusions in weightlessness are due to reversed afference, and they signal changes in the optic motor apparatus that compensate for the tonic effect on its gravireceptors. Weightlessness may cause an optic motor reaction (downward shift) inverse to that of gravireceptors. People with psychic reactions experience more pronounced illusions (impression of falling). Orig. art. has: 1 figure.

45.

AUTHOR: Korzhuyev, P. A.

ORG: Institute of Evolutionary Animal Morphology and Ecology, AN SSSR, Moscow (Institut evolyutsionnoy morfologii i ekologii zhivotnykh AN SSSR)

TITLE: Bone marrow, gravitation, and weightlessness

SOURCE: Zhurnal obshchey biologii, v. 29, no. 5, 1968, 587-593

TOPIC TAGS: bone marrow, biologic gravity effect, biologic weightless effect

ABSTRACT: Marine animals such as whales and seals which, in the course of evolution left the sea and then returned to it secondarily, have lighter skeletons and less bone marrow (based on percentage of body weight) than do terrestrial animals. Hemoglobin synthesis in marine mammals is concentrated in the striated muscles rather than in the bone marrow; in dolphins hemoglobin concentration in the muscles attains a value of 3600 mg/100 ml, and in seals, 7000 mg/100 ml, while for terrestrial mammals this value does not exceed 1000 mg/100 ml. It is suggested that these differences result from adaptational changes caused by the decreased effect of gravitation in the water. These facts are of particular interest in relation to the manned spaceflight program as they indicate that prolonged exposure to lowered gravitational fields has a great influence on morphology and erythropoiesis. Orig. art. has: 2 tables. [WA-22] [EL]

46.

AUTHOR: Korzhuyev, P. A.

ORG: none

TITLE: Physiological and biochemical aspects of the problem of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 89-93

TOPIC TAGS: biologic weightlessness effect, biologic gravity effect, hematopoiesis, bone marrow, skeleton

ABSTRACT: The problem of weightlessness is difficult to study, because no experiments with prolonged weightlessness can be arranged. It is obvious though, that the exclusion of gravitation, to which all living organisms are adjusted, must affect the well-being of these organisms. The disclosure of the ways in which gravitation affects organisms would give a clue to the effects of its absence.

Fortunately, nature twice created conditions of drastic gravitational change: when the vertebrates left the sea to inhabit dry land, and when some vertebrates returned to the sea (marine mammals). The effects of gravitational change have been disclosed by means of studies in the comparative physiology and biochemistry of various groups of vertebrates. The skeleton and the muscles are the structures which have to withstand gravitational forces. Many biologists still regard the bone marrow as the hematopoietic structure which is only located in the bones and is not related to them. Studies prove, however, that an increase of skeletal weight in land vertebrates was basically determined by the bone marrow which first appeared in tailed amphibians. Active and fast-moving animals who need a better oxygen supply have more blood and more hematopoietic substance. For example, the bone marrow of the reindeer comprises 7% of its body weight and 13% of a newborn reindeer, while the bone marrow of a guinea pig, a sedentary animal, does not exceed 1% of its weight. In fish, hemoglobin is synthesized in the spleen, kidneys, and sometimes in the intestinal walls. These structures weigh hundredths or tenths of a percent of the body weight. This shows that the increase of the relative weight of the skeleton is a form of adaptation to increased gravitation which stimulates the hematopoietic function. Thus, if the potency of the hematopoietic structures is determined by the gravitational forces, the absence of these forces must inhibit the activity of the bone marrow. In spaceflights the bone marrow, no longer stimulated by gravitational forces, must become less active, and then undergo degeneration. In relatively short spaceflights, an intensified excretion of calcium was observed; in long flights, serious changes in the skeleton and in the bone marrow should be expected. If this relationship between gravitation and the skeleton and bone marrow development is true, the marine mammals who live in hypogravitational conditions should have a reduced hematopoietic structure. Literature indicates that the skeletons of marine mammals comprise 25—30% of their body weight, which could be explained by the increased need for hemoglobin during prolonged divings. Since whales are difficult to study, attention was focused on smaller representatives of the Cetacea order. The skeletons of the Black Sea dolphins, which dive for 4—10 min, comprised from 4.6 to 7% of their body weight, while the bone marrow weighed about 2%. A study of Caspian seals showed a result of 5% for the skeleton and 2% for the bone marrow. A comparative study in land animals shows that their skeletal weight oscillates between 9 and 18% of their body weight. These results prove that gravitation has a significant effect on the organism and produces changes in vital structures. [EF]

47.

AUTHOR: Mantsvetova, A. I.; Neumyvakin, I. P.; Orlova, V. F.; Trubnikova, V. A.; Freydberg, I. M.

ORG: none

TITLE: Study of the coordination of motion during writing under space flight conditions

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina". 1968, 384-397

TOPIC TAGS: space environment, space environment condition, space physiology, space test, spacecraft environment, space research

ABSTRACT: Entries from the ship's log were used in the analysis and evaluation of motor coordination. In the study of these written entries, particular attention was paid to the characteristics of motor habits appearing as one of the following groups of handwriting indices: a) the index of general handwriting characteristics (the perfection of the handwriting, including coordination and tempo of motion the construction of the handwriting by degree of difficulty etc.); b) topographic indices (characteristics of word distribution, sentence structure of the text as a whole); c) general handwriting index (height, slant, spacing, connection); d) personal handwriting index (form, direction, spread, and the amount of motion during the forming of separate letters). On the basis of these indices as applied both to notes written under normal conditions and to notes logged during space-flight handwriting characteristics were established for each cosmonaut. The coordination of motion during writing was characterized according to the degree of deviation from the norm under natural conditions. Five categories were developed for the classification of writing coordination during the flight. These categories varied according to the degree of deviation from the writing under normal conditions. In the comparison of the writing during the flight with the writing on Earth under normal conditions, it was noted that motor coordination in writing during the flight decreased. This decrease was greatest at the beginning of the flight, but as the flight progressed, there was an improvement in coordination of motion in all of the cosmonauts. However, the degree of improvement varied with each cosmonaut. Changes in writing, which could indicate a functional disruption of the central nervous system, were not observed. A comparison of the writing indicated that coordination of motion while writing depended on the duration of the flight. The data also indicate that the basis for the deviations in writing was not a disruption of the function of the central nervous system, but was due to the unusual conditions for writing. Orig. art. has: 7 figures. [WA 22] [LS]

48.

AUTHOR: Nefedov, Yu. G.; Gurovskiy, N. N.; Yegorov, A. D.; Yegorov, B. B.; Kiselev, A. A.; Nikolayev, S. O.; Polyakova, A. P

ORG: none

TITLE: Quantitative evaluation of the cardiovascular system of animals during extended orbital flight

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 14-22

TOPIC TAGS: space flight, biosatellite, space flight biologic effect, biologic weightlessness effect, cardiovascular physiology, spacecraft/ Kosmos-110

ABSTRACT: The primary problem studied on the Kosmos-110 biosatellite was the effect of extended (22 day) weightlessness on the regulation of the cardiovascular system of two dogs. In-flight functioning of the circulatory mechanism was monitored simultaneously by EKG, sphygmocardiography, and seismocardiography. Two bilateral EKG electrodes were implanted in the fifth intercostal area on the level of the axilla, while the third electrode was placed subcutaneously on the dorsal median line 5—10 cm from the base of the tail. The seismocardiographic sensor was located near the cardiac apex, while the sphygmograph sensor-cuff was placed on a loop of the left carotid artery externalized in a fold of skin. A pneumographic sensor registered respiratory changes in thorax perimeter. Variance analysis (R. A. Fisher method)

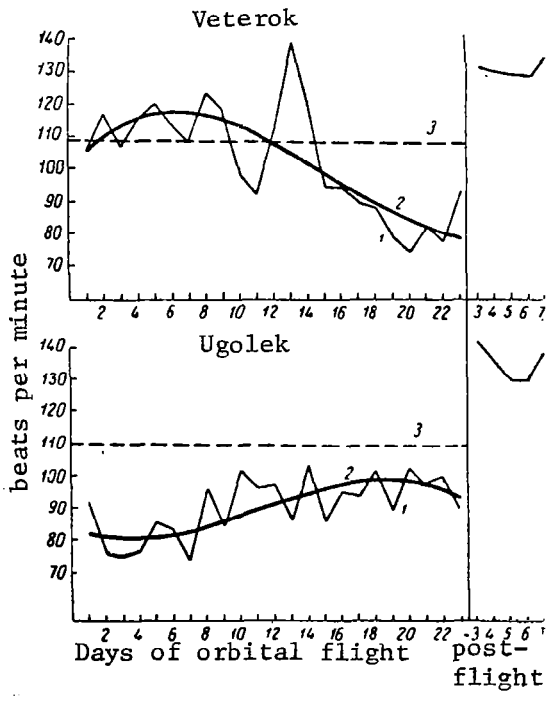


Fig. 1. Heart rate dynamics

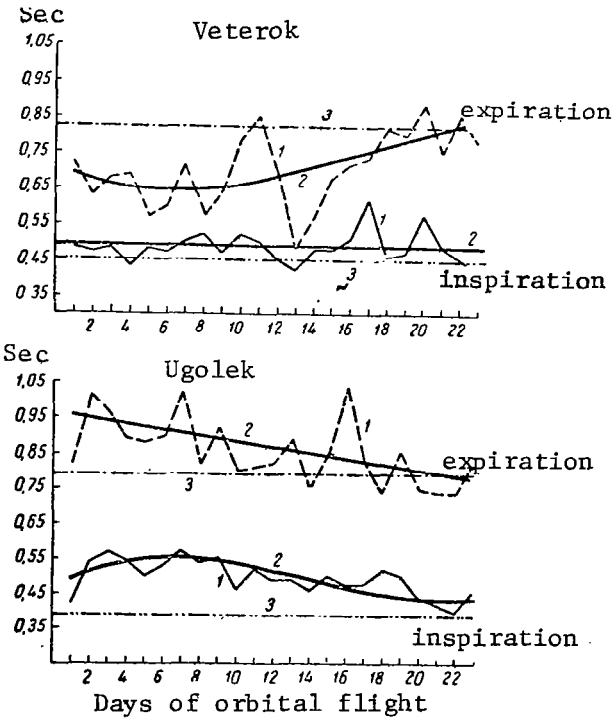


Fig. 2. Dynamics of cardiac cycle duration

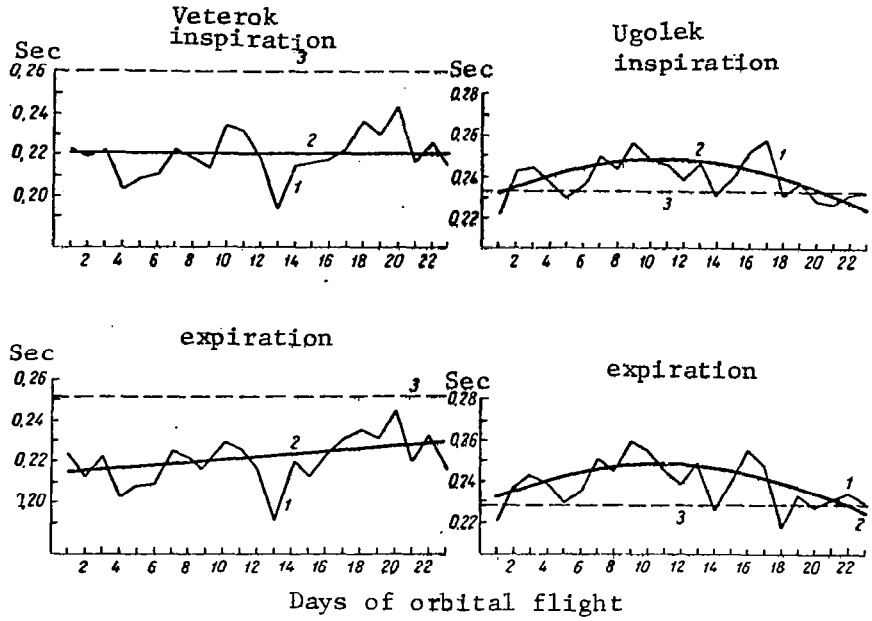


Fig. 3. Dynamics of electromechanical systole duration

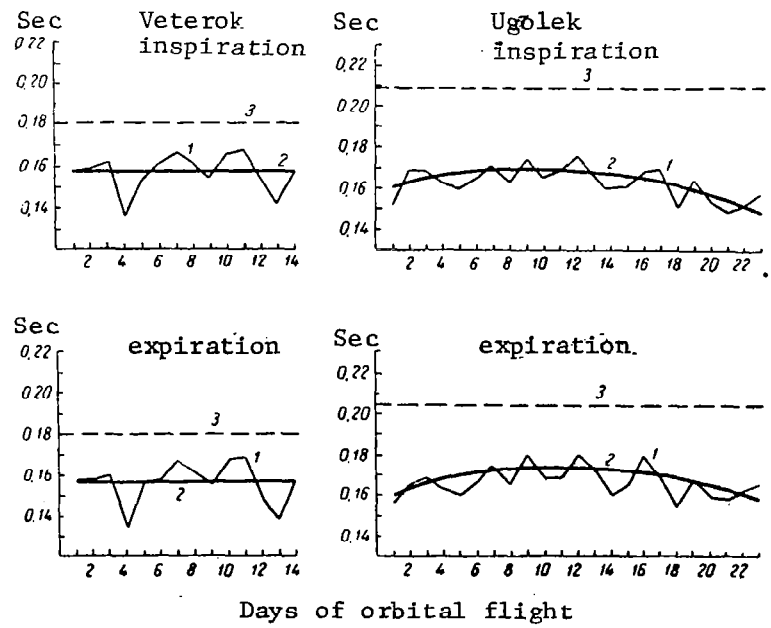


Fig. 4. Dynamics of expulsion duration

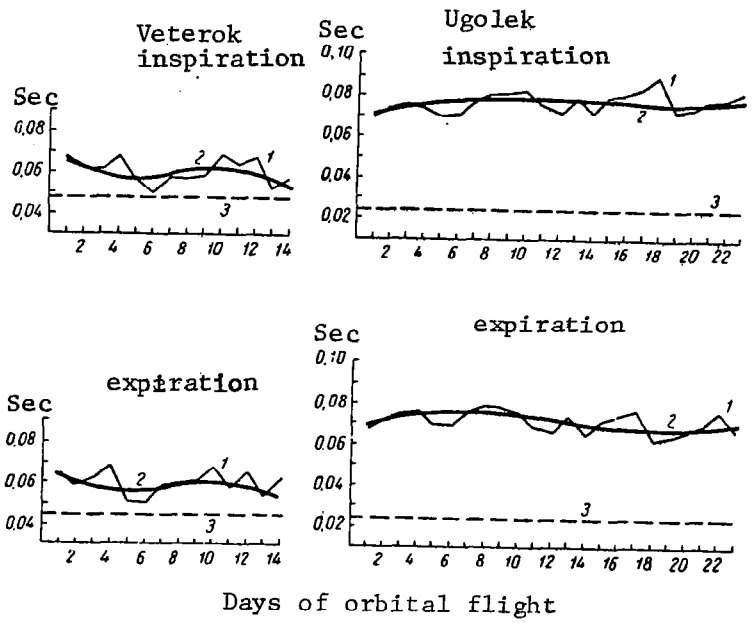


Fig. 5. Dynamics of contraction period duration

of respiration, heart rate, and the cardiac cycle phase-structure indicated that each of two factors, flight duration and diurnal rhythm, had a statistically significant correlation with individual differences of the animals and with respiration. The actual data obtained during orbital flight are shown in Figures 1 through 5. In each of the five figures no. 1 refers to experimental data; no. 2, to average tendency; and no. 3, to average pre-flight levels. It should be noted that individual differences in the physiological reactions of the two dogs were more marked during the period of weightlessness than during the powered phase of the flight. However, the pulse rate in both animals was stabilized at a lower average level during the weightless period than their pre-flight level. This may be due to a shift in the balance of the sympathetic-parasympathetic influences. The relative predominance of the vagus nerve is indicated by a drop in the heart rate from 124, 20 sec before feeding; to 108, 10 sec after beginning of the artificial feeding through the fistula. During weightlessness, systole duration was established at a lower level and diastole duration at a higher one, indicating a more economic functioning of the heart. It is concluded that human cosmonauts should be able to withstand a 22 day space flight without serious cardiovascular disruptions. Orig. art. has: 2 tables and 5 figures. [BM]

49.

AUTHOR: Parin, V. V.; Gazenko, O. G.; Yazdovskiy, V. I.

ORG: none

TITLE: Capacity for protective adaptation and adaptation limits under conditions of maximum accelerations and weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 29-33

TOPIC TAGS: weightlessness, biologic weightlessness effect, adaptation, transverse acceleration, biopotential, nervous system, autonomic system, electroencephalography, biologic acceleration effect, man, rabbit, dog

ABSTRACT: Organic reaction and adaptation to simulated acceleration and weightlessness is discussed and compared with data obtained during orbital flight. Earlier work had shown that man's endurance to head-foot acceleration was greater than in any other orientation, but that disturbances in respiration, hemodynamics, and nerve control occurred. Studies were made on animals to determine permissible acceleration values: under 3-, 6-, and 9-unit transverse acceleration, the pulse pressure in the right ventricle was unchanged or increased 16%, or 62%, respectively; the degree of blood oxygenation was proportional to the rate of blood flow. Thus despite reduced lung aeration, active reorganization of blood circulation in the pulmonary circulation can, within known limits, insure the necessary blood-oxygen level. In studies to determine if the critical phase could be predicted electroencephalographically, definite phasing in the change of cortical activity was found. In rabbits subjected to 2-14-unit accelerations, the first phase at the start of centrifuging was characterized by reduction in the biopotential and in the number of slow waves, and by an increase in respiration and in cardiac contractions. In the second phase (initial animal decompensation), the biopotential synchronized; above 6-unit acceleration, respiratory and cardiac contraction rates decreased (extrasystole and arrhythmia observed in 30% of the cases). The curve showing the dependence of the time at which the second phase occurs on the amount of acceleration has the shape of a rectangular hyperbola similar to electroencephalograms for hypoxia or ionizing radiation conditions. Work was done to explain the

mechanism of acceleration effect on the CNS aminazine, 10 mg/kg, removed reactions to acceleration reflected in bioelectric activity and the respiratory and cardiovascular systems. Data obtained during the Gagarin and Titov flights were compared with laboratory results. The subjective impressions of both men were similar. Pulse, respiration, and other objective indices of physiological functions showed greater changes than during simulated centrifuge testing. True simulation of prolonged weightlessness is practically impossible, and weightlessness in orbit has the additional factors of emotional stress and radiation background. Data obtained from animals in flight showed that under weightlessness there was at first a marked increase in the levels of the basic physiological indices; during the first 2 hr there were changes in heart tone intensity, prolonged length of the first tone, and increased time for blood ejection from the heart to the vessels. These changes disappeared, but after 8-10 hr other changes appeared: 23-26% decrease in systolic indices, and increases in pulse, respiration, and arterial pressure. No changes were observed at the end of a day in orbit. Thus the functional changes did not cause significant disturbances in blood circulation. Data from dogs in flight revealed instability of cardiac contraction rhythm and irregularity in depth and frequency of breathing. Analogous but less pronounced fluctuation in rhythm was observed in Gagarin's electrocardiogram. There was definite instability and lability of the central apparatus regulating autonomic functions; there was no disturbance of the sensory and motor spheres, although subjective disturbances were noted by Titov after prolonged weightlessness. During space flight there is reduction and maybe even change in the usual afferentation of the otolithic and skin receptors; afferentation from the vestibular apparatus may predominate, leading to irritation and possibly to motion sickness. Experimental confirmation is needed for this and to determine the compensational capacity of the nervous system. [WA-22]

50.

AUTHOR: Venttsel', M. D.; Voskresenskiy, A. D.; Chekhonadskiy, N. A.

ORG: none

TITLE: Application of correlational analysis methods in research on human cardiac activity during spaceflight

SOURCE: Simpozium po probleme: "Primeneniye matematicheskikh metodov dlya analiza ritma serdechnykh sokrashcheniy", Moscow, 1966. Matematicheskiye metody analiza serdechnykh ritma (Mathematical methods of analyzing heart rhythm). Moscow, Izd-vo "Nauka", 1968, 69-79

TOPIC TAGS: cardiology, correlation function, space flight biologic effect, space physiology, EKG, EKG analysis

ABSTRACT: This study of the regulation of cardiac rhythm involved correlational analysis of R-R intervals in EKG's recorded from cosmonauts Komarov, Feoktistov, and Yegorov during the Voskhod-1 flight. A recording consisting of 150—300 heart cycles was found to be best for analysis. It is noted that methods involving repeated correlation must be developed in order to demonstrate slow waves more clearly. Recordings were made during the month before flight, during count-down, and during flight. The similarity observed in some correlation functions on the ground and in flight may reflect extremely stable individual characteristics of regulation of the cardiac rhythm. With some methodological limitations taken into account, however, some characteristic changes in the autocorrelation of R-R intervals were found which may be related to the effects of spaceflight factors. For example, the period of slow waves tended to increase, as occasionally did their amplitude. The data upon which to base explanations of these phenomena are very limited and the nature of slow waves in the cardiac rhythm is incompletely understood. Aperiodic rhythms may be caused by cortical influences, such as the orientational reflex, and Bayevskiy has proposed that respiratory variations originate in the function of the autoregulatory system of the sinus node, while nonrespiratory variations are related to central regulatory systems. According to D. Zhemaytite, respiratory and nonrespiratory arrhythmias are dependent to different degrees upon pulse rate, age, and physical fitness. The relationship of these two arrhythmias to each other also depends upon age and fitness. The correlation coefficient characterizing this relationship had a small negative value for a group of athletes and a positive value for individuals with cardiac ischemia. Slow waves were found to be pronounced in atropinized subjects, which led to the conclusion that slow waves are the result of fluctuating changes in the activity level of the central part of the sympathetic nervous system. This is in accord with previous studies by Voskresenskiy and Ventsel' which showed that the most stable slow waves are observed during the emotionally stressful count-down period. The origin of the high-amplitude slow waves, noted particularly in the case of Yegorov, is still unclear, and man's reaction to weightlessness appears to be of a rather individual nature. Further experimental and flight data are clearly needed to explain the mechanism of regulation of cardiac rhythm during exposure to altered environmental factors. Orig. art. has: 3 figures. [EL]

51.

AUTHOR: Volynkin, Yu. M.; Akulinichev, I. T.; Vasil'yev, P. V.; Voskresenskiy, A. D.; Kas'yan, I. I.; Maksimov, D. G.

ORG: none

TITLE: Some data on the condition of cosmonauts during flight of the first space expedition on the spacecraft "Voskhod"

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo Meditsina", 1968, 65-76

TOPIC TAGS: man, biologic weightlessness effect, cosmic medicine, cardiovascular system, central nervous system, autonomic nervous system/(U) Voskhod 1 spacecraft

ABSTRACT: Medical-physiological data were obtained on the 3-man crew of the first Voskhod spacecraft to study the functional state of the analyzers under weightlessness the cardiovascular and respiratory and central nervous systems, and to evaluate the efficiency of the crew members and their programmed work and rest conditions. Physiological functions were monitored radiotelemetrically: data on pulse and respiration rate of all three crew members were transmitted on one channel through the "Signal" system by short wave; electrocardiographic, pneumographic, seismocardiographic, and electroencephalographic data were also transmitted. On board the craft cosmonaut-doctor B. B. Yegorov conducted clinico-physiological examinations, kept a journal of the condition and behavior of the crew during flight (describing their tactile, pain, and tendon reflexes, maximum and minimum arterial pressure, visual acuity, and vestibular sensitivity thresholds to adequate and inadequate stimuli), conducted psychophysiological tests, and obtained blood samples. The microclimate in the craft was essentially comfortable; radiation dose during flight was not excessive (0.15 rem). The data from each of these tests on each of the crew members are tabulated and discussed in this article. The overall condition of the cosmonauts was good over the entire period; efficiency was high; reaction to external stimuli was adequate; body temperature, arterial pressure, pulse, and respiration rate were within normal limits; the nervous emotional state was raised, especially immediately before flight and descent. There were no illusions during transition from acceleration to weightlessness; the latter became apparent not by subjective feeling but upon observation of floating objects. During

weightlessness physical effort was accompanied by greater stress and increased perspiration. After 2-3 hr in flight there was some perception of illusion, but not sufficient to impair completion of planned tests; the brief dizziness was not accompanied by nystagmoid reactions. Indications of vestibulo-autonomic disturbances in one of the cosmonauts reached a maximum at about 7 hr of flight. Analysis of electrooculogram data revealed some asymmetry in oculomotor reaction in one case; decisive data were not obtained for the other two. Analysis of the electroencephalograms showed intensification of the cerebral cortex inhibiting processes. Analysis of dynamograms and writing tests indicated disturbance of coordination-motor habits developed under terrestrial conditions and more rapid tiring. There was some reduction in visual acuity but no change in light-sensitivity threshold; in two of the cosmonauts the fusion reserves of the eye muscles increased. These functional shifts in the visual analyzers are attributed to the limited spatial environment. In the electrocardiogram the values of the P-Q and QRS intervals varied little; the Q-T interval at the start and end of flight was 0.34-0.37 sec, and 0.37-0.44 sec during the middle of the flight; analysis of the changes in the R-R interval, which did not exceed norms, indicate that the fluctuations reflect adaptation of the human statokinetic analyzer to weightlessness.

Amplitudes of the EKG P and R spikes were somewhat lower during flight than before; the T spike tended to increase. Systolic pressure was reduced during the first hours of weightlessness, and then increased; diastolic pressure also dropped at first, then recovered or even surpassed the initial level. Results of the expedition indicate the pronounced individual reaction of cosmonauts to flight factors. The possible specific effect of weightlessness on the statokinetic analyzer and its interaction with other analyzers (leading to development of illusions about spatial position and development of vestibulo-autonomic reactions, and lowering the efficiency of the cosmonauts) was confirmed. Reactions of the various systems (central nervous system, cardiovascular and respiratory systems, statokinetic, visual, and other analyzers) were, for the most part, adaptive in nature. The deviations in the physiological functions were not of a pathological nature, and complete recovery of initial levels occurred in 3-14 days. Orig. art. has: 4 tables and 3 figures. [WA-22]

52.

AUTHOR: Voskresenskiy, A. D.; Kas'yan, I. I.; Maksimov, D. G.

ORG: none

TITLE: Changes in cardiac activity and respiration of cosmonauts during light physical exertion during an orbital flight on the spaceship "Voskhod"

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 206-213

TOPIC TAGS: orbit space flight, space flight biologic effect, space flight fatigue, space biologic experiment

ABSTRACT: A dynamometer was used in a series of tests conducted on the cosmonauts of the spaceship "Voskhod" during an orbital flight. V. M. Komarov worked with the dynamometer for 62 sec; K. P. Feoktistov, for 70 sec; and B. B. Yegorov, for about 43 sec. The intensity of work with the dynamometer during the flight differed from the intensity of the tests conducted on earth. Electrocardiograms, seismocardiograms, and pneumograms were recorded during the period of work with the dynamometer, and one minute periods prior to and following the tests. R-R, Q-T intervals and the amplitude of peak T- of the EKG; were measured. An increase in pulse frequency and respiration was observed in the cosmonauts while performing light work with the dynamometer during the orbital flight. These reactions may be the result of the preliminary effect of the nervous system at the initial moment of stress and the following adaptation of blood circulation and respiration to the increased need for oxygen. In cosmonauts V. M. Komarov and K. P. Feoktistov during work there was noted a decrease in deviation of the R-R interval and in the length of the respiratory cycle was noted, which may indicate a normalization effect of light stress on the regulation of cardiac activity and respiration under conditions of weightlessness. In B. B. Yegorov the deviation of the R-R interval increased during work, and according to the pneumogram a period of tachypnea was observed with a decrease of the respiratory cycle to two seconds. Analysis of the dynamogram indicated rapid fatigue. The peculiarities of the reactions of B. B. Yegorov may be related to discomfort following a spacial disorientation illusion. However, the direct effect of weightlessness on the function of external respiration cannot be excluded. Orig. art. has: 4 graphs. [WA-22] [LS]

53.

AUTHOR: Yazdovskiy, V. I.; Kas'yan, I. I.; Kopanev, V. I.

ORG: none

TITLE: Basic problems in the study of weightlessness

SOURCE: Mediko-bilogicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 34-51

TOPIC TAGS: space physiology, biologic weightlessness effect, manned space flight, biologic space flight

ABSTRACT: This review article summarizes a great deal of Soviet and Western research on the effects of complete or partial weightlessness produced under laboratory conditions, and during parabolic flights, ballistic rocket flights, and orbital space flights, on biological objects, especially man. Tables are given showing all Soviet and Western biological and manned space flights, followed by a discussion of the sensory, motor, and sympathetic changes evoked during weightlessness. It appears that there is great individual variation in sensory manifestations; reactions to weightlessness range from exhilaration to nausea. Sensory reactions to weightlessness are caused mainly by altered afferentation from the receptor zones of a variety of analyzers—proprioceptive, vestibular, cutaneous, etc. The vestibular apparatus, and particularly the otolith organ, have the most influential role of all the analyzers in the development of sensory reactions. It has been shown that, although animals require considerable time to elaborate a new set of motor reflexes appropriate to weightless conditions, man adapts quite readily to space flight conditions, at least to the extent of maintaining satisfactory operator efficiency. There is considerable variety of opinion on the motor component of the general reaction of the organism to weightlessness; some researchers have found that motor coordination is practically unaffected by weightlessness, while others maintain that it is considerably disrupted. Motor acts are performed more easily when the subject is in a fixed position than when he is floating freely. Both muscle tone and muscle bioelectrical activity have been observed to decrease during weightlessness. Limited volume of manned spacecraft cabins must be considered in evaluating motor activity during space flight. Small cabin size has made it easier for cosmonauts to orient themselves. Also, most of the motor tasks required of cosmonauts have been relatively simple. Functions controlled by the sympathetic nervous system have been closely studied during space flights; usually recordings have been made of EKG, phonocardiogram, seismocardiogram, kinetocardiogram, arterial pressure, pulse rate, respiration, etc. Despite close scrutiny, however, it has not been possible to reach definite conclusions on the effects of weightlessness and other space flight factors on sympathetic nervous system function, owing to the small number of subjects exposed so far to space flight. A fair uniformity in the directionality of changes, if not in their magnitude, has, however, been observed in the cosmonauts. Histomorphological changes have been observed in animals subjected to space flight; most authorities consider, however, that they must be attributed to the entire complex of space flight

factors, and not to weightlessness alone. The final section of this article deals with the capacity of the organism to adapt to, and compensate for, weightlessness. Again, there is considerable variety of opinion among the authorities, although there is agreement that means must be found to minimize or eliminate the untoward effects of weightlessness. Improved design of spacecraft appears to be the most promising possibility for solution of this problem; especial emphasis is given to the creation of artificial gravitation on spacecraft. It is concluded that it will be impossible to speak of conquering outer space until space physiology and the other disciplines involved in manned space flight have developed to the extent that it will be possible for a much broader spectrum of people to participate in space flight than is presently possible. Orig. art. has: 4 figures and 3 tables. [WA-22] [EL]

54.

AUTHOR: Yuganov, Ye. M.; Aleshin, V. V.

ORG: none

TITLE: Efferentation of the vagus nerve in intact and labyrinthectomized animals during weightlessness

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk, Problemy kosmicheskoy biologii, v. 6, 1967, 172-176

TOPIC TAGS: biologic weightlessness effect, vestibular analyzer, vagus nerve

ABSTRACT: In 1961-1962 the authors studied the bioelectrical activity of the cervical division of the vagus nerve in intact and labyrinthectomized animals (rabbits) during short-term weightlessness in parabolic flights to determine the basis of vestibulosympathetic reactions and possible methods of their prevention. In all, 36 experiments were conducted, using equipment specially developed for in-flight use. During horizontal flight and during acceleration, electrical activity of the vagus nerve remained virtually unchanged in intact animals, while it decreased sharply during weightlessness. It also turned out that the effect of exposures to weightlessness (during one flight) was cumulative and was the basis for the development of motion sickness. Control experiments were conducted using labyrinthectomized animals; these animals showed no significant change in nerve bioelectrical activity during weightlessness. Evidently, stimulation of the vestibular analyzer causes the decrease in electrical activity of the vagus nerve accompanying the alteration in function of the complex of analyzer systems during weightlessness. The data obtained indicate characteristics of the function of the vestibular analyzer during weightlessness and possible intermediate mechanisms in the development of vestibulosympathetic disorders. These findings may be of use in the study of motion sickness occurring under spaceflight conditions. Orig. art. has: 2 figures. [EL]

55.

AUTHOR: Yuganov, Ye. M.; Isakov, P. K.; Kas'yan, I. I.; Afanas'yev, D. V.; Pavlov, G. I.

ORG: none

TITLE: The vestibular analyzer and the effect of artificial gravitation on animals

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 289-297

TOPIC TAGS: biologic weightlessness effect, artificial gravity, vestibular analyzer

ABSTRACT: Mice and rats were subjected to artificial gravitation (obtained by centrifugation) during parabolic flights to determine the minimum fractional G-load necessary to allow essentially normal motor function. The experimental animals were either intact or delabyrinthectomized; the delabyrinthectomized animals were in either the acute (following temporary inactivation of the labyrinth by injection of monoiodoacetic acid or chloroform) or chronic stage. The animals' behavior during differing G-loads (varying step-wise from 0.05 to 1.0 G) was distinctive and recognizable. Also, reaction to a given G-load did not vary according to the magnitude of the preceding loads. It was found that for intact animals, a G-load of 0.28—0.30 G represented a threshold at which the animals' motor performance was quite normal; normalization increased further as the G-value approached 1.0. In delabyrinthectomized animals in the acute stage a coarse compensatory reaction was observed at values of 0.3—1.0 G, in which the animals "froze" in position. This was attributed to the effect of medication. In chronically delabyrinthectomized animals, however, motor activity was adequately normalized at only 0.1 G. It is concluded that the vestibular analyzer does not facilitate, but rather impedes the normalization of motor behavior during weightlessness. Disordered motor function in intact animals during weightlessness appears to result from a disturbance of the functional interaction of the analyzer systems which has its basis in the vestibular analyzer. Orig. art. has: 1 figure and 1 table. [EL]

56.

AUTHOR: Yuganov, Ye. M.; Kas'yan, I. I.; Gurovskiy, N. N.; Konovalov, A.I.; Yakubov, B. A.; Yazdovskiy, V. I.

ORG: none

TITLE: Sensory reactions and condition of man's voluntary movements under conditions of weightlessness

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 120-126

TOPIC TAGS: man, biologic weightlessness effect, weightlessness, sensory reaction

ABSTRACT: The nature of sensory reactions and the degree of change in indices of voluntary movements in man under conditions of short-term weightlessness were studied. The 40 men, ages 22-28 yr, were subjected to 35-40-sec periods of partial weightlessness (acceleration along y axis--0.05-0.07; along x axis--0.02 units) after accelerations of 3.5 ± 0.5 units at the start of parabolic flights. Weightlessness did not affect the general well-being of the subject; in only one case was there some unpleasantness in the substernal area; spatial orientation with open eyes was good. Thus analytical-synthetic activity was not changed by weightlessness. Examination of the accuracy of muscular strength in working with lever controls showed a tendency on the part of most of the men to overexert during the first flight; this was somewhat improved in subsequent flights; part of the energy used earlier in fulfilling static work was used for dynamic work. Fine coordinated movements were not significantly affected by weightlessness; there was little change in writing, and work on a special coordinograph continued to be fairly rhythmic although at a slightly reduced speed, both under weightlessness and acceleration conditions; there was no difference in time for carrying out horizontal or vertical movements. Movement coordination in eating and drinking was studied with motion pictures. Under weightlessness the movements were sufficiently accurate and smooth; most of the subjects had no real difficulties in intake of solids, semisolids, or liquids; the small disturbances noted are attributed to change in the nature and degree of stimulation of the neuro-receptor apparatus of the statokinetic and vestibular analyzers. Thus under conditions of zero gravity, simple and complex coordinated movements can be carried out with sufficient speed and accuracy. The slightly exaggerated voluntary movements appearing in initial weightlessness tests are reduced or disappear upon repeated tests under weightlessness conditions. Orig. art. has: 1 table. [WA-22]

57.

AUTHOR: Yuganov, Ye. M.; Pavlov, G. I.

ORG: none

TITLE: Possible magnitude of artificial gravity based on electrical activity of the skeletal muscles

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 398-402

TOPIC TAGS: biologic weightlessness effect, artificial gravity, radial acceleration, transverse acceleration, biopotential

ABSTRACT: Experimental data show that the adaptive reactions of the organism in weightlessness are only partially effective. The condition of the cardiovascular system of cosmonauts normalized only during the second day in weightlessness. Some vestibulosensory and sympathetic disorders were also observed. Even experiments with reduced gravity (in water) showed changes in cardiovascular reflexes, decrease of myogenic tonus, general debility, and tendency to dehydration of blood cells, which reduced the tolerance to vibration, high temperatures, and accelerations. In order to increase the organism's resistance, several measures are recommended, such as general and specialized training and some drugs. The most radical means would be the creation of an artificial gravity. Animal experiments (1962, 1964) have proved that acceleration of 0.28—0.3 g was sufficient to avoid the unfavorable effects of weightlessness on motor reactions. American scientists determined the value of 0.277 g to be the minimum effective magnitude for the normalization of motor reactions in man and animals (Loret, 1963). In order to find the optimum magnitude for the organism, experiments were arranged where parameters of the bioelectrical muscular activity, pulse rate, and respiration were recorded. Dogs weighing 6 to 8 kg were placed in a recumbent position on a centrifuge (radius = 145 cm) installed on an airplane which attained weightlessness. The acceleration acted in a back-chest direction. During weightlessness and artificial gravity, pulse rate, respiration, and bioelectric activity of the thigh muscles were recorded. The biopotentials were amplified and recorded by a multicomponent oscillograph. Pulse rate and respiration showed no reliable relationship in their changes, and therefore were not used to evaluate the effectiveness of the artificial gravity. During weightlessness, bioelectrical muscular activity dropped to half of the normal value. It started increasing from this low level when the artificial gravity reached 0.15 g. The biopotentials increased parallel with the transverse acceleration from 0.15 to 0.28 g, and reached normal values between 0.28 and 0.37 g. Further increase of artificial gravity (up to 0.7 g) did not affect the biopotentials. Thus the artificial gravity resulting from acceleration of 0.28—0.37 g can be regarded as the minimum effective magnitude which normalizes the electrical activity of skeletal muscles in weightlessness. These results coincide with data obtained during the study of motor activity. Orig. art. has: 1 figure and 1 table. [EF]

58.

AUTHOR: Alekseyev, S. V. (Leningrad)

ORG: Sanitary Hygienic Medical Institute (Sanitarno-gigiyenicheskiy meditsinskiy institut)

TITLE: Effect of octave noise bands on some physiologic functions of the organism

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 27-31

TOPIC TAGS: man, white noise, acoustic noise, noise modulation, modulation spectrum, acoustic biologic effect

ABSTRACT: Experimental studies were conducted on the effect of octave noise bands in the 300-600 (I), 600-1200 (II) and 1200-2400 Hz (III) spectrum at 65-90 db upon the functional state of the CNS, auditory analyzer, and cardiovascular system. These were conducted on 6 test individuals exposed to the noise in a special chamber for one hour. A spectrometer (S-34) for sound frequencies was used with 1/3 octave filters, thus 3 filters for each octave. Criteria were intensity of effector response, latent period of oculomotor reaction, and the presence of a distorted reaction to strong or mild irritation. The greatest changes in effector response were found for a 90-db noise. After band I effect a decrease by 27% was noted; this value was 40.3% for band II and 42.3% for band III. At 80 db, the greatest change was again seen for the highest band (32.1%). At 70 dB, the decrease was 8.5% for band I, 15.4% for band II, and 19.5% for band III. The latent period of oculomotor reaction was also affected by both level and spectrum of the noise; for 90 db and II the latency period increased by 11.6%; for 70 db and I by 8.5%, II by 15.4% and III by 19.5%. An unfavorable aftereffect was noted in comparison with pre-experimental test values. Changes in concentration were tested with corrector tables. These changes were most pronounced for band III and 90 db (14.9% decrease). Hearing was impaired after 90 and 80 db for all bands and at 70 db for band III and extended to half an octave above this value. Auditory sensitivity to speech after exposure is shown in the Figure. High-band noise at 80 and 90 db also affected the cardiovascular system (no details given). It was concluded that changes in the functional state of the CNS and the auditory analyzer due to noise depend on noise intensity and its spectral composition. This also applies to changes in the cardiovascular system. At spectra of 300-600, 600-1200, and 1200-2400 Hz and noise levels of 75, 70, and 65 db, no

statistically valid changes were observed in the functional state of the systems under study.

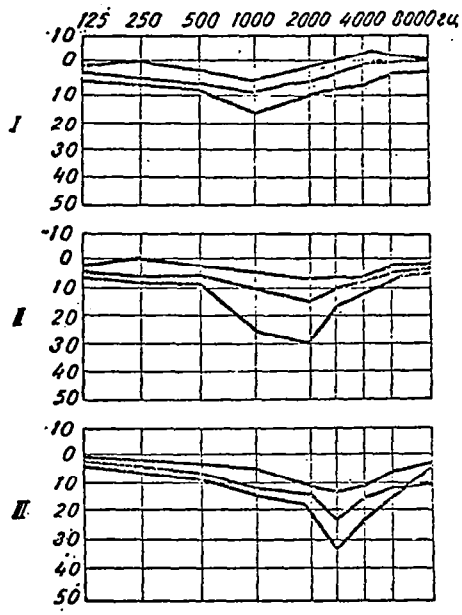


Figure 1. Changes in hearing thresholds after the effect of noise octave bands. Abscissa: frequencies (in Hz) for which hearing thresholds were determined. Ordinate: reduced hearing (in db).

Bottom lines--octave band 300-600 Hz; middle lines--octave band 600-1200 Hz; top lines--octave band 1200-2400 Hz. I) noise level of 70 db; II noise level of 80 db; III) noise level of 90 db.

Orig. art. has: 1 table and 1 figure.
[WA-N-69-2]

SUB CODE: 06/ SUBM DATE: 13Jul67

59.

AUTHOR: Andreyeva-Galanina, Ye. Ts. (Leningrad); Alekseyev, S. V. (Leningrad); Kadyskin, A. V. (Leningrad)

ORG: Medical Institute of Sanitation and Hygiene (Sanitarno-gigiyenicheskiy meditsinskiy institut)

TITLE: Standardization of physical investigation methods in the study of the effect produced on the human organism by noise

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 10, 1967, 14-18

TOPIC TAGS: physical medicine, pathology, central nervous system, cardiovascular system, acoustic analysis

ABSTRACT: The paper presents some suggestions made by the authors relative to the standardization of the most commonly used methods of investigation and the conditions required in the study of the effect produced on the organism by noise. Since current knowledge of noise pathology does not give rise to any doubts as to its being a factor affecting the entire organism, methods have become widely popular calling for the functional investigation of the central nervous system, the acoustic analyzer, and of the cardiovascular system. Dwelling upon procedures adopted in these investigations, the authors make a number of suggestions as to the justification for their use, along with certain conditions to be used in the study of the visual and acoustic motor reactions, audiometry, determination of the critical frequency of sound oscillations, etc. [Authors' abstract]
[NT]

60.

AUTHOR: Barutkina, T. S.; Zarbaylo, T. T.; Mityushov, M. I.; Panov, A. N.; Rakitskaya, V. V.; Sokolova, Ye. V.

ORG: none

TITLE: Effect of sound on the adrenal cortex, the thyroid gland and higher nervous activity of white rats

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 334-342

TOPIC TAGS: acoustic noise, rat, adrenal gland, thyroid gland, central nervous system

ABSTRACT: The effect of noise was tested in rats exposed for 1 hour to 14 days to sound of 650 cps and 70 dB lasting 17 sec and repeated after every 13 sec. Adrenocortical function was evaluated by determining their cholesterol and ascorbic acid content, weight change and in vitro synthesis of corticosteroids. Results showed a stimulatory effect of sound on the gland cortex after 3 hours; this was maximal after 6-12 hours and returned to normal after 8 days. In testing for thyroid function the criteria were protein bound iodine in the blood (PBI) and height of follicular eptihelial cells (detemined histologically). After 6-18 hours there was hardly any effect; after a day or more an increase in PBI and decrease in height of the cells was determined; the latter was considered a sign of increased hormone liberation. No significant changes were found after 3-14 days. Central nervous system tests evaluated latency period, performance time, gait and errors before, during and after the test. During the test, reactions were somewhat slower; there were very few errors, and these only at the beginning of the test. It was concluded that these animals are highly adaptable to noise. Orig. art. has: 3 tables and 1 figure.

61.

AUTHOR: Bondarev, G. I.; Aronova, Ye. N.; Mikhel'son, D. A.; Skuratova, L. Ya.

ORG: Institute of Hygiene of Water Transport (Institut gigiyeny vodnogo transporta)

TITLE: Effect of total vertical vibration and noise on a number of indices of protein, fat and carbohydrate metabolism in warm-blooded animals

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 10, 1968, 58-59

TOPIC TAGS: carbohydrate metabolism, fat metabolism, protein metabolism, white rat, biologic vibration effect, animal experiment

ABSTRACT: A study was made of the effect of vibration and noise on a number of indices of the protein, fat, and carbohydrate metabolism in white rats. It was found that vertical vibration with a frequency from 10 to 12 Hz and amplitude of 0.5 mm in combination with noise from 88 to 90 db induces disorders in fat and carbohydrate metabolism and increases the content of sugar and cholesterol. The vertical vibration in combination with noise also induces some changes in the proteinic metabolism including an increase in the removal of nitrogen, ammonia, and creatinine from urina and a decrease in the sulhydryl groups of blood and albumin-globulin coefficients. No changes were induced in the organism of rats during continuous 18 days exposure to vibration with a frequency of 10 to 12 Hz, an amplitude of 0.01 to 0.02, and a noise level of 72 to 75 db, or with only the noise level at the parameters indicated. Orig. art. has: 1 table. [WA-22] [NT]

62.

AUTHOR: Brzezinska, Zofia -- Bzhezin'ska, Z. (Warsaw)

ORG: Center of Experimental and Clinical Medicine /directed by Professor Dr. Z. Ruszczewski/, PAN, Warsaw (Centrum Medycyny Doswiadczalnej i Klinicznej PAN); Team of Industrial Physiology /headed by Docent Dr. St. Kozlowski/ (Zespol Fizjologii Pracy)

TITLE: Changes of concentration of acetylcholine in the brain tissue in rats after a single exposure to vibrations

SOURCE: Acta physiologica polonica, v. 19, no. 5, 1968, 683-693

TOPIC TAGS: clinical medicine, acetylcholine, brain tissue, biologic vibration effect, grey rat, animal experiment

ABSTRACT: Rats were exposed to vibrations plus noise, or noise alone, for 1, 2, 4, 6, 2, and 10 hr. In fresh brain tissues, concentrations of acetylcholine, acetylcholine esterase activity, and ability of the brain tissue to synthesize acetylcholine were

studied. Concentrations of acetylcholine in the choline in the tissue increased, attaining highest values after exposure for 2 hr. In rats exposed to the action of mechanical vibration plus noise, the increase was 245.2% compared with the control group, and in rats subjected only to the action of noise, 76.0%. In proportion to increasing length of the periods of exposure from 2 to 10 hr, acetylcholine concentrations gradually decreased, approaching the levels observed in the control animals. Similarly, acetylcholine esterase activity and ability of cerebral tissue to synthesize acetylcholine decreased at first, and then gradually increased in proportion to exposure times from 2 to 10 hr. An experimental part of this study was supervised by Professor Dr. W. Missiuro. The author thanks B. Kotulecka for technical assistance. Orig. art. has: 2 tables and a bibliography of 25 titles. [Author's abstract] [WA-22] [NT]

63.

AUTHOR: Brzezinska, Zofia -- Bzhezin'ska, Z. (Warsaw)

ORG: Center of Experimental and Clinical Medicine /directed by Professor Dr. Z. Ruszczewski/, PAN, Warsaw (Centrum Medycyny Doswiadczalnej i Klinicznej PAN); Team of Industral Physiology /headed by Docent Dr. St. Kozlowski/ (Zespol Fizjologii Pracy)

TITLE: Course of the regression of changes in acetylcholine concentration induced by a single two hour exposure to vibrations

SOURCE: Acta physiologica polonica, v. 19, no. 5, 1968, 695-702

TOPIC TAGS: clinical medicine, acetylcholine, brain tissue, grey rat, biologic vibration effect, animal experiment

ABSTRACT: Rats were exposed to vibrations plus noise, or noise only, for 2 hr. After 2, 4, 6, 8, and 10 days, concentrations of acetylcholine, acetylcholine esterase activity, and ability of the brain tissue to synthesize acetylcholine were studied. Concentrations of acetylcholine decreased gradually, while acetylcholine esterase activity and ability of brain tissue to synthesize acetylcholine increased, after 8 days attaining the levels observed in control animals. The experimental part of this study was supervised by Professor Dr. W. Missiuro. Orig. art. has: 2 tables and a bibliography of 5 titles. [Author's abstract] [WA-22] [NT]

64.

AUTHOR: Denisov, E. I. (Moscow); Sergeyev, Ye. I. (Moscow)

ORG: Institute of Work Hygiene and Occupational Diseases AMN SSSR (Institut gigiyeny truda i profzabolevaniy AMN SSSR).

TITLE: Distribution of vibration throughout the human body

SOURCE: Gigiyena truda i professional'nyy zabolevaniya, no. 6, 1968, 3-8

TOPIC TAGS: man, biologic vibration effect, vibration damping, vibration frequency

ABSTRACT: A study was conducted on the distribution of vibration for a wide frequency range for specific points of transmission and various positions of the body to permit determination of the boundary between local and systemic effects and the role of a handle upon the vibratory effect. The test individuals were 10 young males exposed to experimental vibration on a VUC 70/200 apparatus creating vertical sinusoidal vibration of fixed frequency, entering the body through the individual's hand which exerted a persistent 1, 2, 5 or 10 kg pressure on the handle. Results, shown in Fig. 1, resulted from vibration measurements at the point of contact and in other parts of the body (pelvis, chest, and head), taking vibration at the source as standard for experimental 8-, 16-, 32-, 63-, and 125-Hz applications. Vibration attenuation, measured at the immediate vibration site, was directly related to frequency, except for certain frequencies where resonance was involved and an amplitude increase at that site was observed. Such increases were observed at 8 Hz on sitting and standing for all sites under study, and at 16 Hz on standing for all sites except the chest and for sitting at the pelvis only. If the 8-Hz vibration was applied through the hand with a 10 kg pressure, amplitude increased by 5-15 db, due probably to resonance of the upper part of the body; it was thus 2-5 times that at the contact zone. Increase in hand pressure caused a proportional increase in vibration conductivity. At above 1.2 kg, the curves expressing conductivity as a function of frequency had their maximum at 32-63 Hz and increased with increase in pressure. Thus resonance occurred in this case at 30-60 Hz. Attenuation of vertical sinusoidal vibration thus changed with vibration frequency and depended more on the mechanical properties of the human body than the location of the vibration contact. A biomechanical approach to the study of vibration effects should reveal the boundary between traumatic effects and short-term

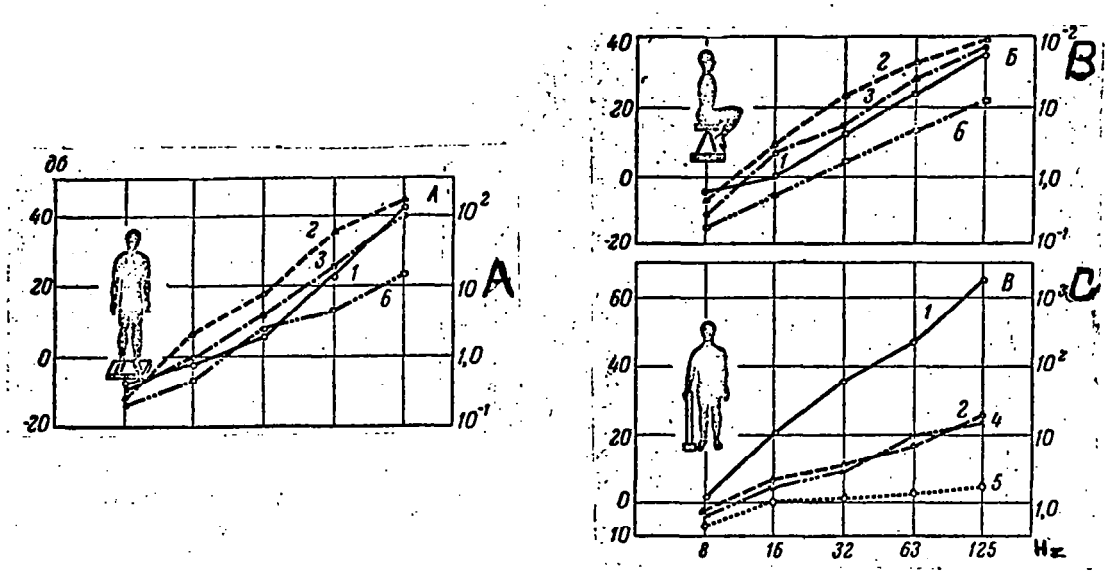


Fig. 1. Vibration attenuation at various points of the body, transmitted through the hand (C), standing (A), and sitting (B). Abscissa: frequency (in Hz); Ordinate: vibration attenuation relative to the transmission point (in dB); 1) head; 2) shoulder; 3) chest; 4) elbow; 5) wrist; 6) pelvis.

tolerance. This study would involve shifts in the body as a physiologic whole, related to attenuation of frequency, its mechanical impedance and that of specific organs and systems. It was concluded that tests in young males exposed to vertical sinusoidal vibration with a frequency of 8-125 Hz/sec whose attenuation was measured in sitting and standing position with and without pressure by the arm showed a smooth course of vibration attenuation curves with a slope of 2.5-17 db per octave depending on frequency. Increased pressure on the handle results in a corresponding rise of vibration conduction, representing 4-5 db for double pressure in the range of 32-125 Hz/sec frequencies. Such determination should be useful in selecting optimal pressures. Original article has: 2 figures. [WA-22]

65.

AUTHOR: Gromov, A. (Engineer; Lieutenant Colonel); Kuznetsov, V. (Engineer; Major; Candidate of biological sciences)

ORG: none

TITLE: Individual means of protection against noise

SOURCE: Aviatsiya i kosmonavtika, no. 5, 1968, 49-52

TOPIC TAGS: man, aerodynamic noise, helmet, protective clothing, acoustic noise, flight suit

ABSTRACT: Various protective devices are considered to decrease the effect of aviation noise. One of these is of the ear muff type. A formula is presented for the coefficient of noise absorption A :

$$A \cong \frac{d}{Q_{вн}} \cdot \frac{\omega^2 M}{\rho v^2},$$

where d is the interior depth of the muff, ω the cyclic frequency, M the muff mass, Q_{BH} the external muff surface, ρ the air density, and v the sound velocity. The study extended only to frequencies

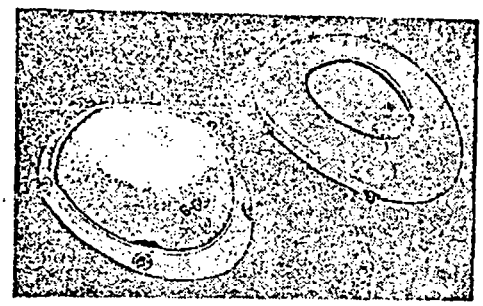


Fig. 1. Noise protecting ear muff Z-63.

below 1000 Hz. Based on calculations according to these formulas, several designs of light earmuffs (weight about 200 g) are presented. Some contain a strictly measured amount of liquid. The earmuff shown in Fig. 1 is highly recommended. It weighs 210 g, consists of a thin aluminum body with an elastic ridge of polyvinylchloride lined with porolon. The ridge contains a chamber 1/3 filled with glycerin. A telephone capsule is mounted inside the earmuff to permit communication. While the earmuffs should fit closely, they cannot be too tight, to accommodate changes in barometric pressure and obviate headache during prolonged wear. Therefore they sometimes have small openings. These earmuffs permit a decrease of noise from 130 to 100 db with a decrease in frequency towards lower values. Since soft helmets with noise protectants of the kind described are very convenient, they should find increasing use in the future. Orig. art. has: 3 formulas and 4 figures. [WA-22]

66.

AUTHOR: Ivanchyk, Yu. V. (Kirovsk); Karepov, G. V, (Kirovsk)

ORG: Murmansk Oblast Station for Work Hygiene and Occupational Diseases (Murmanskaya oblastnaya stantsiya gigiyeny truda i profzabolevaniy)

TITLE: Clinical and X-ray characteristics of vibration sickness in beton workers in the Arctic

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 35-39

TOPIC TAGS: man, biologic vibration effect, nervous system disease, circulatory system disease, bone disease, concrete, arctic climate

ABSTRACT: Studies were conducted in 80 hospitalized concrete workers (50 men and 30 women) presenting various stages of vibration sickness, who were 35-45 yr old and had worked under these conditions for 5-15 yr Some were also exposed to the inclement weather of the Arctic; 50 workers not exposed to vibration served as controls. It was found that vibration levels considerably exceeded tolerance levels in every case, and the factory itself had a noise level of 120 db. The main symptom was polyneuritis, with mainly

nonlocalized pains in hands (75%) and feet (60%) and cramps causing insomnia, trembling of hand and leg muscles, headaches (62.5%) and a syndrome of autonomic dysfunction. Capillaries showed spastic atonia (37.5%) or a spastic condition (30%) which was more pronounced in the toes of those working on a vibrating platform and in fingers of those working with manual vibrators. Paradoxical capillary reaction to heat and cold was noted in 10% of patients in the 2nd and 3rd stage of the disease. Angina pectoris and other cardiac anomalies were found in 22% and 37.5% respectively. Neurological examination revealed that only 10% were neurologically unaffected. The first stage of the disease was characterized by hyperhydrosis, decreased skin temperature at the wrists, and a decrease in some reflex reactions. In the second stage, a pronounced polyneuritic syndrome appeared with reduced sensitivity to pain, temperature, and vibration reaching into arms and legs, while segmental disturbances of nerve sensitivity appeared in the third stage, accompanied by decrease or increase of blood pressure, nonsymmetry of maximal and minimal pressure, and of pulse in hands and feet, reflecting disturbances of vegetative innervation and cortical-subcortical links. Four patients suffered from a kind of diencephalitis. Young workers showed varicose veins after 4-5 yr of work. Skeleton changes (e.g. exostosis, arthrosis, spondylosis) were found in 72.5% of the workers, osteoporosis only in 7.5%. While measures were recommended to improve working conditions, e.g. vibration-proof decks, remote control of machines, vibration-proof shoes, and isolation of vibrators by suspension, these protective requirements were not fully met. Also, further observations of their protective effect are in order. It was concluded: 1) that vibration disease of concrete workers in the Arctic presents a clinical syndrome of vegetative polyneuritis and a mild affection of the central nervous system, and a syndrome of vegetative disfunction with angiodystonic manifestations on a neurotic background; and, 2) the combined effects of vibration exceed established tolerance levels and are the main cause for radiculitis and radiculoneuritis and also of frequent pathologic skeleton changes. Orig. art. has: 3 tables. [WA-22]

67.

AUTHOR: Jurczak, Marek Eugeniusz -- Yurchak, M. (Warsaw)

ORG: Military Institute of Aviation Medicine/ headed by Professor Dr. K. Ostrowski/, Warsaw (Wojskowy Instytut Medycyny Lotniczej)

TITLE: Influence of vibration on metabolism of ^{35}S methionine in the central nervous system

SOURCE: Acta physiologica polonica, v. 19, no. 3, 1968, 329-335

TOPIC TAGS: aerospace medicine, flight physiology, methionine, central nervous system, animal experiment

ABSTRACT: Biochemical and isotope studies have been carried out in 44 guinea pigs subjected to vertical vibration (f = 50 Hz, a = 1 mm) for periods of 1, 3, and 6 days, three hours daily. A single exposure of the animals to vibration caused an increase in the rate of ^{35}S metabolism in the protein and lipid fractions in the central nervous system. Chronic, repeated exposure to vibration, on the other hand, resulted in markedly decreased incorporation and metabolism of ^{35}S. Orig. art. has: 2 figures and 2 tables. [Author's abstract] [WA-22] [NT]

68.

AUTHOR: Keszler, P.; Gati, T.; Sos, J.; Teglassy, L.; Kocsis, Eva

ORG: Institute of Pathophysiology, University Medical School, Budapest

TITLE: Mechanism of the gastric secretion inhibiting effect of the mechanical vibration

SOURCE: Academia scientiarum hungarica. Acta physiologica. Supplement to v. 32, 1967. Abstracts of the lectures held on the First Joint Congress of the Hungarian Societies of Biochemistry, Biophysics and Physiology, Pecs, October 12 to 14, 1967, 87

TOPIC TAGS: biologic vibration, gastrointestinal tract, biologic secretion

ABSTRACT:In their earlier examinations the authors have shown that a vibrational effect in rats lasting five hours operated according to Shay, decreases gastric secretion, and that the α-sympatholyticum (Regitine) does not suspend this effect. In their present experiments, using the most effective frequency and amplitude (3 Hz; 4 cm; horizontal direction), the authors examined the mechanism of the secretion decrease. A comparison with the controls revealed that the

gastric secretion remained unchanged in rats, which were exposed twice a day for six weeks to vibration lasting one hour and which were subjected to Shay's operation 24 hours after the last vibrational effect. Under identical experimental conditions, except for the application of a vibrational effect lasting five hours, following Shay's operation, secretion decreased. Acute vibrational effect (lasting two hours) prior to Shay's operation proved to be ineffective regarding decrease of the secretion. These data led to the conclusion, that the secretion decreasing effect is a transitory one and prevails during the time of vibration, presumably parallel to the adrenalinemia. This surmise is corroborated by the facts that administration of adrenaline (50μ g/100gi.p.), or of MAOI (Nialamid, 5 mg/100 g) and vibrational effect lasting two hours together significantly decrease the secretion. [Full text given] [WA-22] [KS]

69.

AUTHOR: Kublanova, P. S. (Moscow); Yushko, G. Ya. (Moscow)

ORG: Institute of Hygiene im. F. F. Erisman (Institut gigiyeny)

TITLE: Vestibular changes in power shovel operators and data from electronystagmograms

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 43-47

TOPIC TAGS: vestibular analyzer, man, biologic vibration effect, vestibular effect, organ sensitivity

ABSTRACT: Vestibular function was investigated in 66 power-shovel operators, 30-40 yr of age, engaged in open-cut coal mining for 5-20 yr. Later, 31 were hospitalized at the neurological department of the above Institute. Almost all suffered from headaches. A study of vestibular function revealed depressed sensitivity in the caloric test for 50%, and in the rotatory test for 25% of these workers. No caloric nystagmus was obtained in two. Nonsymmetrical sensitivity for the two labyrinths was detected in 12 workers for the caloric and in 6 for the rotatory test. Centrally determined symptoms such as disturbed nystagmus rhythm, particularly

disappearance of the rapid component, specific for the cerebral form of vibration sickness, were frequently encountered. In the hospitalized workers, an electronystagmogram was taken during the caloric test. An example illustrating one case suffering from poor hearing is shown in Fig. 1. Deviations in vestibular reaction reflected in spontaneous nystagmus, and right hand deviation were detected; here the uneven and accelerated nystagmus impulses may be considered an early sign of vibration sickness unaccompanied by subjective signs. It was concluded that exposure to vibration at a frequency of 12-80 Hz/sec and an amplitude of 6-50 μ, irregular impacts following dipper thrusts against the rock and swings over 90-180° repeated as many as 500-700 times per shift will cause reduced vestibular sensitivity in a large percentage of operators and disturbed nystagmus rhythm in some. Electronystagmography may reveal disturbances which cannot be recognized by visual examination. Orig. art. has: 2 figures.

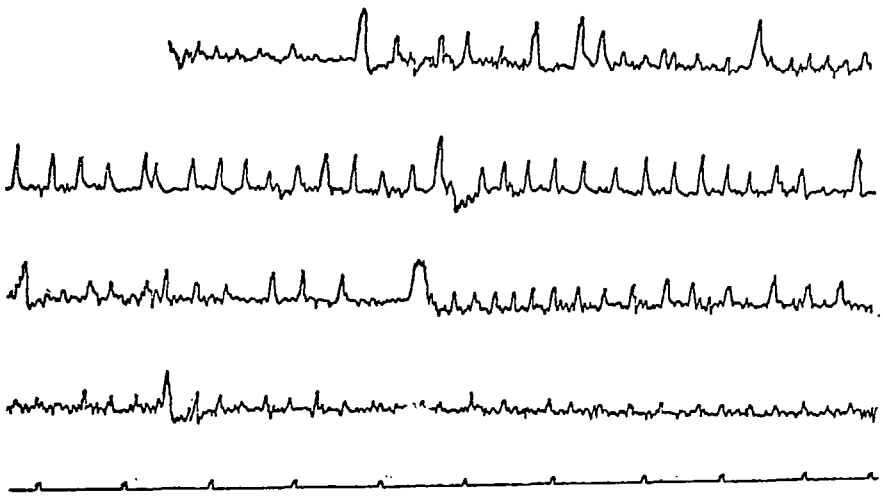


Fig. 1. Electronystagmogram of power shovel operator P. Nystagmus uneven with respect to number of impulses/sec and amplitude. [WA-N-69-2]

70.

AUTHOR: Kudryavtseva, N. N.

ORG: Laboratory of Experimental Pathology of Central Nervous System, Department of Applied Neurophysiology, Institute of Experimental Medicine AMN SSSR (Laboratoriya experimental'noy patologii tsentral'noy nervnoy sistemy Otdela prikladnoy neyrofiziologii Instituta eksperimental'noy meditsiny AMN SSSR)

TITLE: Changes in the dog EEG caused by a background of acoustic stimulation of different levels

SOURCE: Zhurnal vysshey nervnoy deyatel'nosti, v. 18, no. 1, 1968, 120-;25

TOPIC TAGS: electroencephalography, acoustic biologic effect, acoustic field, neurosis, central nervous system depressant, physiologic fatigue, dog

ABSTRACT: The purpose of the study was to determine the response of dog EEGs to acoustic stimulation of variable levels including strong levels causing subneurotic and neurotic conditions. A 16-channel Alvar

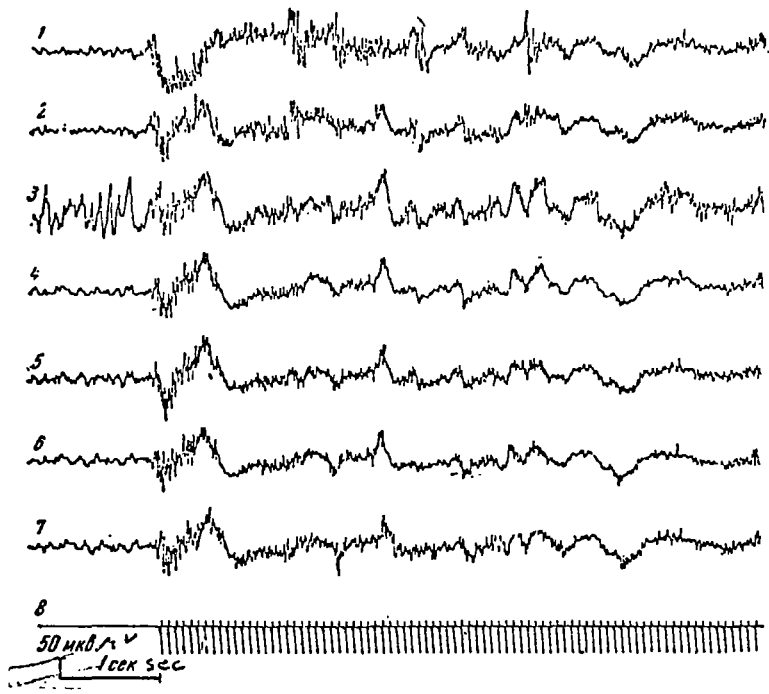


Fig. 2. EEG of a dog for a 56 db background applied initially. 1 and 2- right and left cortical motor regions; 3 - oscillogram of right auditory region obtained with cortex-immersed electrode; 4 and 5 - right and left cortical auditory regions; 6 and 7 - right and left cortical visual regions; 8 - stimulation synchrogram.

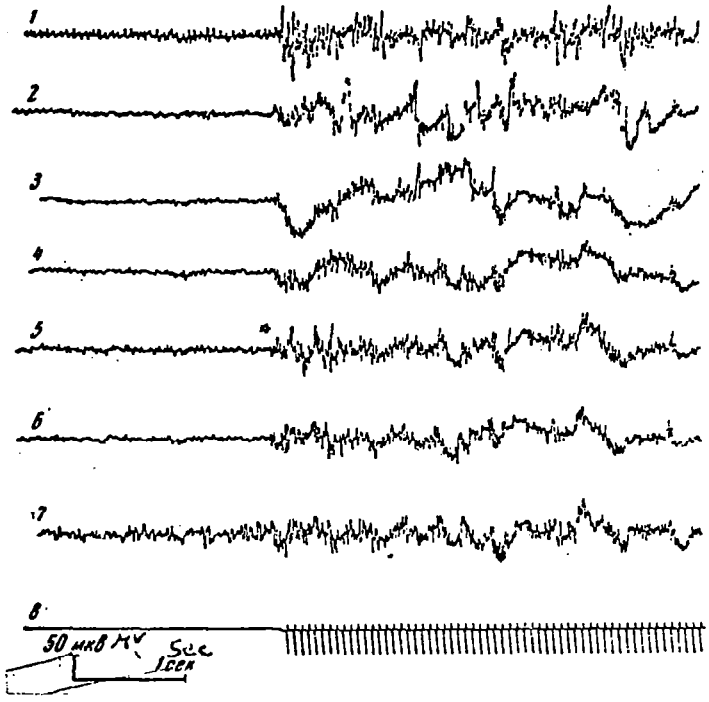


Fig. 4. Changes in EEG of a dog for a 96 db background applied on the 6th day. 1 and 2 - right and left cortical motor regions; 3 and 4 - right and left cortical auditory regions; 5 and 6 - right and left cortical visual regions; 7 - oscillogram of right auditory region obtained with cortex-immersed electrode; 8 - stimulation synchrogram.

encephalograph was used for recording the EEGs of a group of 4 dogs against a continuous 800 Hz acoustic background from a ZG generator, kept at 56 to 90-decibel levels above the human hearing threshold. At 56-66 db, the encephalograms showed a brief 3-20 sec response during initial tests and no response in subsequent tests. At 70 db and higher backgrounds the strong response persisted for up to 2 min, recurred during subsequent tests in the next 2-5 days, and caused (at 90 db) anxiety in 3 dogs and neurotic depression in one dog, with all the dogs showing fatigue during recesses. Two representative encephalograms obtained in the study are shown in Fig. 2 and Fig. 4.

71.

AUTHOR: Lebedeva, A. F.

ORG: Department of Occupational Hygiene, Sanitary-Hygienic Medical Institute, Leningrad (Kafedra gigiyeny truda Sanitarno-gigyenicheskogo meditsinkogo instituta)

TITLE: Changes in electric muscle activity under the effect of vibration and noise

SOURCE: Gigiyena i sanitariya, no. 3, 1968, 25-30

TOPIC TAGS: rat, vibration effect, acoustic noise, muscle stimulation, EMF, electromyography

ABSTRACT: Tests were conducted in rats to determine biocurrents in muscles before, during and after vibration of 50Hz frequency and 1mm amplitude and/or a 75 dB noise. The potential was measured at the neck muscles provided with bipolar electrodes using a 2-channel amplifier and 2 oscillographs. In three series of tests, the animals were exposed to both effects for 1 or 2 hours or to noise only. Results were rather uniform. Increased biocurrents were observed in all cases; the highest values averaged 150% of initial values and were observed after the first minute. Between 1-5 min there were isolated discharges of up to 5 times the initial level, followed by high voltage potentials. This activity decreased thereafter to 68% of the initial level for the 60 min test. A similar but more pronounced effect resulted from 120 min exposure, with a 54% post-experimental level which had not yet returned to normal after 2 min. It was concluded: 1) that vibration causes considerable changes in electric muscle activity depending on its duration. Short-lasting vibration causes increased biopotentials, that over 15 min a considerable decrease; 2) noise alone has a lesser effect. Higher biocurrents in the first min were following by oscillations around normal values; and, 3) both vibration and noise also exert an effect on the animals' behavior. Considerable initial motor activity changes to reduced motion and often deep sleep. It was recommended that the effect of noise accompanying vibration be considered in vibration studies. Orig. art. has: 2 figures.

72.

AUTHOR: Makarenko, N. A. (Krivoy Rog)

ORG: Institute of Work Hygiene and Occupational Diseases (Institut gigiyeny truda i profzabolevaniy)

TITLE: Changes in the functional state of the vegetative nervous system of healthy individuals exposed to local vibration

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 39-43

TOPIC TAGS: man, autonomic nervous system, biologic vibration effect, nervous system disease, parasympathetic nervous system, sympathetic nervous system

ABSTRACT: Tests were conducted in fifteen 25-44-yr-old healthy individuals exposed repeatedly to one hour's local periodic vibration at 50 Hz and 0.83-mm amplitude applied to the wrists of both hands. Criteria were content in the blood of acetylcholine, epinephrine and norepinephrine, activity of true cholinesterase, urinary catecholamine elimination, and circulatory changes in the fingers. Significantly higher values were found for epinephrine and norepinephrine in the blood at the end of one hour's exposure, and urinary elimination of catecholamines was also higher; the highest rate was found during and in the first hour after exposure, e.g. 43.46 ng/min (nanograms: transl.) as against 25.7 for controls. The rate of norepinephrine elimination exceeded that of epinephrine in the first hour after exposure-- revealing increased sympathetic activity --while increased acetylcholine content in the blood (0.99 mcg% as against 0.63 before the test) points to increased parasympathetic activity. Cholinesterase activity generally paralleled the acetylcholine concentration. A comparison of mediator content in blood and the circulatory minute volume in fingers-- a considerable decrease was found for the latter (33.2 as against 41.6 cc/min per 100 cc tissue) with return to normal after about 10 min-- points to a predominance of the sympathetic over the parasympathetic nervous system. It was concluded that data on the functional state of the autonomic nervous and the cardiovascular system under local vibration lasting for an hour point to functional changes of a predominantly zonal character, since no significant systemic changes were found; vascular tone in hands, particularly arteries and arterioles, was even increased. In some individuals, increase in the sympathetic nerve tone is such as to impede normal homeostatic mechanisms, and this may lead to disturbances of neuro-endocrinal-humoral interaction and a state of autonomic decompensation reflected in repeated temporary blanching of fingers. Orig. art. has: 2 tables. [WA-N-69-2]

73.

AUTHOR: Myasnikov, V. I.; Kozerenko, O. P.; Yakovleva, I. Ya.; Matsnev, E. I.; Lebedeva, I. P.: Nesterenko, V. N.; Tambiyev, Ye. Z.

ORG: Institute of Medico-biological Problems, MZ SSSR (Institut mediko-biologicheskikh problem MZ SSSR)

TITLE: Characteristics of human sleep under conditions of continuous protracted action of broad band noise of average intensity

SOURCE: AN SSSR. Izvestiya. Seriya biologicheskaya, no. 1, 1968, 89-98

TOPIC TAGS: sleep, sleep research, acoustic noise, acoustic biologic effect, adaptation, space flight biologic effect, astronaut selection

ABSTRACT: Studies were conducted at the Prof. F. D. Gorbov laboratory on the effects of continuous protracted broad band noise (2000-12,000 cycles/sec) of 75—78 db intensity on sleep and on the transitional state between sleep and wakefulness to determine the physiological basis for the disturbing effects of noise on man during rest. Quality of sleep was evaluated subjectively, and by the dynamics of the bioelectric activity of the brain, reactions of waking to acoustic stimulation, changes in performance indices (sensory motor reactions to light stimulus) and deviation of certain acoustic sensitivity indexes (screening threshold and acoustic adaptation). A relationship between length of presleep and subsequent sleep stages was established: those who fell asleep rapidly slept soundly and awoke feeling well, while those having difficulty falling asleep slept lightly, awakened frequently, and did not feel well. EEG observations were made. The motor reflex latent period was reduced in the first group and increased in the second group compared to background data. In the first group function of the auditory analyzer was restored and in the second group it was not, as shown by respectively lowered and raised screening thresholds. In the first group the disturbance of acoustic adaptation (after 8 hr exposure to noise) was reduced or completely eliminated, while in the second group it did not level out. This last criterion is considered especially significant since it provides means of evaluating shifts in the auditory analyzer caused by noise, and of indicating the state of the cortical section of the auditory analyzer before and after sleep. Since the selected noise frequency range was analogous to that encountered in spaceflight, the study provided a physiologic explanation for the unpleasant sensations encountered by astronauts in flight. It is stressed that attention to sensitivity to tonal and vocal signals, to the adaptive capacity of the acoustic organ, and to sleep characteristics of given individuals in noisy environments is required when selecting subjects for special tasks. Orig. art. has: 4 figures and 2 tables.

74.

AUTHOR: Nitschkoff, S.--Nichkov, S.; Kriwizkaja, G. N.--Krivitskaya, G. N.; Gnuchtel, U.--Gnyukhtel', U.

ORG: Institute for Cortico-Visceral Pathology and Therapy, Berlin-Buch/directed by Professor Dr. R. Baumann/, German Academy of Sciences at Berlin (Institut fur kortikoviszerale Pathologie und Therapie Berlin-Buch, Deutsche Akademie der Wissenschaften zu Berlin); Institute for Brain Research of the Academy of Medical Sciences SSSR, Moscow/directed by Professor Dr. Sarkissow/(Institut fur Hirnforschung der Akademie der Medizinischen Wissenschaften der UdSSR in Moskau)

TITLE: Neurovegetative injuries and histomorphological changes in the rat brain exposed to sound stimuli

SOURCE: Acta biologica et medica germanica, v. 19, no. 1, 1967, 33-45

TOPIC TAGS: brain, sound, intermittent stress, cerebral cortex, histology, morphology

ABSTRACT: In experiments with rats it was determined that the sound stress (95 db) on rats (exposures for 96 nours and chronic intermittent exposures for 5 min. twice daily for 28 weeks) induced disfunction of different organ systems. This included hyper- and hypoelectrolytaemias, increase of serum cholesterol, increase of biogenic amines, hypertrophy of the adrenals, rise of blood pressure and changes in the electrocardiagram and some significant changes in the erythro- and leukopoiesis and of the blood coagulation systems. The experimental animals may be divided into a hyperresponsive and a hyporesponsive group. The number of animals showing normal behavior was small. Intermittent sound stress for 28 weeks produced more pronounced changes than continuous exposure for 96 hours. The complex interrelationship between the neuro- endocrine elements and stress, regulation, feedback, adaptation and exhaustion are emphasized. Histomorphological investigations of the brain showed that cortical areas, sensory and motor regions and the auditory analyzer show early morphological changes, which in the initial stage are partly reversible. Subcortical areas (hypothalamus, thalamus) are injured later, but the degenerative changes are more pronounced and irreversible, including vacuolation of nuclei and cytoplasm, chromatolysis, deformation of myelinated nerve fibers and the dendrite processes as well as hypertrophy and hyperplasia of the microglia. A capillarization with thickening of the intima and infarction in the injured areas was also observed. Orig. art. has: 10 figures and 5 tables. [Based on authors' abstract] [Original article in German] [AM]

75.

AUTHOR: Paran'ko, N. M. (Krivoy Rog); Vyshchipan, V. F. (Krivoy Rog)

ORG: Institute of Work Hygiene and Occupational Diseases (Institut gigiyeny truda i profzabolevaniy)

TITLE: Contribution to the establishment of tolerance limits for medium- and high-frequency noise (experimental study)

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 48-50

TOPIC TAGS: man, simulation test, biologic vibration effect, mining engineering, acoustic biologic effect

ABSTRACT: Experimental studies were conducted in a special cell on 16 healthy young individuals to determine whether tolerance limits established for noise in the mining industry were adequate for protection. These individuals were exposed to the noise shown in Fig. 1 for one hour. Tests procedures comprised audiometry, reflexometry (latent period of oculomotor and verbal reactions), tonometry, pallesthesiometry and pulse rate. Measurements were taken before and after exposure and at certain 10-min rest intervals

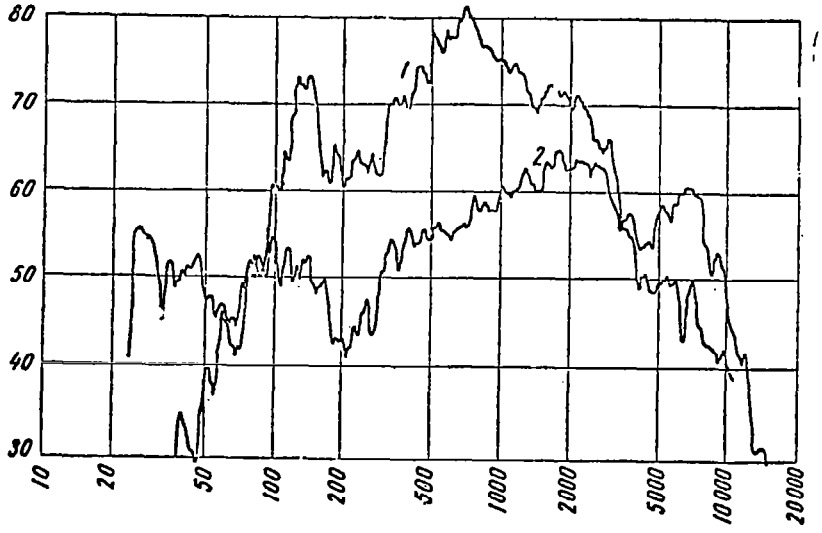


Fig. 1. Spectral composition of noise.
Ordinate: noise level (in dB);
Abscissa: frequency (in Hz);
1) medium frequency noise; 2) high frequency noise.

The effect of a 85 db noise at medium and high frequencies and of 75 db at high frequency led to increase in the hearing threshold. For medium frequencies, this threshold increased by 3.8 db for the 4000 and by 4.3 dB for the 200-Hz sound. Return to normal was faster for the high than for the low sound (3 as against over 10 min). Latent periods were increased by 24-31 msec, returning to normal after 3 min. Blood pressure and pulse rate showed insignificant variations. A decrease in the pulse was noted after high-frequency noise in 53.3%; for medium frequencies this rate increased in 67.7%. It was concluded that the short-term effect of wide-band noises (medium frequency with maximum at 700 Hz and a 85 db level, and high frequency with maximum at 1600 Hz and 75 db) caused insignificant changes in cardiovascular and vibration sensitivity. However, functional changes in the CNS and the slow recovery of auditory sensitivity make it apparent that medium- and high-frequency noise within tolerance limits is by no means harmless. It should be particularly noted that this test lasted only one hour. Exposure is much longer in industry, and effects will probably be more important. On the basis of their own and literature data, the authors recommend a reduction in tolerance limits of noise for the frequencies under study. Orig. art. has: 1 table and 2 figures. [WA-22]

76.

AUTHOR: Ponomarenko, I. I.

ORG: Moscow Scientific Research Institute of Hygiene im. F. F. Erisman (Moskovskiy nauchno-issledovatel'skiy institut gigiyeny)

TITLE: The standardization of high-frequency industrial noise for adolescents

SOURCE: Gigiyena i sanitariya, no. 8, 1968, 34-38

TOPIC TAGS: acoustic noise, industrial condition, industrial medicine, central nervous system, audiology, acoustic biologic effect

ABSTRACT: The biologic effect on adolescents of stable, high-frequency noise within or below tolerable adult levels was studied because noise level standards for adolescents were nonexistent. In a sound-proof chamber 15—16-year old boys were subjected to artificially created noise within the limits of an octave band of 1000 cps and at levels of 75, 70, and 65 db. The exposure period was one hour, and tests of physical function were performed at 5-min intervals during the subsequent

Table 1

The mean change in indices for adolescent physical condition as affected by various noise levels

Indicators	Noise level (in db)			Indicators	Noise level (in db)		
	75	70	65		75	70	65
Audibility threshold (in db) at frequencies				EKG indicators:			
200 cps	-1[1]	-1[1]	-1[1]	pulse (in min)	-8.5	-6	-3
500 cps	+1[1]	+1[1]	-1[1]	Systolic indicator (in %)	-5.5	-4	-1.8
1000 cps	+10	+8	+3	Time of diastole (sec)	+0.07	+0.06	+0.02[1]
2000 cps	+5	+1[1]	0	Heart cycle time (sec)	+0.08	+0.06	+0.03[1]
4000 cps	+1[1]	+1[1]	+1[1]	Reaction time (in microsec)			
8000 cps	0	-1[1]	-1[1]	to light	+10	+6[1]	+3[1]
Blood pressure (in mm of mercury column):				to sound	+12	+8	+4[1]
Maximum	-8	-7	-5	Mental work capacity:			
Minimum	+3	+1[1]	0	Problem-solving time (in sec)	+10	+5	+1[1]
Pulse	-11	-8	-5	No. of errors	+0.6	+0.4	+0.2[1]
Index of vascular tone (in conventional units)	-2.8	-1.8	-0.8				

[1]Statistically unproven.

25 minutes. These tests included tonal audiometry, blood pressure, oscillograph, EKG, determination of the latent period for conditioned reflex reaction, and a test of mental work capacity. Test results, shown in Table 1, indicate that functional changes were dependent on the noise level. A level of 75 db, the adult maximum level, had a pronounced effect on hearing and on cardiovascular and CNS function in adolescents. Noise at 70 db caused less, but still pronounced, change. The author recommends 65 db as the maximum tolerable level for adolescents. This level coincides with that recommended by the International Standards Organization; however, the author suggests further study before applying the ISO curve as a whole to adolescents. Orig. art. has: 1 table. [WA-22]

77.

AUTHOR: Ponomareva, N. I. (Moscow); Ostapkovich, V. Ye (Moscow)

ORG: Institute of Industrial Hygiene and Occupational Diseases AMN SSSR (Institut gigiyeny truda i profzabolevaniy AMN SSSR)

TITLE: Evaluation of hearing and working capacity in individuals working under conditions of industrial noise

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 10, 1967, 50-53

TOPIC TAGS: acoustic noise, industrial hygiene, audition

ABSTRACT: Since industrial noises sometimes reach levels of 100-110 decibels or more and since the indicators for determining impairment due to industrial noises leave much to be desired, audiologic examinations were conducted in 1000 individuals working under noise exceeding hygienic norms who were tested at the factory before and after work. Hearing loss was determined at speech range and at high frequencies (4000 cpm). Results supplied the basis for a scale indicating slight, moderate and important hearing loss (see Table 2) in groups divided according to age, sex and duration of work under these conditions. The authors recommend tests involving frequencies of 125, 250, 500 and 1000-8000 and understanding of whispered words. Tests should be conducted once and occasionally twice a year; individuals with rapidly progressing impairment or those with considerable hearing loss should be transferred to other work. The same applies to patients with non-occupational hearing impairment which may be exacerbated by occupational noise. Orig. art. has: 2 tables and 2 figures.

Table 1. Evaluation of the degree of hearing impairment in decibels * (key).

1) Degree of hearing impairment	2) impaired hearing at speech frequencies (500-1000-2000 cpm)	3) impaired hearing at 4000 cpm	4) understanding of whispered speech (distance in meters)
5) slight 6) moderate 7) considerable	8) to 25 9) over 35	10) to 50 11) 50 and more 12) over 50	13) 1 and less

78.

AUTHOR: Ponomareva, N. I. (Moscow); Okhnyanskaya, L. G. (Moscow); Nikiforova, N. A. (Moscow)

ORG: Institute for Work Hygiene and Occupational Diseases AMN SSSR (Institut gigiyeny truda i profzabolevaniy AMN SSSR)

TITLE: Evaluation of the functional state of the vestibular analyzer in men exposed to vibration

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 31-35

TOPIC TAGS: man, vestibular analyzer, biologic vibration effect, vestibular effect

ABSTRACT: Based on earlier work related to the effect of noise and local vibration which revealed increased stimulation of the vestibular analyzer by high-frequency vibration and its depression by noise and low-frequency vibration, the authors conducted clinical studies on the activity of the vestibular analyzer and its interaction with other analyzers, particularly the motor analyzer. Otolaryngological examination involved rotatory, caloric, and hearing tests. Eye movements were recorded with a 15-channel electroencephalograph; electronystagmograms, myograms, pneumograms, and EKG which were also taken in the test subjects under the following conditions: 1) relative rest; 2) fully lateral eye movement; 3) 20° horizontal movement to right and left; 4) opticokinetic nystagmus; and 5) caloric irritation of the ear. Results of these tests are shown in Figure 1. Only results of the caloric tests are discussed; these were conducted in 20 workers exposed by local contact to vibration with various parameters (11-900 Hz) or to total vibration. All these individuals suffered from vibration sickness of varying severity. In the healthy controls caloric nystagmus lasted 90-160 sec, was rather pronounced and clearly rhythmic, with a 8-12 mm amplitude, and the culmination phenomenon appeared at the 60-80th second. Bioelectric activity in the hand muscles was somewhat increased. In the patients, nystagmus lasted 130-160 sec, the rhythm was disturbed, amplitude varied from 2 to 20 mm or more, and culmination appeared between the 50th and 120th second and occurred earlier in those with depressed vestibular function. Tonus in the hand muscles was significantly increased. No valid differences were found for the effects of vibrations with different parameters. It was concluded that this method may serve as an additional method of detecting functional changes in the vestibular analyzer, its interaction with motor analyzers, and autonomic functions in patients suffering from vibration sickness.

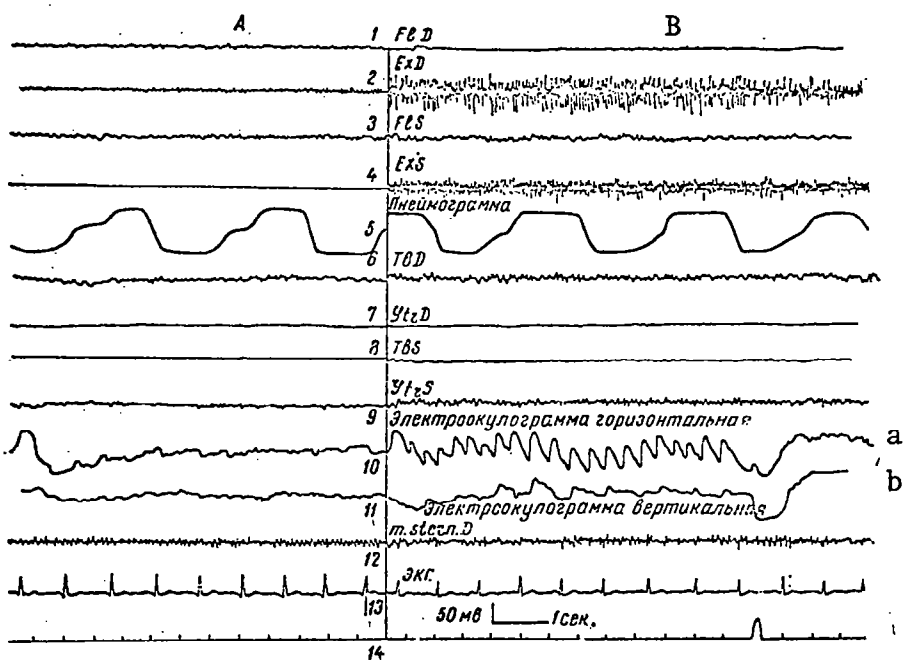


Figure 1. Electronystagmogram together with electromyogram, pneumogram and EKG of K, riveter who has done this kind of work for 21 yr

A) rest; B) after caloric test of right ear; 1--4) hand muscles (flexor and extensor); 5) pneumogram; 6--9 feet muscles (flexor and extensor); 10) horizontal nystagmogram; 11) vertical nystagmogram; 12) neck muscles; 13) EKG.
Key: a) horizontal electrooculogram;
b) vertical electrooculogram.

Orig. art. has: 1 figure. [WA-22]

79.

AUTHOR: Ponomar'kov, V. I.; Tysik, A. Yu. Kudryavtseva, V. I.; Barer, A. S.; Kostin, V. K.; Leshchenko, V. Ye.; Morozova, R. M.; Nosokin, L. V.; Frolov, N. I.

ORG: none

TITLE: Biologic effect of intense, broad band noise on the animal organism

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 331-334

TOPIC TAGS: acoustic noise, dog, acoustic noise, biologic effect, pulmonary disease

ABSTRACT: Tests were conducted in dogs exposed to short-term (0.6-3.5 sec) broad band noise of 105-155 dB with particular attention to pathologic changes in the respiratory tract. EKG, EEG were also taken, and the respiratory rate was monitored. The dogs were killed 1½-2 hours after exposure. At a noise above 126 dB, blister-like hemorrhages up to 3 mm in diameter were detected under the pleura and on the thoracic surface of the right lung. The greater the noise the larger their number. Tears in capillary or larger vessels were seen under the microscope. These hemorrhagic changes preceded emphysematous swelling of the outer lung tissue; under the microscope this was found to consist of focal alveolar edema. No other pathology was detected. Both EEG and EKG were normal. The cardiac rate increased to 120-130/min and returned to normal within 15-40 sec. Slower and irregular respiration appeared right after the exposure, lasting for 10 min. In tests for reversibility of this process, animals were autopsied 3-60 days after exposure. Full resorption of the hemorrhage occurred in the second month, but emphysematous changes persisted throughout the observation period. It was concluded that the critical threshold for pathologic changes lies between 126 and 130 dB, and that these consist of acute emphysema and bleeding. The effect may be ascribed to pressure changes. Orig. art. has: 4 figures.

80.

AUTHOR: Rappoport, M.B.; Pasternak, G.A.

ORG: Institute for Work Hygiene and Occupational Diseases (Institut gigiyeny truda i profzabolevaniy)

TITLE: Pathomorphologic changes in various parts of the central nervous system and endocrinal organs under jolting vibration

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 55-57

TOPIC TAGS: rat, rabbit, biologic vibration effect, vibration stress, mechanical vibration

ABSTRACT: Experimental studies were conducted in rats and rabbits to detect structural changes in organ systems under conditions close to those found in factories. The animals were subjected daily for 3 months to a 3-hour jolting vibration of 2 vibr/sec at 0.25 g acceleration, then autopsied for histologic studies of the brain and spinal cord, pituitary, spleen, pancreas, adrenals and sex glands. Enzymatic studies on cytochrome oxidase succindehydrogenase were also conducted. Under exposure, the animals were initially restless, then usually slept through the tests. Their weight was slightly below that of controls. Histologic studies revealed dystrophic disturbances in nerve cells which were more pronounced in those of motor neurons of the anterior spinal crescent, accumulation of glial and histiocytic cellular elements, and proliferation of microglia. Nissl substances had disappeared in nerve cells and the cytoplasm showed more minute vacuoles than in controls. Hemodynamic disturbances consisted in hyperemia and small hemorrhages in the brain, histiocytic and lymphoid infiltrates in spine-brain ganglia. In endocrine glands, there was hyperemia and occasional interstitial cell proliferation. Morphologic signs e.g. in the thyroid were generally those of functional gland hyperactivity, while blood circulation showed atonia. It was concluded that a total horizontal jolting vibration at 2 vibr/sec and 0.25 g acceleration causes certain morphologic changes in the regulatory systems of small laboratory animals. These may be seen in dystrophic and necrotic changes in nerve cells (brain cortex, the subcortical zone, cerebellum, cervical, thoracic, sacral parts of the spinal cord). the proliferation of glial and histiocytic cells, some lymphoid infiltration, hyperemia, and focal hemorrhages. These changes are more pronounced in the brain compared to the spinal cord.

The endocrine system showed disturbances pointing to decreased function of adrenals and gonads and increased thyroid function. Histochemical tests revealed increased activity of the enzymes succindehydrogenase and cytochrome oxidase. These signs point to the traumatic effect of such vibration. [WA-22]

81.

AUTHOR: Samoylova, I. K.; Zaytseva, K. A.

ORG: Institute of Evolutionary Physiology and Biochemistry im. Sechenov AN SSSR (Institut evolyutsionnoy fiziologii i biokhimii AN SSSR)

TITLE: Recognition of complex acoustic stimuli with different probabilistic structures

SOURCE: Zhurnal vysshey nervnoy deyatel'nosti, v. 18, no. 3, 1968, 394-398

TOPIC TAGS: recognition process, form recognition, acoustic noise, acoustical signal, probability distribution, man

ABSTRACT: Four unidentified different types of 10-sec (series 1) and 200-microsec (series 2) complex low-frequency acoustic signals recorded on magnetic tape in sequences of 50 signals with variable-order probability of 0.4 (signal type 1), 0.3 (type 2), 0.2 (type 3), and 0.1 (type 4) for the occurrence of each type, were used at 60-70 db levels at unspecified tape motion rates in a total of 30 (series 1) and 53 (series 2) experiments on a group of 5 persons instructed to recognize the type of each signal in a sequence. In series 1, the number of errors was 44 out of 600, 34 out of 450, 7 out of 300, and 27 out of 150 signals of types 1, 2, 3, and 4, respectively, with relative error frequencies of 0.073, 0.074, 0.023, and 0.18. The numbers and proportions of errors in series 2 were higher than in series 1 but showed similar trends in individual types of signals. These values also were lowest for signal type 3 (142 out of 530, and 0.268) and highest in signal type 4 (156 out of 265, and 0.588), with signals types 1 and 2 having intermediate error rates. It is noted that in both series errors were more frequent in the lowest-probability signal. Orig. art. has: 3 tables and 2 figures. [WA-22]

82.

AUTHOR: Shishlovskaya, K. Ya. (Moscow)

ORG: Institute for Hygiene of Water Transportation (Institut gigiyeny vodnogo transporta)

TITLE: Changes in some indicators of circulatory function under low frequency vibration (experimental study)

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 18-23

TOPIC TAGS: man, biologic vibration effect, cardiovascular system, tolerance limits

ABSTRACT: Tests were conducted in 11 healthy young men on a manually operated vibrating platform exposing them to 20 Hz/sec vibrations at amplitudes of 0.35, 0.7, and 1.5 mm for 20 min. Blood pressure, pulse wave rate, EKG in 3 standard leads, skin temperature, and vibration sensitivity in fingers were measured before, during and after vibration. A decrease in skin temperature of the fingers of the right hand was observed in the majority (0.3--7.2°C), from 63% at the lowest to 69% at the highest amplitude, due probably to spasm of peripheral vessels. Blood pressure changes involved mainly the maximum which decreased in 35% and increased in 10% of the individuals at 0.35 mm amplitude; for 0.7 mm, the corresponding values were 54 and 16%, with shifts of 5--25 mm. Changes in minimum pressure were observed in 22--31%. These values had not yet returned to normal after 10 min. Pulse wave rate, measured between *a. carotis* and *a. radialis*, changed in 65% by ±30--120 mm/sec for 0.35 mm amplitude and in 75% by ±30--340 mm/sec for 0.7 mm. In most cases, the rate was reduced which, in connection with blood pressure changes, points to disturbances of the neurohumoral mechanisms which regulate vascular tone. EKG showed mild changes: a slight rise of T and R waves and lengthening of the Q-T interval in 48, 30, and 20% for 0.35 mm and in 49, 34 and 38% for 0.7-mm amplitude. Thresholds of vibration sensitivity were slightly increased after 0.35-mm amplitude, but for the 1.5-mm amplitude this value sometimes reached 25 db. It was concluded that experimental low-frequency vibration frequently leads to decreases in skin temperature at the wrist, blood pressure, pulse wave rate, and vibration sensitivity. Under these conditions, the increased tone of small vessels and the decreased tone of larger vessels may be interpreted as a compensatory-adaptive reaction. Data on the effect of low-frequency vibration upon the cardiovascular system may be used to establish vibration tolerance limits. [WA-22]

83.

AUTHOR: Shkarinov, L. N.; Denisov, E. I.; Lashina, R. A.

ORG: Institute of Work Hygiene and Occupational Diseases AMN SSSR, Moscow (Institut gigiyeny truda i profzabolevaniy AMN SSSR)

TITLE: Effect on the organism of pulsed noise and vibration in leveling and hammering work

SOURCE: Gigiyena i sanitariya, no. 7, 1968, 104-106

TOPIC TAGS: biologic vibration effect, acoustic noise, acoustic effect, nervous system disease, man

ABSTRACT: Noise and vibration in machine-building work done manually or mechanically was studied with a special apparatus (see Figure) to determine the time characteristics of the pulse and accompanying noise. Results obtained at the factory were compared with those obtained under laboratory conditions. Average vibration was 120-136 db with peaks up to 148; duration of the pulse was from < 1 to 1.5/msec. Average noise was 108-122 dB with peaks of 142. The test individuals, selected after medical examination, were up to 40 yr old and had done this kind of work for at least 5 yr. Over 80% complained of pain in the

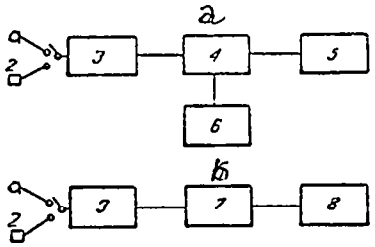


Figure 1. Scheme of units for measuring pulsed noise and vibration under industrial (a) and laboratory (b) conditions.
1) microphone
2) vibration recorder
3) pre-amplifier
4) spectrometer
5) analyzer of noise pulses
6) recorder
7) microphone amplifier
8) oscillograph with a photoattachment

hands, numbness and occasional blanching of fingers. Those who had worked for 10 yr or more suffered from spastic or atonic capillaries. Skin temperature of wrists was considerably below normal (18-27 °C). Muscular fibers were also affected (tendovaginitis and myofascitis of shoulder muscles). The diagnoses were: autonomic polyneuritis of hand with angiospastic manifestations, and myofascitis. Analysis of the case histories determined that autonomic polyneuritis developed before the myofascitis; the former was found in 70% of those working 6 yr and longer and was later accompanied by dystrophic changes. These medical findings were confirmed in the further study of 45 men at the clinic. Vibration causes peripheral angiodystonia and dystrophic changes in muscle and bones of arms and shoulders. The authors recommend use of materials that dampen noise and vibration to avoid these pathological effects, but the best approach would be a radically new technology to avoid manual contact. Orig. art. has: 1 figure and 2 tables, [WA-22]

84.

AUTHOR: Sviderskaya, G. Ye.

ORG: Laboratory of Nerve Activity Development of Animals in Ontogenesis Institute of Evolutionary Physiology and Biochemistry im. I. M. Sechenov AN SSSR, Leningrad (Laboratoriya razvitiya nervnoy deyatel'nosti zhivotnykh v ontogeneze Instituta evolyutsionnoy fiziologii i biokhimii AN SSSR)

TITLE: Effect of sound and vibration on the motor activity of chick embryos

SOURCE: Zhurnal evolyutsionnoy biokhimii i fiziologii, v. 4, no. 3, 1968, 251-257

TOPIC TAGS: motor reflex, embryology, animal, acoustic biologic effect, biologic vibration effect

ABSTRACT: The effects of sound and of mechanical vibration on the motor activity of chick embryos from the time of spontaneous movement development were investigated. White Leghorn eggs were incubated at 38 C; observations during the first 12 days were made directly in the egg, and later observations of the embryo were made in 38 degree physiological solution. The embryos were exposed to

1000 and 300 hz frequencies of 95 db (from generator 2G-11), or to 40 vibrations/sec, for 5 sec in each 25 sec. Motor movements of the embryo were recorded by a method (A. V. Voyno-Yasenetskiy, Yu. E. Moskalenko, Fiziol. zh. SSSR. 47, 1205 (1961)) in which the mechanical movements of the embryo are converted to electrical oscillations and recorded on loop oscillator film. Recordings were made for 20 min: 10 min to establish background, and 10 min of motor activity under the effect of sound or vibration. Data obtained on 350 embryos 5, 6, 8, 10, 12, 14, and 16 days after start of incubation was treated statistically. The embryo reacts differently to the action of sound and vibration at different stages of development: in the early stages, from the 6th to the 12th day sound has some (less than 20%) stimulative or inhibitive effects on embryo motor activity, and vibration has a stimulative (up to 20%) effect. These effects are presumable nonspecific since specialized auditory systems are not yet formed. During the development of the auditory system, beginning with the 12-14th days, the effects become more pronounced, and are inhibitive (in the case of high frequency sound) or stimulative (low frequency sound or vibration). At this time specific auditory structures start to function and apparently play a significant role in the observed effects. Orig. art. has: 3 figures.

85.

AUTHOR: Tomanek, R. (Prague, Czechoslovakia)

ORG: Otolaryngologic Laboratory AN Czechoslovakia (Otolaringologicheskaya laboratoriya AN Chekhoslovakii)

TITLE: Short-term changes in hearing thresholds after noise irritation, and autonomic equilibrium

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 6, 1968, 14-18

TOPIC TAGS: man, white noise, sympathetic nervous system, audiology, acoustic biologic effect

ABSTRACT: Tests were conducted at the author's laboratory (Head: Academician Przhetsentel) in young healthy individuals to determine alertness and tonus of the autonomic nervous system, using the eye-heart reflex test and orthostatic and clinostatic pulse changes for the former, and the atropine test for the latter system. In prior tests, the effects of irritation by a 95-100-db white noise were found to disappear after 20 min. Frequencies of 500-6000 Hz were applied in the experiment, first without, then with atropine (up to 2 mg). Results revealed that hearing

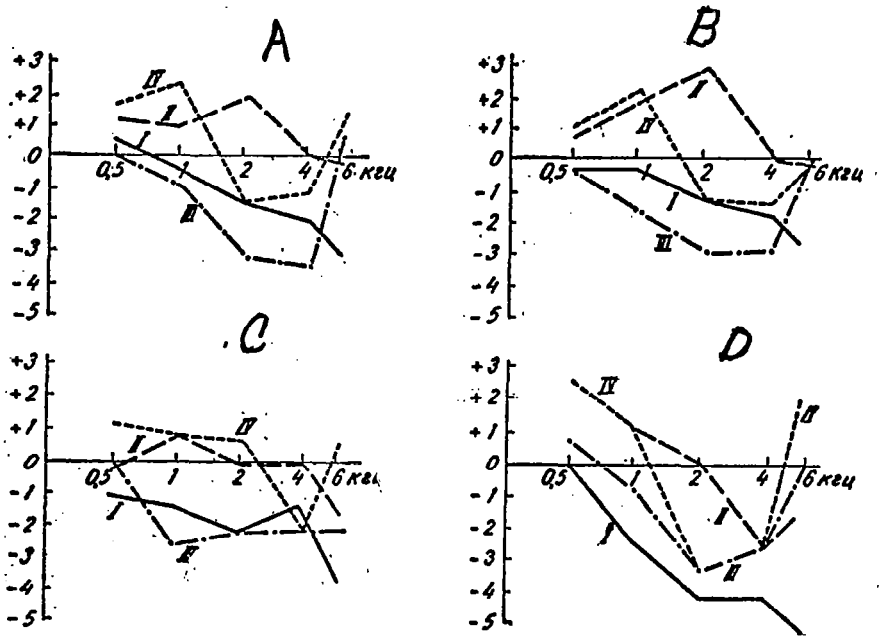


Figure. Relative curves of auditory fatigue after irritation with white noise:
I) 5 min after stimulation;
II) 20 min after stimulation;
III) following atropine injection, 5 min after stimulation;
IV) following atropine administration, 20 min after stimulation;
A) in individuals with normal autonomic tonus;
B) in individuals with normal autonomic sensitivity;
C) in individuals with vagotonia;
D) in individuals with increased sensitivity of the vagal nerve.

acuity returned to normal after 20 min except for one out of 34 test individuals. In the 20 men with normal tonus, 27 with normal autonomic sensitivity, 11 with high vagal tonus, and 6 with high vagal sensitivity, it was determined that higher vagal tonus results in greater acoustic fatigue and slower return to normal (see figure). The threshold increase after irritation reached maximum at high frequencies and decreased to normal and occasionally subnormal values within 20 min. In those with normal autonomic sensitivity and a blocked parasympathetic nerve, the threshold increase was higher after stimulation and maximal thresholds shifted from 4000-6000 to lower 200-4000 frequencies. Return to normal took longer. In those with high vagal excitability no threshold changes or even a drop to below normal values was observed, again followed by a slower return to normal (see figure). It was concluded that the process of noise adaptation

is regulated reflexively by way of the efferent autonomic nerves. In short-term irritation, these reflexes have a short-term effect on threshold values and apparently on the hydromechanics of the cochlea. These conclusions were based on the following: In individuals with prevalent vagus tone, short-term changes of thresholds were greater and were slower to return to normal than in those with normal tonus. Under parasympathetic block produced by intravenous injection of atropine, i.e. conditions comparable to sympathicotomy, stimulation results in greater threshold changes and slower return to normal, and the post-irritation curves has a different course.
Orig. art. has: 1 figure. [WA-22]

86.

AUTHOR: Tambovtseva, A. M.

ORG: Moscow Scientific Research Institute of Hygiene im. F. F. Erisman (Moskovskiy nauchno-issledovatel'skiy institut gigiyeny)

TITLE: Effect of vibration and noise on the protein metabolism of operators of excavating machinery on the basis of certain biochemical indices

SOURCE: Gigiyena i sanitariya, no. 1, 1968, 58-61

TOPIC TAGS: biologic vibration effect, man, acoustic noise, protein metabolism, liver function

ABSTRACT: Tests involved 115 men operating excavating machinery in a quarry in whom the effect of vibration on total serum protein and serum protein fractions was studied, following a full medical checkup. The men had performed this kind of work for 5-10 or more years; over half were 25-30 years, the rest older. Total protein was determined refractometrically, fractionation by paper electrophoresis was followed by photoelectrocolorimetric identification of the fractions. Prothrombin tests were also performed. The albumin/globulin ratio was significantly decreased in these workers (decrease of albumin and increase in beta and gamma globulin), depending on the number of years at this work. The ratio was 0.9-1.7 as against 1.8-2 for controls. Positive coagulation (Weltman's test) was found in 92.3% of the men with over 10 years working time in the 8-9th sample, in controls the 5-6th sample. It was concluded that these findings point toward functional changes in the liver. Orig. art. has: 4 tables.

87.

AUTHOR: Volkov, A.M. (Moscow)

ORG: Institute of Railroad Hygiene (Institut zheleznodorozhnoy gigiyeny)

TITLE: Development of studies on noise and vibration in railroad transportation and their results

SOURCE: Gigiyena truda i professional'nyye zabolevaniya, no. 11, 1967, 58-60

TOPIC TAGS: railway transportation, railway structure, vibration effect, acoustic noise, man, vestibular analyzer

ABSTRACT: This is a survey of studies on the adverse effect of noise and vibration in railroad cars started in 1933 by the Central Scientific Research Institute of the Ministry of Communications (TsNII MPS). Further studies started in 1948 used EEG and EKG to determine the function of analyzers, thresholds of acoustic sensitivity and vestibular chronaxy and effects on the cardiovascular system; model vibratory platform was constructed. Characteristics of noise and vibration were divided into 3 groups according to noise and 2 according to vibratory parameters; these were determined for the various types of passenger coaches. A tolerance of 70 db was established for high frequency up to 6 hours and 80 db for low frequency noise; for vibration, the tolerance limits were 5-8 cpm resonance for the body and 17-30 cpm for the head. In later tests, an acceleration leading to 80-100 cm/sec^2 vibrations was found to result in a slow return of biolectric cortex activity to normal; 200 cm/sec^2 led to a delay of up to 30 min. in return of hearing and vestibular chronaxy; such accelerations also caused an increase in blood pressure and lengthening of EKG intervals. New hygienic rules were promulgated in 1959 and remained in force until 1966, and new coaches with sound proofing were built from 1960 on. Standards were developed for measuring noise in railroad cars; 1962 and 1963 saw studies of engineers and helpers tolerance to noise in various engine types and those of repair men and employees in the depots. New recommendations were published for improving working conditions and to create sections in freight cars protected from noise and vibration. In 1966 new standards were established for limiting vibration and noise. Orig. art. has: 1 table.

88.

AUTHOR: Yakubovich, T. G.

ORG: Department of Labor Hygiene/headed by Prof. Ye. Ts. Andreyeva-Galanina/, Leningrad Medical Institute of Sanitary Hygiene (Kafedra gigiyeny truda, Leningradskogo sanitarno-gigiyenicheskogo instituta)

TITLE: Changes in glycogen level in the liver of animals under the effect of total vertical vibration

SOURCE: Arkhiv anatomii gistologii i embriologii, v. 53, no. 12, 1967, 55-58

TOPIC TAGS: biologic vibration effect, vertical test, liver function

ABSTRACT: A study of glycogen content and its distribution in the liver was carried out on 50 guinea pigs and 100 albino rats under conditions of total vertical vibration of different duration. Distribution of glycogen in the liver was studied in rats, maintained on a diet containing vitamin B_1, and guinea pigs fed with vitamin C and subjected to long-lasting effect of the total vibration. Changes in the distribution and concentration of glycogen in the liver of the animals under study were found already within 30--40 minutes of the vibration application and were progressing with continuous duration of the stimulation to 60 days. B_1 and C--vitaminization produced normalizing action on the contents and distribution of glycogen in the liver. Orig. art. has: 4 figures. [Author's abstract]

[AM]

89.

AUTHOR: Gati, T.; Sos, J.; Zelles, T.; Keszler, P.

ORG: Institute of Pathophysiology, University Medical School, Budapest

TITLE: Vibrational hypertension of the rat

SOURCE: Academia scientiarum hungarica. Acta physiologica. Supplement to v. 32,1967. Abstracts of the lectures held on the First Joint Congress of the Hungarian Societies of Biochemistry, Biophysics and Physiology, Pecs, October 12 to 14, 1967, 82

TOPIC TAGS: blood pressure, biologic vibration effect

ABSTRACT: It has been established earlier that horizontal vibration lasting one hour with a frequency of 3 Hz and an amplitude of 28 mm induces hypertension in rats. Hypertension may be inhibited by previously administered regitine, and by ingesting potassium and magnesium, respectively. In recent experiments the effect of frequency and amplitude changes on the development of vibrational hypertension was examined. Vibration in all the experiments lasted one hour and was in a horizontal direction. In the case of frequencies of 2.5 Hz, and 8 Hz, the raising of the amplitude (5, 15, and 25 mm) proportionally increased the tensiogenic effect. Relying on comparative examinations of vibrational effects of identical amplitude and different frequencies, it was found that increasing the frequency also intensified the tensiogenic effect. Therefore, it may be established that both amplitude and frequency values are important factors in the development of vibrational hypertension. [Full text given] [KS] [WA-22]

SECTION 4. COMBINED FACTORS

90.

AUTHOR: Abaturova, Ye. A.; Antipov, V. V.; Davydov, B. I.; Demochkina, N. G.

ORG: none

TITLE: Change in certain biochemical indexes in animals subjected to acceleration after gamma irradiation

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 338-345

TOPIC TAGS: gamma irradiation, mouse, biologic acceleration effect, enzyme, radiation biochemical effect, carbohydrate metabolism, brain tissue, gastrointestinal tract

ABSTRACT: Tissue respiration, anaerobic glycolysis and certain enzyme systems in the stomach and intestinal tissues, in the brain, and in cardiac and skeletal muscle were studied, and their significance in the overall reaction of an organism to cosmic flight factors was considered. Studies were conducted on white mice (centrifuged 1 hr at 10 g) and on mice SBA (centrifuged 5 min at 40 g) 10 days after 700 r (18 r/min) gamma irradiation with Co-60. Brain, muscle, and small intestinal tissue respiration and anaerobic glycolysis (except of intestine), activity of alpha-glycerophosphate and succinate dehydrases, pepsin content of the stomach, and alkaline phosphate in the upper third of the intestine were determined. Data show the disturbances (caused by acceleration) in the carbohydrate metabolism are due to congestive manifestations expressed by accumulation of incompletely oxidized metabolites in the tissue, especially in the intestine and femural muscles. This is apparently also the cause of intensified oxygen absorption by the tissues immediately after centrifuging. There is a definite relationship in the observed changes of the respiratory coefficients: for several days after acceleration they are below the level immediately after acceleration. Succindehydrase activity was completely depressed at first, and then started to increase after 7 days. In 3 weeks it reached normal level in intestinal and femural muscle, and half the normal level in the brain. The rapid increase in glycolysis with insufficient tissue respiration is considered compensatory. The regulatory functions of the central nervous system concerning cardiac activity and skeletal musculature recovered rapidly, if disturbed. The depressed glycolysis and the incompleted recovery of brain tissue respiration 3 weeks after acceleration indicate disturbance of the carbohydrate metabolism in this period and intensification of lipid synthesis with accumulation of glycerin. Thus

the effect of acceleration gradually disturbs the carbohydrate metabolism of the organisms and the activity of certain gastrointestinal tract enzymes. These changes are caused to a substantial degree by disturbance of the regulatory function of the brain, first by the presence of protective inhibition, and then by depression of the oxidizing processes. The increased activities of the alkaline phosphatase in the small intestine and of the pepsin in the stomach on the background of irritation cause still greater disturbance of the regulatory function of the brain. Disturbances in brain tissue respiration were accompanied by disturbances in pepsin and alkaline phosphatase secretion. Orig. art. has: 4 tables.

91.

AUTHOR: Anashkin, O. D.

ORG: none

TITLE: Functional condition of the coagulatory system of dog blood after the 22-day flight on the Kosmos-110 biosatellite

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 26-30

TOPIC TAGS: blood coagulation system, space flight biologic effect, dog, biosatellite

ABSTRACT: Blood of the two dogs (Veterok and Ugolek) was tested 36 hr before launch and on the 1st, 5th, 9th, 26th, 60th, and 100th day after completion of the 22-day space flight on the Kosmos-110. A 0.1 M solution of sodium oxalate was used as an anti-coagulant. Results are listed in Table 1. During the first seven post-flight days animals were listless and tired easily. Both dogs showed a sharp drop in body weight. Sedimentation rate reached maximum value on the third post-flight day. The leucocyte count increased while erythrocyte count and hemoglobin diminished. Calcium, potassium, and phosporus increased in urine and dimished in blood. Enterokinase and alkaline phosphatase activity in feces increased. Capillary permeability was elevated in the post-flight period but returned to normal by the 30th day. Erythrocytes were found in urine and feces. Thromogenic

Table 1. Indeces of coagulatory system of the blood of Veterok and Ugolek in the post-flight period

Indicator	Norm M±σδ n=30	36 hours before flight		Post-flight day: 1-st		5-th		9-th		21-st		29-th		100-th	
		Vet.	Ugo.	Vet.	Ugo	Vet.	Ugo.	Vet.	Ugo.	Vet.	Ugo	Vet.	Ugo.	Vet.	Ugo.
1 Time of plasma recalcification (in sec)	76,4±24 $P<0,001$	98	80	62	60	64	65	61	54	—	63	80	85	90	80
2 Tolerance of blood to heparin (in sec)	90±17,5 $P<0,001$	105	90	75	60	75	60	75	60	—	75	90	90	90	90
3 Thromleoplastin time (in sec)	14,8±1,37 $P<0,001$	15	15	15	12	13	13	10	10	—	14	13	14	15	14
4 Prothrombin activity (in %)	100±7,12 $P<0,001$	100	100	100	133	115	115	150	150	—	106	115	106	100	106
5 Proaccelerin concentration (in %)	100±7,12 $P<0,001$	100	100	104	128	120	113	148	146	—	102	120	102	100	102
6 Thrombin time (in sec)	20±2,7 $P<0,001$	24	25	11	12	13	13	21	18	—	21	25	17	20	22
7 Free heparin (in sec)	7,9±1,6 $P<0,001$	8	7	1	2	2	3	8	1	—	7	10	8	10	9
8 Fibrinogen content (in mg %)	265±41 $P<0,001$	242	261	726	660	526	616	508	598	-	396	528	330	550	782
9 Fibrinolytic activity (in min)	176±15,63 $P<0,001$	240	270	120	60	30	90	45	90	--	121	90	120	90	90
10 Resistivity of thrombocytes (in %)	75±20 $P<0,001$	96	75	5,8	5	6,2	15	31	7	--	12	50	22	31	40

properties of the blood increased during the first nine post-flight days, while plasma recalcification time, thromoplastin time, and coagulation time diminished. Blood tolerance to heparin, prothrombin activity, and proaccelerin and fibrinogen content increased but free heparin content of plasma diminished. The increase of fibrinolytic activity of the plasma during the early post-flight period appears to be a defensive reaction to an increase of procoagulants in the blood. The changes noted in the coagulatory system of the blood may indicate a potential hazard of thrombic injury to internal organs. Orig. art. has: 2 tables. [BM]

92.

AUTHOR: Antipov, V. V.; Davydov, B. I.; Panchenkova, E. F.; Saksonov, P. P.; Chernov, G. A.

ORG: none

TITLE: State of organism reactivity under the complex action of certain cosmic flight factors

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 367-381

TOPIC TAGS: radiation sickness, biologic acceleration effect, biologic vibration effect, gamma irradiation, X ray irradiation, proton, irradiation, mouse, rat, dog, hematology, physiology, biochemistry

ABSTRACT: The effect of acceleration and vibration on the course and result of radiation sickness in animals was studied to try to determine possible means of changing the radiosensitivity of the organism under dynamic flight factors. Effects of subjecting mice, rats, or dogs to 8-10 g acceleration for 15-30 min, or of 60 min vibration at 70 or 700 cycles/sec at periods of 30 min, 4 hr, or 1 day before or after irradiation with gamma- or X-rays (400-900 r at 13-15 r/min) or high energy protons (660 Mev, 1300 rad) were evaluated by clinico-hematological, physiological, biochemical, morphological and cytogenetic methods. Analysis of experimental data showed the action of acceleration reduced radiation injury in mice and intensified certain radiation effects in rats and dogs. These modifications of radiation action are apparently due to change in organism reactivity to radiation effected by the action of acceleration, the effect depending on the type of animal. The radiation pathology in mice and rats subjected to vibration and irradiation was less pronounced than when subjected to radiation alone. This protective effect was manifested in reduced mortality, longer lifetime of animals lost (mice), and smaller reduction in the leukocyte content (dogs). In rats the radiobiological effects of the combined action of vibration and irradiation were more pronounced than in dogs. Thus vibration as well as acceleration change organism reactivity to the radiation factor differently depending on the animals. Examination of survival, average lifetime, dynamics of body, spleen, and thymus weight, hematological indexes and morphological studies of spleen and bone marrow showed vibration or acceleration before irradiation reduced radiation effects in 10 and 11 of the 17 indexes, while vibration and acceleration after irradiation intensified 6 and 8 of these indexes. Mechanisms for these reduced and intensified radiation injuries are discussed. The mechanisms of the modifying

action of vibration and acceleration on radiation injury are different. Dynamic flight factors significantly change organism reaction to ionizing radiation and must be considered in cosmic flight, e.g., by establishing permissible limits of radiation levels and working out means of antiradiation protection for the different biologic objects entering in the complex ecological system. Data on effects of acceleration and ionizing radiation was obtained together with N. I. Konnov. Data on effects of vibration and ionizing radiation was obtained in conjunction with T. S. L'vov. Orig. art. has: 5 figures and 6 tables.

93.

AUTHOR: Asyamolov, B. F.; Voskresenskiy, A. D.

ORG: none

TITLE: Effect of two-week immobilization in a plaster cast on the reaction of the cardiovascular system in dogs during orthostatic tests and the action of transverse accelerations

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 33-37

TOPIC TAGS: acceleration, hypodynamia, cardiovascular system

ABSTRACT: Female dogs weighing 6—12 kg were placed on the abdomen and immobilized for 14—16 days. From 10 to 14 days before immobilization, a catheter was introduced into the right auricle of 4 dogs anesthetized with morphine and hexenal; these animals were then subjected to 5 repeated orthostatic tests lasting up to 10 min with 5-min intervals during anesthesia and in the intact state (1—2 days after insertion of the catheter). Blood pressure was registered through the catheter, and EKG was registered on the 42-B Swedish Mingograf. Tolerance to increasing transverse acceleration on a 4.2-m radius centrifuge was determined in 6 dogs for 6—10 days before application, and on the day of removal of the cast. The dogs were immobilized so that the body was slightly elevated and its longitudinal axis formed a 78—80° angle with the vector of acceleration stress. Blood pressure was registered. Accelerations were increased by 1 G in 10 sec until the appearance of progressive bradycardia, which was evaluated by the coefficient of respiratory arrhythmia proposed by D. Yu. Arkhangel'skiy *et al*. Before hypodynamia, during orthostatic tests on the 4 anesthetized animals, blood pressure remained close to initial levels when the body was placed in a vertical position. After hypodynamia, the mean arterial pressure and pulse pressure were decreased. There was a slight increase in pulse rate both before and after hypodynamia in anesthetized dogs; this was more pronounced in unanesthetized animals. There was a hypertensive reaction

to orthostatic tests in 4 of the 6 dogs. After hypodynamia, arterial and pulse pressure increased and pulse rate decreased when the body was placed in a vertical position in 5 of 6 dogs. During acceleration, significant tachycardia and marked changes in blood pressure occurred in all dogs. Before hypodynamia, the maximum average pulse rate was 260/min; after hypodynamia it was 285/min. There was a rapid increase in blood pressure at the beginning of acceleration before and after hypodynamia. Pulse pressure increased significantly in some animals. When accelerations were increased to 5—7G's, there was a progressive decrease in pulse rate, and mean arterial pressure increased in some, and decreased in other animals. Pulse pressure decreased in all. After hypodynamia, the mean arterial pressure was lower during accelerations; the decrease in pulse pressure with increasing accelerations was more significant than before hypodynamia. It was concluded that the capacity of dogs to tolerate accelerations was not markedly affected by hypodynamia; this may be explained by the anatomo-physiological features of their cardiovascualr system. Orig. art. has: 1 figure and 1 table. [XF]

94.

AUTHOR: Chkhaidze, L. V.; Kolosov, I. A.; Lebedev, V. I.; Cherkirda, I. F.; Yeremin, A. V.; Burchuladze, A. D.; Stepantsov, V. I.

ORG: none

TITLE: Biomechanical features of simple human movements under weightlessness and acceleration

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 146-159

TOPIC TAGS: biomechanics, biologic weightlessness effect, biologic acceleration effect, muscle physiology

ABSTRACT: Changes in the coordinational structure of very simple hand movements upon changes in the gravitation field (0-2 g) were studied photographically in four young individuals by Bernshteyn's cyclogram method during weightlessness (20 sec) and overload of 1.8 to 2.2 units (10-12 sec); 3 fingers of each hand were provided with electric bulbs. Results were expressed graphically. The tests consisted in slow or

Component	Normal gravitational field	overload 2 units	weightlessness
Dynamic characteristic at maximum (in kg)			
Longitudinal force at the start of flexion (n γ)	0.4	0.2	0.2
Decelerating force at end of flexion (Δ)	0.3	0.2	0.2
Force at start of extension (ξ), vertical	0.9	0.3	0.6
Force at start of flexion (A)	1.3	2.4	0.3
Force at start of extension (B)	1.3	2.2	0.0
Reactive extension force (B")	0.5	2.2	0.2
Decelerating force at end of movement (C)	1.1	2.4	0.4
Kinetic characteristics at extreme (in m/sec)			
Longitudinal rate component	2.3	1.2	2.0
Vertically rate component	2.1	1.0	1.6

rapid flexion and extension of the empty or loaded hand (3 kg dumbbell). A total of 25 photos was taken. It was found that muscle force decreased by 50% for slow movements under weightlessness and involved lesser vertical force; thus a greater role was assumed by the longitudinal component of motion. There was greater contribution by the central nervous system in execution of motion, due to absence of automatized movements. Slow flexion and extension of the loaded hand differed from those at normal gravity not only by absolute values but also by sharper motion (corrective waves more pronounced). While rapid aimed extension at 1 unit was characterized by the appearance in the curve of 2 corrective guide waves at the start of extension. These were absent in weightlessness; thus the latter state probably facilitates such aimed motion. At overload of 1.8-2.2 units, customary motion is more difficult; thus more force was applied, and the vertical vector increased by over two-fold while the longitudinal component was somewhat decreased (inverse of weightlessness). Here again the central nervous system was highly involved. The rapid motion was more tense and condensed under overload, and the corrective waves at the beginning of extension more pronounced. Changes may be seen in the table. It was concluded that studies of motion under acceleration satisfactorily agreed with findings in weightlessness and confirm the usefulness of this experimental method. Orig. art. has: 6 figures and 1 table.

95.

AUTHOR: Gaydamakin, N. A.; Dobrov, N. N.; Yevepchuk, N. I.; Kozlov, V. A.; Kul'kin, S. G.

ORG: none

TITLE: Hematological and pathomorphological changes in animals under experimental conditions simulating effect on the organism of ionizing radiation and flight factors

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 346-355

TOPIC TAGS: morphology, ionizing radiation, ACTH, spleen, internal organ, radiation hematologic effect, flight simulation,space flight biologic effect, guinea pig

ABSTRACT: In this hematological and pathomorphological study of changes in animals caused by ionizing irradiation and flight, the response reaction of the blood system to flight was effected by administering 0.2 ml of ACTH 3 hrs before irradiation. The test guinea pigs were exposed 2 or 3 times to 25 r dosages at 15 day intervals and then to repeated 3 r irradiations at 14-35 day intervals. Hematological studies were made the day before irradiation and before ACTH administration, and 3 hrs, and 1 day after. Histological and pathomorphological examinations of sections of the spleen, lung, liver, stomach wall, and thigh and breastbone marrow were made over a period of 1.5 months after final irradiation. The hematological studies showed changes in the morphological composition of the animal blood were caused by the action of irradiation, by the combined action of irradiation and small doses of ACTH, and by ACTH alone. With the help of ACTH to simulate functional stress, functional changes were developed in the blood systems of animals previously subjected to 75 or 50 r irradiation followed by 3 r doses. The functional stress permitted determination of the dependence of blood reaction to even such low levels of irradiation. The changes in the group subjected to 75 r were more pronounced than in the 50 r group, and these changes (in level of leukopenia, lymphopenia, neutropenia, and increase in inversion of leukocytic and eosinophilic reaction to ACTH) were retained or even progressed with periodic 3 r irradiations. Under the experimental conditions the disturbed functions did not recover completely. Pathomorphological and neurohistological examinations revealed destruction of and reduction in the size of spleen follicles, blood filling, emphysema and collapse of the lungs and monotypic degenerative changes in the nerve system of the urinary bladder of the repeatedly irradiated animals. In cases when ACTH was administered before irradiation these changes, and the exhaustion of spleen follicle lymphocytes and disturbance of the gland metabolism, were less pronounced than in animals subjected to irradiation alone. Orig. art. has: 1 table.

96.

AUTHOR: Gaydamakin, N. A.; Petrukhin, V. G.; Antipov, V. V.; Saksonov, P. P.; Shashkov, V. S.

ORG: none

TITLE: Complex action of certain aspects of ionizing radiation and dynamic flight factors on the blood producing organs of mice

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 355-367

TOPIC TAGS: mouse, ionizing radiation biologic effect, biologic acceleration effect, vibration, biologic vibration effect, spleen, bone marrow, radiation sickness, hemodynamics

ABSTRACT: The dynamics of pathomorphological changes produced in the spleen and bone marrow of mice by the combined actions of penetrating radiation and vibration or acceleration were studied. Eleven series of experiments were run to study effects of proton (830-785 rad dosage at 400-600 rad/min) and gamma- (Co-60, 700 r dosage at 18 r/min) irradiation of animals subjected to 1 hr of 70 cycle/sec vibration, or to 30 min of 10 g acceleration 1 or 3 days before, or 3 or 5 days after the irradiation. Clinical manifestations of radiation sickness and pathomorphological changes in the blood-producing organs caused by the proton and the gamma irradiations were monotypic, but the degree of injury differed. With proton irradiation the destructive changes were less pronounced and recovery was faster--in 30 days the spleen and bone marrow structures were almost normal, while after gamma irradiation recovery was not effected in 30 days. The action of 1 hr of vibration caused a lack of lymphoid elements in the follicles in the spleen and destroyed a small part of the blood producing cells. The spleen recovered normal structure in 15 days; 30 and 60 days after vibration the myelopose of the spleen was intensified. In bone marrow, vibration caused venous congestion and blood effusion, which disappeared by the third day. Afterwards an increased amount of segmentonuclear granulocytes was observed in the bone marrow stroma. Isolated action of 10 g acceleration caused destructive changes less pronounced than in the case of vibration. The combined action of ionizing radiation with action of single vibration of acceleration changed the course of morphological changes in the spleen and marrow. Vibration 3 days after irradiation intensified destruction of spleen follicles and depletion of lymphocytes, although recovery of follicles was rapid. Injury of marrow in animals subjected to preliminary action of vibration was the same as caused by proton irradiation, but recovery in marrow blood

production occurred earlier, especially when vibration was only 1 day before irradiation. Action of vibration 3 days after irradiation accelerated destruction of spleen lymphoid tissue and retarded recovery. Injury of marrow was also intensified and recovery of its blood producing elements was less intense than after proton irradiation. Vibration 5 days after irradiation caused most serious injury of the blood producing organs, intensifying destruction of stroma and blood producing elements; recovery and cell composition was complicated by the appearance of necrosis sites. The action of acceleration before gamma irradiation reduced destruction of lymphocytes in follicles and speeded up recovery, while acceleration a day after irradiation did not cause any significant changes in comparison to the effect of irradiation alone. Thus vibration and acceleration caused qualitative differences in the morphological changes in the spleen and bone marrow. Acceleration disturbed erythroblastic growth in some animals. Hypoxia of the blood-producing organs developed from disturbance of their hemodynamics. Maturing of granulocytes in bone marrow was accelerated by vibration. The venous congestion and blood effusion caused by vibration also caused hypoxia and specific action manifested in an increase in the number of cells with chromosome changes. The difference in the mechanism of the action of the dynamic factors in blood-producing organs is caused by differences in the reactions of the spleen and bone marrow of irradiated animals to the action of vibration and acceleration. Orig. art. has: 6 figures.

97.

AUTHOR: Kitayev-Smyk, L. A.

ORG: none

TITLE: Visual illusions in man during weightlessness and under the combined effects of weightlessness and angular and Coriolis acceleration

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 180-188

TOPIC TAGS: biologic weightlessness effect, biologic acceleration effect, vision, visual analyzer, angular acceleration, Coriolis acceleration

ABSTRACT: A study was made of the effect on perception of two-dimensional figures of weightlessness, and weightlessness combined with linear, angular, and Coriolis accelerations. The tests were made during parabolic flights; angular and Coriolis accelerations were created by a special mechanized chair on board the airplane. Tests were made in the dark using illuminated figures, or in daylight with black-and-white figures. Twenty-eight men were each subjected to 6—30 periods of weightlessness in the course of the experimentation. The

subjects indicated appearance and duration of visual illusion by pressing a button. The following types of illusions were noted by the subjects: 1) increase in size of the entire figure; 2) illusory movement of the figure; 3) distortion; 4) change in intensity of the color of the entire figure or its parts; 5) appearance of a violet halo around the illuminated figure. The duration of these illusions varied, but they were stable and tended to recur. A greater number of stable illusions were noted in tests conducted in darkness than in daylight, and the most sharply expressed illusions were observed at the beginning of the first period of weightlessness. Also, the most notable and stable illusions occurred in naive subjects (i. e. previously unexposed to weightlessness) who had a pronounced sensation of falling during weightlessness, and who were most afraid. Six subjects were exposed to linear, angular, and Coriolis accelerations in addition to weightlessness; their reactions were all similar. Visual illusions disappeared during linear, vertically directed acceleration. Angular and Coriolis accelerations, however, tended to intensify illusions. The author proposes that these visual illusions are essentially of vestibular origin and proceed on the basis of central (possibly cortical) mechanisms regulating afferentation from gravireceptors and coordinating it with the visual analyzer system. There is, however, insufficient experimental work to allow these manifestations to be localized in the nervous system and their exact level to be defined.

[WA-22] [EL]

98.

AUTHOR: Kosmolinskiy, F. P.

ORG: none

TITLE: Effect of changed afferentation on the human body

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 59-68

TOPIC TAGS: sensory deprivation, physical exercise, biodynamics, psychological training, cabin environment

ABSTRACT: The author examines sensory deprivation as a sum of insufficient external and internal afferentation (the latter due to weightlessness and hypodynamia) and points out the stress occurring when excess afferentation suddenly replaces sensory deprivation, as may happen during special work assignments or emergency situations. He recommends physical exercise as a means of maintaining physiological tonus, work capacity, and psychical stability. He also suggests a pleasant interior arrangement of the cabin, use of drugs, and special self-control training, and speculates on the possibility of compensating for the functional atrophy of the muscular analyzer by intensified functioning of the visual and auditory analyzers. [EF]

99.

AUTHOR: Lazar', A. F.

ORG: Department of Roentgenology and Radiology /Head--Associate Professor N. F. Zarkevich/ and Department of Pathological Physiology /Head--Professor N. N. Zayko) Kiev Medical Institute

TITLE: Change in permeability of vessels, of blood sugar content, and of catecholamines in rabbits under the influence of X rays and radial acceleration

SOURCE: Meditsinskaya radiologiya, v. 13, no. 2, 1968, 84-86

TOPIC TAGS: rabbit, radiation sickness, x ray radiation biologic effect, biologic acceleration effect, catecholamine, blood pressure

ABSTRACT: Since radial acceleration at the time of irradiation can moderate the course of radiation sickness, and permeability of vessels is an important component of the hemorrhagic syndrome, it is desirable to discover the share of the sympathetic-adrenal system in the regulation of vessel permeability during isolated or combined irradiation and acceleration effect. Determinations of adrenaline (AD) and noradrenaline (NAD) and of blood sugar content were carried out on rabbits given 800 r irradiation in apparatus RUM-11 and radial acceleration with overloads of 4 and 10 g in a special centrifuge with dorsal-ventral alignment of overloads. Total vessel permeability was evaluated by removal time for half of the intravenously injected serum protein tagged with S^{35} methionine by the Sergeyev method; blood sugar by the Hagedorn-Jensen method. Catecholamine content in blood and organs of rabbits killed two days after treatment was examined by the Utevskiy-Osinskaya analytic fluorescence method. Resolving power of the fluoremeter was to 0.004 μg/ml AD and 0.008 μg/ml NAD. Permeability of vessels to protein increases two days after irradiation, protein half-removal time decreasing from the norm of 335 ± 2 min to 232 ± 31 min. Given 10 g acceleration for 5 min, rabbits reacted according to individual sensitivity: in some, permeability decreased or was unchanged; in others, it increased as after irradiation alone; but given only 4 g acceleration, vessel permeability decreased in all rabbits. A table shows catecholamine content in blood, brain, spleen and adrenals of rabbits in the norm and two days after 800 r irradiation with subsequent 4 g acceleration for 5 min: in the spleen NAD in μg % increased from 65.6 ± 11.8 (norm) to 177.0 ± 32.7 (irradiated) to 302.0 ± 52.6 (irradiated and accelerated); NAD, μg in organ was

1240, 1272 and 1770, respectively. While NAD in blood and brain, and AD in the adrenals, increased after irradiation alone, they were unchanged after irradiation plus acceleration. Change in blood sugar content can serve as an indirect indicator of the reaction of the sympathetic-adrenal system to irradiation and acceleration. There is no substantial change in blood sugar content within 30 min after start of irradiation, but if rabbits also receive 4 g acceleration directly after irradiation, a brief but significant increase occurs (from 80 to 123 mg %), returning to the initial level in the next 2 hr. The decrease, through radial acceleration, in radiation disease disturbances of vessel permeability is connected with the functional condition of the sympathetic-adrenal system. The significant adrenal weight increase after irradiation and especially after irradiation and acceleration, which is caused by hypertrophy of the cortical layer, confirms the value of corticosteroids in the regulation of vessel permeability. Hyperglucemia during acceleration effect is also connected with increased discharge of adrenal hormones into the blood. Orig. art. has: 1 table and 1 formula.

100.

AUTHOR: Mansurov, A. R.

ORG: none

TITLE: Effect of altitude and acceleration on the human organism; an x-ray investigation

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 286-289

TOPIC TAGS: flight physiology, altitude test, biologic acceleration effect, pulmonary physiology, cardiovascular system, x-ray investigation

ABSTRACT: The effect of repeated exposure to altitude and acceleration during a 1—7-yr period was investigated in 26 healthy professional flyers. X-rays made 10—25 min after the altitude test showed in 8 cases out of 9 an irregular contrast increase in the pulmonary picture, and in 7 cases out of 9 a transient enlargement of the heart due to hyperemia. Thirty minutes after the test, no such changes could be observed. However, extended and systematic exposure to the altitude factor can cause stable changes in the respiratory and circulatory systems. The X-rays of one subject exposed to the factor for 4 yr revealed changes characteristic of the initial stages of pulmonary fibrosis and emphysema. The author observed these results also

in his previous studies. Enlargement of the heart and vascular bundle was also observed in subjects exposed to the factor for 5 yr, although the heart function showed no significant changes. Transverse acceleration tests of 7—8 g in a chest-to-back direction for 1.5—5 min without, and for 5—10 min with anti-G suits, caused some functional and morphological changes which could not be observed 18 hr later. However, large and extended transverse accelerations produce shifts in pulmonary circulation, resulting in blood pooling, which can cause pulmonary edema and atelectasis. The combined effect of altitude and acceleration experienced for 2—3 yr caused some unstable contrast increase in the pulmonary x-ray. These results lead to the conclusion that a systematic exposure to the altitude factor for more than 4 yr can lead to pronounced morphological changes of the pulmonary tissue, characteristic of pulmonary fibrosis and emphysema. Orig. art. has: 1 table. [EF]

101.

AUTHOR: Mikhaylovskiy, G. P.; Dobronravova, N. N.; Kozar', M. I.; Korotayev, M. M.; Tsyganova, N. I.; Shilov, V. M.; Yakovleva, I. Ya.

ORG: none

TITLE: Change of general body resistance following 62 days of hypokinesia and acceleration

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 66-70

TOPIC TAGS: man, hypokinesia, biologic acceleration effect, natural immunity, phagocytosis, pulmonary disease

ABSTRACT: Six subjects were exposed to transverse acceleration (11.9-14.5 G) 6 and 12 days before confinement to 62 days of strict bedrest in a horizontal position. Three of these subjects performed physical exercises daily according to a special training program. All six subjects were on a 3,000-3,500 cal diet. Three of the subjects were exposed to rotation on a centrifuge (11.0-16.0 g) on the 1st and 18th days of bedrest, and three subjects were exposed on the 3rd and 50th days. Immunobiological reactivity of the body was based on properdin in the blood, phagocytic capacity of neutrophils, lysozyme activity of saliva, and bactericidal function of the skin. Properdin was determined by a modification of I. L. Chertkov

and N. L. Samoylinaya's method (1959). Phagocytic activity of neutrophils was studied in relation to *Staphylococcus* of the Lepin strain. Lysozyme activity of saliva was determined by N. N. Klemparskaya and O. G. Alekseyeva's method (1959). The indices were determined 1-2 times before, 3-6 times during, and 1-3 times after the experiment. Data show that prolonged hypokinesia combined with acceleration induces significant changes in general body resistance and immunobiological reactivity. Starting with the third week the protective properties of the body began to deteriorate. Depression of natural immunity indices was more pronounced in subjects who did not exercise, but the shifts were unidirectional for all six subjects. Clinical observations disclosed that during the experiment the subjects developed inflammatory diseases of a nonspecific etiology. Four subjects had acute catarrh of the upper respiratory passages and rhinopharyngitis, one subject had follicular angina, and one subject had acute peridontitis. In 1-1½ months following completion of the experiment, four subjects developed inflammatory diseases including thrombophlebitis, angina, catarrh of the upper respiratory passages, and furunculosis. A definite correlation was noted between lowering of body reactivity and development of disease. The index shifts indicate a breakdown of the regulatory mechanisms of nonspecific antibacterial protection. Though regular physical exercises do reduce the changes to a certain degree, immunoreactivity of the body is still seriously affected. This should be taken into consideration in developing protective measures for prolonged spaceflights and in selecting cosmonaut candidates. Orig. art. has: 6 tables. [06]

102.

AUTHOR: Nuzhdin, N. I. (Corresponding Member AN SSSR); Dozortseva, R. L.

ORG: none

TITLE: Influence of the combined effects of gamma radiation and space flight factors on barley seeds in different physiological states

SOURCE: AN SSSR. Otdeleniye obshchey biologii. Eksperimental'nyye raboty po vliyaniyu ioniziruyushchikh izlucheniy na organizm (Experimental studies on the effects of ionizing radiation on the organism) Moscow, Izd-vo "Nauka", 1967, 3-29

TOPIC TAGS: agriculture crop, barley, gamma radiation, ionizing radiation biologic effect, space flight biologic effect/(U) Voskhod 1 spacecraft

ABSTRACT: Irradiated and non-irradiated seeds of the spindle tree were sent into space on the spaceship Vostok-5. The combined reactions of radiation produced an increase in the percentage of damaged cells. These experiments showed the value of the use of seeds in experiments studying the genetic effects of space flight

factors (SFF). Further experiments were accomplished with orbital flight on the space ship Voskhod-1 using air-dried seeds of the barley, Wintering Moscow. This was obtained by A. T. Trukhinova from the summer grain crop of barley, Pallidum 32, specially grown to produce a stable form of wintering barley which characteristically enters a state of organic dormancy after maturation. The experiments were conducted on a mixture of two years' harvest (1963 and 1964). Seeds of the 1963 crop were stored in the laboratory for 14 months. At the time of the experiments they were in a state of forced dormancy. Seeds of the 1964 crop were kept for two months in a dormant state with 3% germination. A portion of both groups was irradiated with gamma-rays of Co-60 in doses of 10 and 15 kr and intensity of 231 r/min. Irradiated and non-irradiated seeds were divided into three groups: the experimental group, destined for flight in the space ship Voskhod-1 and two controls (I, seeds flown to the cosmodrome and back; and II, seeds stored in Moscow). Control I seeds were returned to Moscow after 7 days, experimental seeds after 9 days. Half of all seeds were soaked for 24 hrs in a 0.01 M solution of neutral cysteine. The remainder were soaked simultaneously in distilled water. Germination was carried out by placing seeds on moist filter paper at 22-4° and periodically moistening the paper with cysteine or water. Seeds of the 1964 harvest germinated in 7 days. When rootlets were 4-8 mm, they were fixed with acetic acid-alcohol (1:3) for 12-24 hrs and then transferred to 70° ethanol. After coloration by Fel'gen they were crushed on a microscope slide with Hoyer medium and examined. The highest percentage of germination was found in seeds in a state of emerging dormancy, while the lowest was in seeds put into orbit in the dormant state. Gamma-radiation without the influence of SFF did not raise the energy of seed germination and did not stimulate their emergence from dormancy, but SFF stimulated the germination of seeds pre-irradiated with gamma- rays. SFF stimulated the germination of seeds found in the dormant state independent of pre-irradiation and did not stimulate seeds in a state of forced dormancy, showing that the stimulating effect of SFF is probably not connected with the effect on the seeds of ionizing radiation. Cytological study of the meristimatic cells of the first rootlets showed that SFF led to an increase in the percentage of cells with chromosome aberrations. Soaking the cells in cysteine solution lowered the number of aberrant cells while it had no influence on the controls. With rootlets irradiated in the dormant state and germinating immediately the percentage of aberrant cells was 2-3 times lower than with rootlets which were stored before germination. SFF and ionizing radiation showed dissimilar influence on air-dried seeds. SFF caused chromosome damage only in cells emerging from the dorment state while ionizing radiation influenced cells of all categories of air-dried seeds. Chromosome damage differed in seeds spontaneously emerging from the dormant state and seeds in which emergence was artificially induced. Orig. art. has: 4 tables and 4 figures.

103.

AUTHOR: Parin, V. V.; Khazen, I. M.

ORG: none

TITLE: Structural and functional disturbances within some systems of the animal body in response to extreme exposures

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 5, 1967, 17-24

TOPIC TAGS: acceleration effect, biologic acceleration effect, hypoxia, physiologic stress, acceleration stress

ABSTRACT: Data is presented on structural and functional disturbances within some systems of the animal body when exposed to hypoxia, acceleration, and other stress factors. Structural disturbances occurring during acceleration depend not only on specific characterictics of the acting stimulus (dimension, duration, rate, direction, and so forth), but also on the functional condition of the organism itself. One of the first characteristic results of the acceleration effect is disruption of the permeablilty of the vascular walls. Acceleration causes a redistribution of the circulating volume of blood, a large part of which accumulates in those parts of the body or organ, which are exposed to maximal effect. Research results indicate that disruption of the condition of the organism during acceleration and hypoxia is equal to certain other extreme effects (for example, explosive decompression), and is considerably leveled during the multi-day interval between repeated effects. In tests using mice and dogs, conducted under realistic space flight conditions on board biosputniks, a decrease was noted in the concentration of serotonin in the blood of mice by 8-10 times and in dogs by 3.5-10 times in comparison with the control level (0.12-0.2 mcg/ml). By the tenth day of the flight the serotonin level normalized. During hypoxic conditions, irradiation, traumas, and other extreme effects, the histamine level in the tissues of the organism considerably increased. This data indicates that acceleration changes the internal medium of the organism. This is reflected by changes in the condition of the neural and neuro-endocrine mechanisms of the vegetative regulatory functions of the organism. Deviations in lipid metabolism indicate a new level of homeostatic reaction during acceleration. The results may also aid in understanding the mechanisms involved in the increase of the cholesterol level of the blood in flight crews following flights on new types of aircraft. Apparent changes in the tissue structure of different systems (particularly the digestive system), as well as changes in internal media were revealed. The disturbances are latent and can develop in spite of a satisfactory state of health, and the absence of significant changes in behavioral responses and rapid recovery of vital systems (central nervous, cardiovascular and respiratory systems), thus giving evidence for a good compensatory capability of the animal and human organism. The function of the nerve and glandular

apparatus of the digestive system can indicate the response of the organism to space flight stress factors and can help analyze the homeostatic mechanisms at different regulation levels. Apart from higher mechanisms of the cortical and subcortical levels, the adaptive system of auto regulation with an alternative structure appears to play a significant role. A proper theoretical approach makes it possible to predict the development of physiological processes and to control them, while maintaining homeostatic functions of man and providing his good health and performance. [LS]

104.

AUTHOR: Prives, M. G. (Head; Meritorious scientist; Professor); Kosourov, A. K.; Aleksina, A. A.

ORG: Department of Normal Anatomy / Head — Honored scientific worker Prof. M. G. Prives /, I Leningrad Medical Institute im. Academician I. P. Pavlov (Kafedra normal'noy anatomii I Leningradskogo meditsinskogo instituta)

TITLE: Effects of certain factors of high altitude flights on the structure of the vascular system

SOURCE: Arkhiv anatomii, gistologii i embriologii, v. 55, no. 7, 1968, 54-60

TOPIC TAGS: biologic acceleration effect, altitude test, acceleration centrifuge test, centrifuge training

ABSTRACT: X-rays were used to study the effect of repeated high altitude flights stress factors on the structure of the vascular system. Changes caused by repeated exposure of the same animal were observed over a prolonged period. Pelvic area x-rays were made of arteries in the rabbit and of lymphatic capillaries in the rat. In the half of the body subjected to greatest acceleration stress (caudal or cranial, depending on direction of acceleration) hyperemia was observed with considerable morphological changes in the vascular system (dilation of the main arteries of the limbs, tortuosity of the arterial trunk). Examination of the lymphatic system in living animals revealed an increased amount of engorged lymphatic vessels, enlargement of their lumina, and increased lymphatic nodes. Similar changes, on a larger scale, were found in post-mortem examination. The arterial system suffered greater changes than the lymphatic. The effect of hypokinesia on collateral lymph circulation was also studied. Hypokinesia caused a delay in restitution of the interrupted main lymphatic stream, long-lasting functioning of the collaterals, and hyperemia. Increased physical loading contributed to a more rapid development of collaterals. Preliminary training in the centrifuge prevented changes in the lymphatic system produced by gravitation overloading. The authors concluded that training under gravitation overloading was important for normalization of vascular system activity and its rapid adaptation to new conditions. Orig. art. has: 5 figures. [WA-22] [LS]

105.

AUTHOR: Zagryadskiy, V. P.; Sulimo-Samuyllo, Z. K.

ORG: none

TITLE: Change in the organism's resistance to acceleration after prolonged exposure to small concentrations of CO_2

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 234-241

TOPIC TAGS: acceleration effect, cabin environment, carbon dioxide toxicity, physiologic stress, environment test

ABSTRACT: Twenty-one rabbits were used as test subjects in the experimentation described in this article. Before being placed in an altered gas environment, the animals were subjected to accelerations of 4.5—7 G; the maximum period of exposure lasted 60 sec. The acceleration rate was 0.65—0.7 G/sec and the deceleration rate 1.3—1.5 G/sec. The rabbits were fitted into aluminum cradles shaped to their bodies, leaving only their heads free, and acceleration was in the back-chest direction. Before, during, and after rotation, EKG's were taken to measure the rate of respiration and cardiac contraction. Before and after accelerations, EEG's were taken with leads from the motor zone of the cortex (Sakhiulin's method). Restoration of functions after acceleration was observed for a period of 15 min. The rabbits were then placed in a chamber containing an increased concentration of CO_2 (3—5%) and remained there 5, 10, 24, 49, 96, 120, and 240 hours. Before being placed in the chamber and after being taken out, rectal temperature was taken and a blood sample was taken from the ear to determine the hemoglobin and leukocyte count. Fifteen minutes after being removed from the chamber, the animals were again subjected to acceleration. A group of rabbits which was exposed only to increased CO_2 concentration served as a control. The experimentation showed that functional changes are more pronounced when the animals are exposed to the altered gas medium. Some of the results were: inhibition in the brain's bioelectric activity, pronounced changes in the rates of respiration and cardiac contraction, changes in the EKG, rupture of the myocardium, and paresis and paralysis. These phenomena all attest to the fact that small concentrations of CO_2 can cause substantial functional changes in the organism during exposure to extreme forces. The authors state that it is still too soon to discuss the nature of the mechanisms which alter the activity of organisms exposed to CO_2. But it seems that inhibition of higher CNS activity, decrease in circulatory reserves resulting from cardiovascular changes, and inhibition of hormone activity and of the activity of oxidative enzyme systems will definitely result. But the very fact that there are such changes having such serious effects, indicates the necessity of thoroughly studying the immediate and long-range effects of any altered gas medium. The experiments have shown that the more prolonged the exposure, the better the organism can tolerate the altered medium.

Evidently, when the organism is better adjusted to the altered medium, when physiological functions have reached a relative stability, the shift is easier. This is why changes were significantly more pronounced in animals which spent 48—96 hours in the chamber than in the animals which remained there 120—240 hours. It is mentioned in a footnote in the article that all histological data were provided by Professor V. N. Kurkovskiy, Head of the Neurohistological Laboratory of the Institute of Neurosurgery im. Polenov. Orig. art. has: 2 figures and 1 table. [AC]

106.

AUTHOR: none

ORG: none

TITLE: How to overcome weightlessness

SOURCE: Trud, no. 257, 1 Nov. 68, p. 2, cols. 4—7.

TOPIC TAGS: hypodynamia, weightlessness, artificial gravity, centripetal acceleration, Coriolis force

ABSTRACT: Three series of experiments were conducted to investigate the possibilities of eliminating the effects of hypodynamia and weightlessness. The subjects were 8 healthy 23—36-yr-old men, and each experiment lasted 3 hr. In the first series, some effects of hypodynamia were reproduced by semi-rigid fixation of the subject on a special chair in a small chamber. In the second series, centripetal acceleration was applied, and in the third series, body movements imitating the movements of cosmonaut-operator during spacecraft rotation were added. The results produced by rest and muscular relaxation showed minimal functional shifts in the organism, but the dynamics of changes in the cardiovascular and respiratory systems was close to that of hypodynamia. The introduction of centripetal acceleration of hundredths or tenths of a G normalized external respiration and reduced some unfavorable shifts produced by hypodynamia. This result leads to the conclusion that centripetal acceleration can be used as a stimulant and stabilizer of some functions disrupted by weightlessness and hypodynamia. Introduction of Coriolis acceleration increased the statokinetic stability of the organism. These results suggest that complex accelerations of small magnitudes accompanying artificial gravity in actual spaceflight can favorably affect the vestibulo-sympathetic coordination system, thus maintaining a high-level work capacity in the cosmonaut. [WA-22] [EF]

SECTION 5. HYPODYNAMIA

107.

AUTHOR: Agadzhanyan, N. A.; Machinskiy, G. V.

ORG: none

TITLE: Effect of long-term hypokinesia on altitude tolerance in white rats

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 25-28

TOPIC TAGS: hypodynamia, hypoxia, altitude test, experiment animal

ABSTRACT: The effect of hypokinesia on altitude tolerance was studied in experiments with 20 male white rats. The animals were placed in a special facility with individual compartments. They were given a standard diet developed at the Institute of Nutrition of the Soviet Academy of Medical Sciences, and their water consumption was unlimited. The animals were divided into two groups and exposed to 10- and 25-day periods of hypokinesia. The weight control proved that the experimental animals weighed more than the controls until the 13–14th day, after which their weights remained steady, while those of the control animals increased. Altitude tolerance was tested in a pressure chamber where the simulated altitude was attained at a rate of 25 m/sec. During the effect of hypoxia, in some cases, electrocardiograms were recorded and rectal temperature was taken. According to N. A. Agadzhanyan and A. V. Sergiyenko, the drop in rectal temperature depends on the rate of ascent; at the maximum altitudes attained at a rate of 25 m/sec the temperature dropped 0.9°. The experiment showed that the tolerance of animals exposed to hypokinesia for 10 days differed very little from that of the controls, but the tolerance of animals exposed for 25 days was considerably lowered. The altitude at which convulsions developed was 2530 m lower in the 25-day animals than in the controls. Besides, the convulsions were less pronounced and the animals were apathetic and did not show agitation, which is normal in moderate hypoxia. The level of the altitude threshold was also 2707 m lower for the 25-day animals. This proves that long-term hypokinesia significantly reduces tolerance to hypoxia. Orig. art. has: 3 figures and 1 table. [EF]

108.

AUTHOR: Borkowska, Jolanta -- Borkovska, Ya. (Lublin); Tyburczyk, Wlodzimierz -- Tyburchik, V. (Lublin)

ORG: Laboratory of Biochemistry /headed by Dr. W. Tyburczyk/, Main Research Center/ headed by Professor Dr. J. Billewicz-Stankiewicz/, Institute of Industrial Medicine and Hygiene, Wsi /directed by Docent Dr. H. Rafalski/, Lublin (Pracownia Biochemii Zakladu Badan Podstawowych Instytutu Medycyny Pracy i Higieny Wsi)

TITLE: Influence of graded physical exercise on excretion of Donaggio-positive substances

SOURCE: Acta physiologica polonica, v. 19, no. 3, 1968, 345-350

TOPIC TAGS: industrial medicine, excretion, urine formation, physical medicine, animal experiment

ABSTRACT: In 9 male white Wistar rats, the relation between levels of urinary excretion of Donaggio-positive substances and the degree of physical exercise was studied. The animals were compelled to swim in a tank containing water (temperature 30—36°) for periods of 15, 30, 45, and 90 min. In 24-hour portions of urine from each rat, levels of creatinine and Donaggio-positive substances were determined by the test described by L. Roche. After 90 min of exercise, levels of hydroxyproline and total hexosamine contained in fractions precipitated with 95% ethanol were assayed in the urine hydrolysates. The Donaggio fatigue test gave positive results only after marked physical exertion. The increased levels of urinary mucoproteins giving a positive Donaggio test was accompanied by a rise in urinary levels of hydroxyproline and hexosamines, indicating that collagen is their source. Orig. art. has: 1 figure and 1 table. [Authors' abstract] [WA-22] [NT]

109.

AUTHOR: Buyanov, P. V.

ORG: none

TITLE: Change in cardiovascular activity and function of external respiration under the influence of prolonged limited movement (hypodynamia)

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 136-141

TOPIC TAGS: hypodynamia, space environment simulation, space flight biologic effect, cardiovascular system, respiratory physiology

ABSTRACT: Changes in the blood circulation, external respiration, and gas exchange were studied in 10 subjects in conditions of strict limitation of movement, and in 12 subjects in conditions of partial limitation of movement. Six subjects in the latter group were studied in conditions of barometric pressure equal to 5000—7000 m in the pressure chamber, but with normal sea-level pO_2. The results are shown in Table 1. The significance of the disorders of space flight is discussed. Changes in cardiovascular regulation and disorders of vascular tone can reduce the tolerance

Table 1

xf

Character of function disorder	Marked hypodynamia			Partial hypodynamia		
	No. times observed in 10 subjects	No. of days changes observed during course of hypodynamia		No. times observed in 12 subjects	No. of days changes observed during course of hypodynamia	
		2-5 days	8-12 days		3-10 days	30-60 days
1. Tachycardia at rest	7	2—3	3—5	7	1—4	5—8
2. Decreased arterial pressure	3	3—4	—	5	—	2—6
3. Increased arterial pressure	1	—	6	6	4	3—8
4. Decreased stroke volume (of heart)	3	—	5—8	4	2	2—5
5. Decreased elasticity of arteries	6	3—4	3—10	9	1—2	15—17
6. Decreased capacity for orthostatic test	7	3—5	4—10	9	2—6	15—30
7. Changes in capacity for graded physical stress	5	2—3	4—6	10	4—6	10—30
8. No hemodynamic changes noted	—			—		
9. Increased O_2 consumption & CO_2 production	3	2—3	—	3	2	5—8
10. Decreased O_2 consumption & CO_2 production	4	3	4—8	6	3—7	10—15
11. Increase in respiratory coefficient	4	2—4	3	4	3—5	5—10
12. Decrease in respiratory coefficient	2	—	3—5	2	—	4—6
13. No change in gas exchange noted	3			2		
14. Increase in minute volume of ventilation	2	2	2	2	—	3—6
15. Decrease in vital capacity or partial volumes of lungs	2	1—2	1—2	5	—	2—5
16. No changes in functions of external respiration noted	7			6		

to stresses which arise during changes in the flight trajectory and return to conditions of normal gravitation. It is imperative that measures be found to prevent the negative effects of hypodynamia and to maintain vascular tone on a sufficiently high level. Orig. art. has: 1 table. [XF]

110.

AUTHOR: Cherepakhin, M. A.

ORG: none

TITLE: Effect of prolonged bed rest on muscular tone and proprioceptive reflexes of healthy men

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 43-47

TOPIC TAGS: man, hypodynamia, muscle physiology, reflex activity

ABSTRACT: The 62-day experiment was carried out to study the effect of prolonged bed rest and physical exercises on the muscular tone and proprioceptive reflexes of man. One group of 6 men, age 22-36 yr, was subjected to complete bed rest with no physical exertion; effects of isolation and unpleasant hygienic conditions were kept at a minimum. Another group of test subjects performed physical exercises in the recumbent position for up to 2.5 hr /day at a rate of 1200 kgm/min. Food rations amounted to 3000-3500 kcal/day. Muscle tone was measured every 10 days with "Sirma" myotonometer. Proprioceptive reflexes were determined by a dynamotensometric hammer. Responses of the knees, of the mandibular, biceps, and triceps brachialis muscles, and of the Achilles reflexes were recorded on an oscillograph in the form of muscle bioelectric activity. Prolonged bed rest reduced the muscular tone in the test subjects, especially in those who performed no physical exercises. Weight loss occurred in the first 30 days in the immobile test subjects and in the first 20 days in those performing exercises; in the first group there was complete weight recovery by the end of the experiment, while in the second group recovery was only partial. Muscle strength in the men performing exercises increased 20% by the end of the test; in the other group it decreased 24%. The muscular tone decrease produced no effect on proprioceptive reflexes; their latent periods depended on the length of the reflex pathway: 5 msec for the mandibular and 34 msec for the Achilles reflexes. X-ray photometry indicated increased removal of calcium from the organism: 10.5-20.7% in the men not exercising, and 2-7% in the other group. Orig. art. has: 3 tables and 2 figures. [WA-22]

111.

AUTHOR: Cherepakhin, M. A.

ORG: none

TITLE: Normalization of physiologic functions under conditions of hypokinesia by performing physical exercises

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 37-42

TOPIC TAGS: man, hypokinesia, muscle physiology, acceleration protection, autonomic nervous system

ABSTRACT: Earlier experiments show that for persons performing daily physical exercises (90 min totaling 350 kcal) during twenty days of hypokinesia, resistance to acceleration and physical exertion remain at initial values, but orthostatic resistance and tone of postural musculature are reduced. To determine whether the latter are reduced due to insufficient volume and intensity of physical exercises, two experimental series were staged on six healthy males ages 22 to 36 yrs with a 62 day period of hypokinesia. In the first series the subjects were not allowed to get up, sit up or perform any physical exercises. In the second series conditions were the same, but subjects performed physical exercises in a horizontal position 15-30 min at 8 A.M. and 60-120 min at 4 P.M. During the first 30 days the duration of daily exercises gradually increased from 75 to 150 min; and, during the next 30 days the intensity of physical exercises gradually increased from 600 to 1200 kgm/min, with total amount of energy expended daily about 7.3 kcal/min. Resistance to acceleration was tested before and after the experiment. Following the 62 day period without any physical exercise, the strength indices of different muscle groups decreased by 14-24%, dynamic endurance was reduced by 26-55% and static endurance was reduced by 24%. Especially marked were the disturbances of the sympathetic system as expressed by tachycardia, pale skin and shortness of breath. Orthostatic resistance, acceleration resistance and salt-water metabolism were also affected. For persons performing daily physical exercise the strength indices for different muscle groups increased by 19-21%, dynamic endurance increased by 25-27% and static endurance increased by 20-30%. Thus, with a 150 min period of physical exercises daily, orthostatic resistance, static and dynamic endurance and acceleration resistance are higher. Exercises also favorable affect the mineral levels of the bones and the immunological properties of the body. In planning a program of physical exercises under conditions of hypokinesia, special attention should be paid to endurance exercises becuase this quality is affected first as reflected by sympathetic system disturbances and then by lowered physical work capacity. It is important to use static exercises to preserve resistance to acceleration, but the methods for their use require further study. Orig. art. has: 4 figures and 1 table.

112.

AUTHOR: Cherepakhin, M. A.

ORG: none

TITLE: Normalization of physiological functions under conditions of hypokinesia caused by a regime of motor activity

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967,. Materialy. Moscow, 1967, 69-70

TOPIC TAGS: hypodynamia, training exercise, endurance test

ABSTRACT: The purpose of this study was to analyze the effect of different methods of physical training on endurance during prolonged hypodymania to acceleration, physical stress, and orthostatic stress. Six healthy males (23—31 yr old) particated in an experiment lasting 62 days. There were two series of experiments run with three men taking part in each of the series. In the first series, the men were confined to strict bed rest. The second series was different in that the subjects performed physical exercises each morning from 15—45 min, and from 1—2 hr in the afternoon. The output of work was 600—1200 kg/m per min. The amount and intensity of work gradually was increased from the beginning to the end of the test. After the conclusion of the test, the subjects of the first series showed a decrease in muscular strength and endurance. Strength and endurance of the subjects of the second series did not change. The tests clearly demonstrate the positive effect of physical training on the subjects' endurance to orthostatic stresses, accelerations, and physical stress. [WA-22] [AC]

113.

AUTHOR: Dushkov, B. A.; Znachko, V. A.; Kozar', M. I.; Kosmolinskiy, F. P.; Zolotukhin, A. N.

ORG: none

TITLE: Change in the functional state of the human body in trials in chambers

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 118-127

TOPIC TAGS: hypodynamia, space environment simulation, space flight biologic effect

ABSTRACT: The article reports the effect of isolation in a small sealed chamber for periods lasting from 12 hr to 70 days (conditions simulating cosmic flight) on the higher nervous activity, motor and vegetative reactions, muscular strength, and the emotional state of eighty 24—38-yr-old healthy males. Room temperature was kept at 20—25°C. The experiments were done in the normal and altered regimens of 24-hr activity. Total sleep periods per diem ranged from 6—8 hr for all subjects. The functional state of the CNS was evaluated by determination of the critical frequency of flicker fusion, and mental work capacity was evaluated by verbal tests and problem solving. The "Shydir" spherical apparatus by F. P. Kosmolinskiy was used for integral determination of shifts in work capacity. Dynamometry and kinocyclography were used to evaluate muscular strength and to determine the effect of the experimental conditions on fatigue. Biochemical analyses consisted of determination of urine levels of ascorbic acid, 17-hydroxycorticosteroids, 17-ketosteroids, the urine light sedimentation reaction (Kimbarovskiy), and the content of lysozyme in the saliva. Analysis of the results indicated that there were changes in the neuroemotional sphere suggesting decreased emotional stability. There were changes in hormone metabolism indicative of a stress condition, especially in conditions of a marked change in the work and rest regimen. There was some decrease in the excitatory phase of the CNS. Mental efficiency decreased at the beginning of the experiment, stabilized during the 9—10th twenty-four-hour period, and decreased further towards the end of the experiment. There was a constant decrease in muscular strength in the sitting position from the beginning to the end of the experiment. While subjects were in the supine or horizontal position, muscular strength did not decrease, but had a tendency to increase. Lysozyme titers in the saliva decreased from 2 to 8 times during the course of the experiment, indicating decreased immunity. This was accompanied by increased levels of non-oxidized products in the urine. These phenomena are explained by hypodynamia. Orig. art. has: 5 figures. [XF]

114.

AUTHOR: Fedorov, I. V.; Milov, Yu. I.; Vinogradov, V. N.; Grishanina, L. A.

ORG: none

TITLE: Body weight and protein synthesis of animals with hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 22-24

TOPIC TAGS: rat, hypokinesia, protein synthesis, carbohydrate metabolism, muscle physiology, physiologic parameter

ABSTRACT: In experiments on 217 white male rats weighing 140-200 g the experimental animals were fed a fully balanced diet without limitation of water intake and subjected to hypokinesia for 15 days; control animals were kept under the same conditions, but not subjected to hypokinesia. Indices included body weight and the weight of the liver, right kidney, heart, testes and skeletal muscles. The glycogen level of the liver, total nitrogen level and proteolysis intensity of the skeletal muscle tissues were also determined. Proteolysis intensity was based on increase of nonprotein nitrogen in a skeletal muscle homogenate following incubation in a phosphate buffer for 20 hrs at 37°C. Residual and total nitrogen were determined according to the K'yeldal' method. Glycogen level was measured with the use of alanine-1-C-14 (50,000 pulses/min per 1 g body weight). Following the 15 day period the weight of control animals increased by 18%. In the experimental group 44 animals died after 3 days of hypokinesia and the rest of the animals displayed growth retardation and loss of body weight due to lowered interest in food and increased activity of adrenal glands (because hypokinesia acts as a stress factor). The body weight of experimental animals decreased by 16% after 15 days, and the difference between the weight of control and experimental animals was close to 34%. The absolute weight of the organs and skeletal muscles of experimental animals decreased, but the total nitrogen level in 1 g of moist skeletal muscle tissue was the same for control and experimental animals. Proteolysis intensity did not change after three days of hypokinesia, but increased slightly (figures are not statiscally reliable) after 15 days. In some experimental animals proteolysis intensity was lower than in controls. Following 15-18 days of hypokinesia, intensity of glycogenesis tended to increase, but the total glycogen level was sharply reduced by 89%. The authors conclude that retardation of growth and loss of body weight with 2-3 weeks of hypokinesia are related basically to metabolic change in the skeletal musculature as expressed by the reduced intensity of protein synthesis and slightly increased intensity of proteolysis. Orig. art. has: 3 tables.

115.

AUTHOR: Filatova, L. M.; Anashkin, O. D.

ORG: Institute of Medical-Biological Problems, Ministry of Public Health, SSSR, Moscow (Institut mediko-biologicheskikh problem Ministerstva zdravookhraneniya SSSR)

TITLE: Changes in blood coagulation during prolonged hypokinesia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 6, 1968, 36-39

TOPIC TAGS: hypokinesia, circulatory system, blood coagulation

ABSTRACT: The effect of 62-day hypodynamia on blood coagulation was studied in six healthy men, ages 24—36 yr. One group of three men was subjected to strict bedrest, while the other three followed a regime of static and dynamic exercises while remaining horizontal. A number of blood tests, chosen to give a complete picture of the status of the blood-clotting system in the subjects, were made before the experiment; and on days 8, 28, 46, and 56 of the study. The changes observed were consistent for all the subjects and apparently were not affected by the performance of the prescribed exercises. In all cases, coagulability was elevated on the eighth day. The coagulating property of the blood was least on the 28th day. The increased coagulability of the blood seen on the 8th day is interpreted as a stress reaction. These first days of immobility are most dangerous from the standpoint of thrombogenesis; after the 8th day fibrinolytic activity increases by 20—25%, thus lessening the danger of clot formation. The mechanisms of this change are not clearly understood and require further study; it is possible, however, that during hypokinesia, change in arteriole tonus leads to increased fibrinolytic activity. [WA-22] [EL]

116.

AUTHOR: Georgiyevskiy, V. S.; Kakurin, L. I.; Mikhaylov, V. M.

ORG: none

TITLE: Reaction of the human cardiovascular system to a sixty-two-day restriction of muscular activity

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 22-23

TOPIC TAGS: hypodynamia, cardiovascular system

ABSTRACT: Since the cardiovascular system is the first to reach its functional limits under the effect of intense muscular activity and acceleration stress, its reactions to 62-day hypodynamia were investigated. In order to approximate the circulatory condition to that during weightlessness, the hydrostatic component of the blood pressure was reduced by constant horizontal position. Three subjects observed bed rest under severe restriction of motor activity, while another three (control group) did exercises without altering the horizontal position. After 56 days, a reduction of the absolute duration of the asynchronous contraction, expulsion, mechanical, electrical, and electromechanical systole phases was observed in both groups. In the experimental group, an increase of pulse rate, of stroke and minute volume, and a slight increase of the mean hemodynamic and pulse arterial pressure were also noted. The expulsion period increasingly shortened until the 42nd day when it stabilized; the pulse rate and the mean hemodynamic arterial pressure constantly increased during the experiment; and the increase of the stroke and minute volume became clearly apparent after the end of the experiment. These data indicate functional shifts and detraining of the cardiovascular system caused by restriction of muscular activity and altered distribution of blood in horizontal position. [WA-22] [EF]

117.

AUTHOR: Georgiyevskiy, V. S.; Mikhaylov, V. M.

ORG: none

TITLE: Effect of hypokinesia on blood circulation in man

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 48-51

TOPIC TAGS: hypodynamia, blood circulation

ABSTRACT: Two experimental groups of three young men (20—35 yr) each were subjected to bed rest (group I — 20 days; group II — 62 days) preceded and followed by centrifugation; the effects of this regime on circulation were studied by mechanocardiography and polycardiography. The compensatory capability of the cardiovascular (CV) system was determined by orthostatic tests. The CV shifts observed were unidirectional in all cases. Pulse rate increased throughout the experiment and the length of the cardiac expulsion period decreased. Blood pressure at first decreased, then equalled and eventually exceeded initial values. During orthostatic tests following hypodynamia, however, sharply lowered blood pressure, accompanied by other CV shifts, resulted in syncope in some cases. There was evidence of a phasic pattern in the CV shifts observed, with maximum changes being observed on days 32—42. The contractile function of the myocardium is evidently not affected by this regime, although changes are observed in extracardiac regulation of the heart and in arterial tonus. Differential analysis will be necessary to distinguish changes in hemodynamic indices resulting from hypokinesia from those resulting from decreased hydrostatic pressure. This will be the subject of the authors' next study. Along these lines, it was observed that three subjects who underwent 62-day bed rest combined with physical loading fared somewhat better in the orthostatic tests. Orig. art. has: 1 table.
[WA-22] [EL]

118.

AUTHOR: Iseyev, L. R.; Katkovskiy, B. S.

ORG: none

TITLE: Similarity of changes in the oxygen balance of man, caused by bed rest and confinement in a sealed chamber

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 62-72

TOPIC TAGS: oxidative metabolism, hypodynamia, isolation chamber, training exercise, fatigue test

ABSTRACT: Changes in the oxygen balance during physical work in men exposed to hypokinesia and to confinement in sealed chambers were investigated experimentally. Two groups of 21—32-yr-old men (4 in each group) spent 20 days in bed. The first group had to observe complete rest, while the subjects of the second group performed physical exercises equal to 330 Kcal/day, in a horizontal position. Before and after the experiment, the oxygen balance of the subjects was studied in a test which consisted of walking up and down one hundred 25-cm steps. An increase of oxygen requirement and oxygen debt, and a decrease of the restoration coefficient and efficiency were observed in subjects of the first group after the experiment. Ten days later, the oxygen requirement and the efficiency reached their normal values, while the oxygen debt (in 3 subjects) still exceeded the initial by 8.5—20.2% and the restoration coefficient was not normalized. In subjects of the second group no significant deviations from the initial values were observed, thus indicating that the exercises performed by the second group counterbalanced the effect of hypokinesia. In another experiment, 5 healthy 19—32-yr-old men, previously trained in veloergometer exercises which served as a test, were confined for 4 months in a sealed chamber. A progressive increase of oxygen consumption, oxygen requirement, and restoration time was observed. During the fourth month, the condition of the subjects improved due to the introduction of such measures as physical exercises, UV-irradiation, additional vitamins, and air purification. These results prove that changes caused by hypokinesia and confinement in the oxygen balance of man are of the same trend, and that the main cause in both cases is hypokinesia, although the confinement experiment also shows effects of some associated factors. The observed deviations should be considered in the planning of work-rest and alimentation schedules for cosmonauts, as well as in the arrangement of life-support systems for spacecraft and especially for extravehicular space suits. It is also obvious that physical exercise is indispensable for satisfactory physical condition during spaceflights. Orig. art. has: 4 tables. [EF]

119.

AUTHOR: Iseyev, L. R.; Nefedov, Yu. G.

ORG: none

TITLE: Tolerance for physical stress during 4-month confinement

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 42-46

TOPIC TAGS: cabin environment, confinement, hypodynamia, test method, physiologic stress, human physiology, physical fitness

ABSTRACT: The reactions of the organism to a 4-month confinement in a hermetically sealed chamber were studied by means of functional tests performed on a veloergometer. The first test consisted of three 5-min periods of easy (250 kg/min), medium (500 kg/min), and difficult (750 kg/min) exercises. The second test consisted of five 5-min periods of 500 kg/min exercises with 1 min breaks between them, excepting the break after the first period, which lasted until the oxygen shortage disappeared. The magnitude of the stress was controlled by the veloergometer, and the rhythm (60 rpm) was indicated by a flashing lamp. During the functional tests the parameters of external respiration were recorded on the "Belau" apparatus, while circulatory indices and cerebral biopotentials were recorded on an "Alvar" apparatus. Thermistors were used to measure the skin temperature. The magnitudes and the times of heat emission were determined by N. K. Vitte's method which, correlated with the gas exchange parameters indicating heat production, permitted evaluation of heat balance at rest and exercise. The subjects were 5 healthy males, 19-32 yr old. The temperature in the cabin was 22-25°, the relative humidity 47-51%, the oxygen content 19-25%, and the carbon dioxide content 0.2-0.8%. The experiment was preceded by a 4-week training period. During training, an increase in efficiency and normalization of the reactions were observed. During the experiment a progressive decline became evident. Oxygen consumption, oxygen requirement, and recovery time increased. A condiserable negative heat balance, observed during the training period, decreased during easy exercises and became positive during medium and difficult exercises; this indicated a tendency to heat accumulation and overheating of the organism. The pulse rate reached 214 during difficult exercises, did not return to the initial value for a long time, and was still 14.3% higher when the oxygen shortage disappeared. This reaction to muscular activity indicated a possible change in the mechanism regulating the respiratory and circulatory systems. Reduced tolerance to physical stress was apparently a result of asthenia due to relative

hypodynamia, isolation from habitual activities, and prolonged exposure to specific factors of a hermetically sealed chamber. During the second, and especially the third month, the condition was aggravated. The intensity of the α-rhythm also decreased, indicating a generally rundown condition. The oxygen requirement during the second test rose from 33.6 to 44.3 l. The pronounced increase in oxygen consumption in each 5-min period of the second test can be explained by the impairment of movement coordination and involvement of additional muscle groups in the performance, which is a symptom of efficiency decrease. Parameters of several systems of the organism increased inadequately. The daily loss of energy oscillated between 2433 and 4536 kcal, notwithstanding the reduced physical activity. During the fourth month, measures were taken to improve the condition of the subjects: additional decontamination of the cabin air, UV-irradiation of the skin, more frequent washing, more vitamins in the food, and additional physical exercises. The gas exchange parameters and EEG improved. The special set of exercises contributed to the improvement of the general condition of the subjects, to the normalization of sleep, stabilization of weight, and readaptation to normal conditions after the experiment. It is interesting that even during pronounced asthenia the α-rhythm attained highest intensity after difficult exercises, which indicates that physical exertion contributes to the balance of neural processes. During the first month after the experiment the parameters of external respiration returned to their initial values. The results obtained should be considered in the design of work and rest schedules, diets, life support systems, and extravehicular space suits. Orig. art. has: 3 figures and 1 table. [EF]

120.

AUTHOR: Kakurin, L. I.

ORG: none

TITLE: Effect of prolonged hypokinesia on the human organism, and the hypokinetic component of weightlessness

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 59-63

TOPIC TAGS: space flight simulation, man, hypodynamia, physical training, physical fitness, physiologic parameter, space medicine

ABSTRACT: In a test simulating weightlessness, six young men, divided in two groups, were kept in bed uninterruptedly in a close to horizontal position for 62 days. The first group performed physical exercises involving most muscle groups with daily energy expenditures of 700-800 kcal in the first 15-20 days, increasing to 1100-1200 kcal toward the 20th day; 1200 kcal was the upper limit. The second group remained inactive. Post-experimental results showed reduced capacity for physical work (by 43.4%) in the second group, as against a 4% increase in those subjected to training. Acceleration tests revealed decreased tolerance (by 2 units) in non-trained individuals while tolerance remained unchanged in the trained group; this also referred to values for upright position, physiologic tremor and cortical bioelectric activity. Circulatory tests confirmed the positive effect of training. In immunologic resistance tests, a lesser decrease in phagocytic activity of blood neutrophils, and of skin bactericidal capacity was found in the trained group. With respect to diuretic processes, no polyuria was observed under physical training in the first two weeks; towards the 30-40th day, both urinary output and water requirements increased, and urinary volume exceeded fluid consumption towards the end. Hypokinesia caused reduced diuresis in the first 5-14 days, followed by signs of dehydration. Polyuria was accompanied by higher electrolyte elimination. Signs of osteoporosis, detected under x-ray, were more pronounced in the hypodynamic group. Calcium reduction in the bones led to its increase in blood serum. It was concluded that these results, while only part of the broad clinical physiologic 2-month observations, reveal the development of a complex of disturbances characterizing the syndrome of hypokinesia. Physical training had a positive effect but failed to prevent dehydration, the increase in electrolyte excretion, maintenance of mineral saturation in bones, full muscle tone, and increase in pulse rate and systolic volume at rest. It should also be considered that this model involved only one factor of daily work, its intensity. Since both horizontal position and weightlessness fail to permit an activation of the locomotor apparatus comparative to that in motion under gravity, maintenance of the working capacity of an astronaut crew would require the application not only of physical but also of pharmacologic means. Orig. art. has: 1 figure.

121.

AUTHOR: Karpova, L. I.

ORG: none

TITLE: Research on motor activity in man in conditions of hypodynamia and increased content of CO_2

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 152-156

TOPIC TAGS: space environment simulation, space flight biologic effect, hypodynamia

ABSTRACT: The article reports the effect of 6 different regimens of motor activity and respiratory gymnastics designed by S. G. Zharov on coordination of movement, on the dynamics of exertion, on change in the general resistance, resistance to static forces, strength of different muscle groups and precision and efficiency of movement in human subjects in a sealed chamber with a useful capacity between 5 and 6 m^3. The 6 different regimens were carried out in the course of four 30-day hypodynamia experiments, using a total of 7 subjects. Temperature within the chamber was 20±20° C, humidity was 40—60%, O_2 content was 19—22%, and CO_2 was 8.2—16.7 mm Hg. Maximum muscle strength determined by polydynamometry was equal to or exceeded initial values in the majority of cases after the exercises. There was improvement in static resistance of the muscles, which was determined by the maximum time certain static positions could be maintained by the subjects. There was also improvement in joint motion, which was demonstrated with the H—102 gonio-oscillograph. The exercise program also produced improvement in movement coordination and in execution of problems requiring expenditure of a precise amount of energy; this was demonstrated by vector-dynamography and vector-stabilography. The exercises prevented negative changes in the neuromuscular apparatus; this was determined by electromyography on muscles of the upper arm, upper and lower leg, the masticatory muscles, and the trapezius muscle. Physical exercises prescribed in the experiments restored blood O_2 levels to normal after hypoxemia induced by breath-holding. The O—38 oximeter was used to determine blood O_2. [XF]

122.

AUTHOR: Katkovskiy, B. S.; Pilyavskiy, O. A.

ORG: none

TITLE: Effect of prolonged hypokinesia on human resistance to physical labor

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 32-33

TOPIC TAGS: hypokinesia, circadian cycle, performance test

ABSTRACT: The purpose of this experiment was to study human physical work capacity after prolonged confinement to bed with varying motor activity. Six young healthy males participated; three of them were under strict confinement to bed with limited motor activity and the remaining three performed exercises in bed without leaving the horizontal position. The general caloric value by the end of the experiment was 1000 Kcal/day (M. A. Cherepakhin's data). In order to evaluate human work capacity and the circulatory system's adaptation to physical labor, two tests were used: 1) a measured physical load of average intensity on an ergometer (500 kg-m/min for a period of 8 min), and 2) a continually increasing physical load with a discrete augmentation of 200 kg-m/min from a starting level of 600 kg-m/min. The exercise or stress was continued until the subject could no longer perform the work. After 62 days of confinement to bed, the pulse reaction to measured physical stress of the subjects whose motor activity had been limited, sharply increased. The periods of "getting-into" the work, or warming-up, and of recovery to normalcy also took longer. For example, on the first day after the period of bed rest was terminated, the pulse rate stroke volume during an 8-min work period increased 18% in comparison with the initial value. There was practically no increase in pulse frequency during this work period. Cardiac contractions for a 5-min restoration period after physical work increased 26% and for a 10-min period increased 34%, with a corresponding increment increase of 45 and 55%. Pulse frequency, in a state of rest after the experiment, increased by 18%. During the same test on subjects who had performed physical exercise during bed rest, processes of "warming-up" and restoration did not change or even become worse, but the pulse reaction to work was even less pronounced. Cardiac contractions in these subjects in an 8-min work period decreased on an average of 13% and the increment decreased by 15%. Cardiac contractions for 5- and 10-min periods of restoration practically did not change (there was an increase of 2 and 3%, respectively) and an increment growth of 13 and 20%. On the second day after bed rest, the amount of work performed by the first group decreased 40%. In equal work conditions, pulse frequency in the first group after the experiment was significantly higher. Two subjects in the second group performed 10% more work than in the initial tests. A third subject performed 9% less. On the average, the group performed 4% more work. The results confirm that intensive physical training does maintain organism tolerance to physical work even after prolonged bed rest. [WA-22] [AC]

123.

AUTHOR: Korobkov, A.V.; Dushkov, B.A.

ORIG: none

TITLE: Significance of muscular activity for the conservation of motor function

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 148-159

TOPIC TAGS: physiologic stress, physiologic training, biologic rhythm, adaptation, psychophysiology

ABSTRACT: The authors point out the role of stability of motor function in the development of several mental, physiological, and biochemical processes, and the importance of physical training for better adaptation to environmental changes (altered gas mixture, temperature, radiation), and for compensation of the injurious effects of spaceflight factors. Muscular weakness and even degeneration caused by weightlessness, and decrease of motor coordination and general resistance caused by hypodynamia, should be prevented by adequate physical exercises. The exercises should also improve emotional condition and adaptation to prescribed work and rest schedules. The selection and organization of the exercises should be based on the characteristics of cosmonaut's activities, and on the spaceflight-conditioned changes of physiological mechanisms. The physical exercises should be divided in several short periods and performed during work and rest periods. Various types of exercises (inertial, isometric, relaxational, and exercises with an expander, weights, and velocrgometer) applied during prolongned hypodynamia and altered daily rhythm experiments caused increase of muscular force and maintained work capacity at a high level. [EF]

124.

AUTHOR: Korobkov, A. V.; Ioffe, L. A.; Abrikosova, M. A.; Stoyda, Yu. M.

ORG: none

TITLE: Dynamics of orthostatic resistance in athletes subjected to 40-day hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 33-40

TOPIC TAGS: hypodynamia, physical fitness, space medicine

ABSTRACT: The effects of 40-day hypodynamia on the cardiovascular system were studied in ten highly trained athletes — five middle- and long-distance runners, and five weightlifters. The subjects underwent orthostatic tests following hypodynamia. A variety of cardiovascular shifts were observed, with sympathetic effects predominating. Ventricular filling decreased due to deterioration of the functional state of the venous system resulting from accumulation of blood in the extremities. The performance of the weightlifters in the orthostatic tests was notably better than that of the runners, leading to the conclusion that the type of physical training to which weightlifters are exposed increases tolerance to hypodynamia. The observed shifts were reversible, and in all cases normalization occurred within 2—3 days. Orig. art. has: 2 figures and 3 tables. [WA-22] [EL]

125.

AUTHOR: Korobova, A. A.; Vinichenko, Yu. B.

ORG: none

TITLE: Dynamics of diurnal diuresis, creatinine excretion, and mean thickness of the skin fatty layer in athletes during long term hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 40-43

TOPIC TAGS: man, diurnal variation, urine formation, skin physiology, creatinine, hypodynamia

ABSTRACT: Dynamics of diurnal diuresis, creatinine excretion, and mean thickness of the skin fatty layer in male weight lifters and runners was studied during 40-day hypokinesia. The daily food intake contained 2800-3000 cal, 80 mg protein. Liquid requirement did not exceed the physiological norm of 2.5 l/day. The diurnal diuresis was determined volumetrically with an accuracy of 1 ml; creatinine was determined photoelectrocolorimetrically (blue filter in cuvette 5.090 in the photoelectrocolorimeter); the mean thickness of the fatty layer was determined from standard caliper measurements.

Individual coefficients of variation in diurnal creatinine excretion varied from 13.06-43.29%; group average over the 40-day period was 29.27%. In weight lifters the excretion level was slightly higher than in runners (3.03 vs 2.87 g/day). During the mid-period of the test, the amount of creatinine decreased slightly in most of the men, and increased again somewhat toward the end of the test. In most cases the diuresis level was reduced (1.3-14.3%; average 4.6%) in the second half of the experiment. The mean thickness of the skin fatty layer increased regardless of the individual's weight changes. The small fluctuations in the creatinine excretion and the increase in the mean thickness of the skin fatty layer indicate a reduction of protein synthesis, intensification of the decomposition processes, and replacement of a portion of the muscular tissue with fatty tissue. The decrease in the diurnal diuresis by the end of the experiment may be due to a changed level of fatty metabolism, since limited motor activity results in reduction of oxidation processes and consequent reduction in the hydrolysis of the fats. The hemodynamic factor also contributes: prolonged horizontal position causes compensating reduction in arterial pressure and volume of circulating blood, cutting down on reflex inhibition of antidiuretic hormone discharge, and correspondingly reducing amount of diuresis. Orig. art. has: 4 tables. [WA-22]

126.

AUTHOR: Kravchuk. L. A.; Ovechkin, V. G.

ORG: none

TITLE: Effect of barbamyl and somatotropic hormone on mice under long-term hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 7-12

TOPIC TAGS: white mouse, somatotrophic hormone, hypodynamia, sleep, sleep research, isolation test

ABSTRACT: Studies on the effect of soporific drugs were conducted in preparation for modeling spaceflight factors. The effect of barbamyl by itself, and in conjunction with somatotropic hormone on white mice under normal, isolated, and hypokinetic conditions (mechanical immobilization) was investigated for 37 days. Food and water requirements, behavioral dynamics, weight changes, mortality rate, orthostatic tolerance (electrocardiograms and pneumograms were obtained on the 30th day), and sensitivity to barbamyl (on the 35th day) were determined. The mean effective dose ED_{50} of barbamyl, the

time of sleep onset, and its duration were determined for barbamyl alone, and for barbamyl injected 2-8 hr after intraperitoneal injection of 0.5 mg of human somatotropic hormone (extracted from human hypophysis). The isolated and immobilized animals showed increased irritation and aggressiveness after a week, and some adaptation in 7-10 days, but they were still more irritable than the control animals throughout the experiment. The immobilized animals required the least food; the isolated animals, the most water. Mortality rate among the control, isolated, and immobilized animals was 3.3, 10, and 33%, respectively (in the last group 1/3 died of pneumonia). Orthostatic tests showed that the largest spread in pulse and respiration rate fluctuations, with pulse increasing as respiration decreased, was in the control animals. The fluctuations were much less pronounced in the test animals: long-term isolation and hypokinesia cause changes in the functional state of the cardiovascular and respiratory systems. The initial stimulant effect of barbamyl in the isolatated animals appeared earlier and was more intense and longer than in the controls; sleep onset was later and sleep was longer; ED_{50} was increased 1.1-1.4 times. In the immobilized animals the effect of barbamyl developed more rapidly and strongly than in the isolated animals; length of sleep was shorter; ED_{50} was unchanged. Preliminary administration of somatotropic hormone caused little change in the ED_{50} of barbamyl in the control or test animals, and the length of sleep in the isolated animals was essentially unchanged; but in the immobilized animals length of sleep was doubled, and in the controls it was prolonged 3-4 times. Thus the somatotropic hormone changes the functional state of the central nervous system, lowering its stimulation. The somatotropic hormone and barbamyl appear to act synergistically on the central nervous system. The possibility of using somatotropic hormone in conjunction with soporifics to intensify the effect of the latter needs clinical evaluation. Orig art. has: 3 figures. [WA-22]

127.

AUTHOR: Krutova, Ye. M.

ORG: none

TITLE: Dynamics of mental work capacity during hypodynamia, confinement, and exposure to high temperature in a sealed chamber.
SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 137-147

TOPIC TAGS: confinement, temperature chamber, physiologic fatigue

ABSTRACT: The present study reveals the effects of partial movement and sensory limitation, and also of elevated temperature and humidity in a small cabin on mental work capacity and such mental functions as thinking, memory, and concentration. Partial movement and sensory limitation at normal room temperature caused slowness in thinking processes and decrease in concentration and work capacity. Effects on memory varied with individuals. Experiments in a cabin with increased temperature showed a significant decline of working capacity, concentration, and memory functions, and a considerable slowness of thinking proceses. These effects increased in direct proportion to the duration of the experiment. [EF]

128.

AUTHOR: Panferova, N. Ye.; Tishler, V. A.

ORG: none

TITLE: Arterial tone in relation to limited muscular activity in man

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 56-62

TOPIC TAGS: man, blood circulation, hypodynamia

ABSTRACT: The dynamics of some of the indices characterizing arterial tone prior to, during, and following the 5-20-day exposure of 16 test subjects to relative physiological rest (chair or bed rest) were determined in this examination of the effect of hypodynamia on the functional state of the human vascular system. Recordings were made of the velocity of the pulse wave distribution in the aorta and vessels of the arm and leg; of the calibrated pulse amplitude of vessels of the II and IV fingers and toes (mm^3); of the skin temperature of the chest, forehead, back of the hand, foot, and front part of the shin (room temperature constant at 22-23°C). Before and after the experiment the test subjects underwent 15-10-

min tilt table (85°) orthostatic tests during which time the above indices were also recorded. The pulse wave distribution of the aorta remained unchanged, increased slightly in the arm vessels (0.5-1 m/sec), and considerably in the leg vessels (2-4.5 m/sec); the original level was recovered gradually after the test. During hypodynamia the pulse amplitude of the fingers was slightly lower, and that of the toes decreased 4-7 times during the first four days, and then stabilized; recovery was not complete in 5 days. There were no temperature changes of the chest and forehead; hands were slightly warmer, feet slightly colder. In the orthostatic tests the indices shifted in the same directions before and after hypodynamia; the shifts were somewhat more pronounced in the latter. Thus changes in the vascular system under hypodynamia are not the same; there is a significant selective effect, increasing constriction of vessels of the lower extremities (including skin arterioles) and a narrowing down of the functional adaptation range of the arteries of the lower extremities. The tone of the aorta and arm vessels remained practically unchanged. Orig. art. has: 1 table and 3 figures. [WA-22]

129.

AUTHOR: Panferova, N. Ye.; Tishler, V. A.; Popova, T. G.

ORG: none

TITLE: Effect of prolonged limited muscular activity on the dynamics of cardiac contractions in man

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 75-78

TOPIC TAGS: cosmonaut, cardiovascular system, reflex activity, adaptive pattern recognition

ABSTRACT: The 15 experimental subjects were kept in an easy chair for 5-20 days; the contours of the chair provided for support of joints at certain angles. In this posture, the individuals periodically performed complex physical tasks to maintain muscle tone and prevent pain in the joints. EKG's were taken and the following indices calculated before and after tests: intrasystolic, myocardial tension, initial rate of increase in intraventricular pressure, mean rate of ventricular evacuation and electromechanical difference, i.e. the difference between electric and mechanical systoles. Blood pressure, rate of pulse wave propagation and stroke and minute volume were also determined. After the test, the pulse rate increased by 10% and diastolic pressure by 7.5%, systolic decreased by 4.2%, pulse pressure by 20%, stroke

volume by 18% and minute volume only by 7%. In respect to the dynamics of cardiac contraction, absolute values of mechanical systole and diastole decreased somewhat while those of electric systole increased. The phasic structure of the left ventricular systole changed during the test in that the ejection period shortened and the tension period lengthened. This was reflected in a lesser intrasystolic index and a higher index for myocardial tension. Simultaneous decrease of the initial rate of increased ventricular pressure and the mean rate of ventricular evacuation was also observed. None of the changes exceeded normal limits. These changes correspond to the syndrome of functional cardiac hypodynamics seen in trained sportsmen at rest and normally in the evening. It was concluded that cosmonauts experience changes in cardiac contraction reflecting physiologic adaptation to muscular rest. Orig. art. has: 2 tables.

130.

AUTHOR: Portugalov, V. V.; Gazenko, O. G.; Il'ina-Kakuyeva, Ye. I.; Malkin, V. B.; Artyukhina, T. V.; Bukayeva, I. A.; Gotlib, V. Ya.; Rokhlenko, K. D.; Roshchina, N. A.; Starostin, V. I.

ORG: none

TITLE: Some effects developing during hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 17-25

TOPIC TAGS: hypokinesia, mouse, animal physiology

ABSTRACT: The effect of 30-day hypokinesia on mice was studied using various physiological, cytochemical, electron-microscopic, and histological techniques. The voluntary muscles, nervous system, adrenal glands, thyroid gland, liver, and other organs and systems were studied. The mice were divided into two groups; 90 mice were controls and 71 were subjected to hypokinesia by confinement in small boxes. The test mice exhibited two phases of motor activity. In the first phase, lasting 2—3 days, there was an increase in motor activity, as the mice attempted to free themselves from the close-fitting boxes. After 2—4 days, motor activity decreased as the mice adjusted to confinement. During the second the animals spent prolonged periods in sleep, during which time they assumed unusual positions. By the end of the first day the following results were noted: 14.2% increase in body weight, 67% increase in weight of the adrenal glands, 9.5% decrease in weight of the spleen, and increase in α-glycerophosphate activity, and in succinate-dehydrogenase activity in cardiac muscle. After 15 days of confinement the test mice had lost 22.3% of body weight, and the weight of the adrenal gland was 30% greater than in controls. The weight of the thyroid gland decreased by 33.4%. The quantity of thymocytes sharply decreased, and mucus secretion in the stomach increased. Cross-section area of the quadriceps muscle was 30% smaller in test animals than in controls. There was a sharp decrease in A- and

B-phosphorylase activity in the quadriceps muscles. Glycogen content sharply decreased. On the 30th day of the test the body weight of the test animals was 12.8% less than in controls, and there was evidence of muscular atrophy, especially in the quadriceps muscle. During the first days of hypokinesia the test animals developed predominantly stress reactions. By the 15th day, changes characteristic of hypokinesia had appeared, but by the 30th day were less pronounced than at earlier stages of the experiment. [LS]

131.

AUTHOR: Purakhin, Yu. N.; Petukhov, B. N.

ORG: none

TITLE: Neurological changes in healthy men caused by two-month hypokinesia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 51-56

TOPIC TAGS: neurology, central nervous system, autonomic nervous system

ABSTRACT: To determine the neurological changes caused by hypokinesia, six healthy male test subjects were twice exposed to accelerations followed by a 62-day period of bed rest during which three of the subjects performed calibrated physical exercises. The study included tests of the nervous system, EEG'S, and observations of physiological tremor, and stabilography. Neurological examinations were conducted once every third day throughout the experiment, and the data obtained indicated the development and dynamics of neurological disorders. As a result of acceleration and hypokinesia, neurasthenia developed. Neurological changes developed during the first two weeks accompanied by a decrease in efficiency, changes in the sleep pattern, and "explosiveness" in behavior--all indicating a decrease in tonus of the cerebral cortex. Analysis of the data also indicated changes in the CNS, ANS, and orthostatic tolerance in response to long-term hypokinesia. Functional shifts were accompanied by morphological changes of the muscular system. Orig. art. has: 1 figure and 2 tables. [LS]

132.

AUTHOR: Syzrantsev, Yu. K.

ORG: none

TITLE: Effect of hypodynamia on the nitrogen metabolism; role of planned physical exercise in maintenance of nitrogen balance

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 342-347

TOPIC TAGS: man, hypodynamia, muscle physiology, nitrogen, physical fitness, training progem

ABSTRACT: Human nitrogen metabolism was studied in healthy young men subjected to inactivity with or without physical exercise. Their food ration corresponded to physiologic requirements. Food intake was slightly reduced in inactivity. In five test series the men were: 1) lying in a horizontal position for 8 days except for periods of meals, elimination and metabolic testing; 2) lying in a bath tub for 8 days; 3) leaning back in a chair located in a small space for 10 days with exercise prescribed twice a day (100 calories output); 4) sitting in a pressure chamber for 10 days with exercise twice a day (150-200 cal.); and, 5) assuming a horizontal position for 12 days interrupted by strenuous exercise (400 cal). Increased nitrogen elimination was noted in all groups except group 5 where it remained unchanged. A 20-25% elimination was observed in groups 1-3. Lesser changes in N_2 elimination were directly related to increase and diversification of physical exercise. A detailed analysis of nitrogen elimination in group 3 showed an average negative nitrogen balance seen usually only in severe trauma. Analysis of the protein metabolism revealed some changes, e.g. appearance of creatine, high creatinine excretion, increase in urea and free urinary amino acids. It was concluded that high nitrogen elimination and a negative nitrogen balance were due to muscle atrophy in hypodynamia and a lowering of protein resynthesis. In space flights with their prolonged inactivity and nervous tension these signs should be more pronounced. Physical exercise corresponding to 400 calories, certain B vitamins, and a high protein content in the food (essential amino acids) would prevent such metabolic changes. Anabolic medication, e.g. androgens, could also be used as a preventive of nitrogen losses. Orig. art. has: 2 tables.

133.

INVENTOR: Vinogradov, V. N.

ORG: none

TITLE: A method of prophylaxis for hypodynamia. Class 30, No. 208192

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 3, 1968, 95

TOPIC TAGS: hypodynamia, cosmonaut training, musculoskeletal system

ABSTRACT: An Author Certificate has been issued for a method of prophylaxis for hypodynamia involving muscular training. To maintain muscular function at a high level, cosmonauts are subjected to orthostatic loads corresponding in force and direction to terrestrial gravitation. These loads are applied by means of elastic cables. [LS]

134.

AUTHOR: Vinogradov, V. N.; Petrukhin, V. G.; Fedorov, I. V.

ORG: none

TITLE: Morphological changes in the organs of animals after prolonged hypodynamia and subsequent physical load

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 6, 1968, 96-99

TOPIC TAGS: hypodynamia, exercise physiology

ABSTRACT: Morphological changes were studied in 30 white rats subjected to hypodynamia for 15 days; six rats in this group were also subjected to physical loads. In addition, resistance to transverse loads was studied in 12 rats and 2 dogs after a 100-day exposure to hypodynamia. After 15 days' hypodynamia there was an average weight loss of 15 g of adipose tissue. Succinate-dehydrogenase activity increased, alkaline phosphatase activity decreased, weight of the adrenals increased, and ribonucleoproteid content increased. After 100-day hypodynamia, the average weight of the animals was 53—61% of that of the controls. Resistance to transverse loads was decreased in experimental animals, and physical exercise produced more pronounced morphological changes in the experimental animals than in controls. Experimental data demonstrate a decrement in synthetic processes in animals exposed to hypodynamia. Orig. art. has: 2 figures. [WA-22] [EL]

135.

AUTHOR: Fedorov, Yu. A.

ORG: none

TITLE: Objective evaluation of the deodorant and freshening effect of some oral toilet preparations for use under special conditions

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 424-427

TOPIC TAGS: cosmonaut personal equipment, hygiene, cosmonaut personal hygiene

ABSTRACT: This method for objective evaluation of the deodorizing and purifying effect of preparations designed for the cosmonaut's oral hygiene consists in determining free and residual sulfhydryl groups, hydrogen sulfide, products of nitrogen metabolism, pH, oxidability and microbe number in the oral fluid and in rinses from the oral cavity of fasting individuals before and 10 min after application of a tooth paste or mouth wash. Analysis was conducted by the usual test methods. It was found that the content of sulfhydryl groups (calculated for cysteine) depends on the conditions of the teeth and parodontal tissues. It was 2-3 times as high before than after cleaning in all test individuals. Other indices are shown in the table before and after use of a toothpaste called "Lesnaya". Twice repeated rinsing with distilled water gave much poorer results. It was concluded that comparative studies of various oral hygiene products to determine their deodorant and cleansing effects are perfectly feasible. Enlarging the number of indices would permit selection of the most suitable preparations. Orig. art. has: 2 tables.

Ingredients in the oral fluid before and after cleaning with "Lesnaya" toothpaste

Ingredients	Before	After cleaning
Hydrogen sulfide	none	none
Ammonia, mg/liter	2	none
Nitrites, mg/liter	0.07	0.002
Nitrates, mg/liter	0.3	none
Oxidability, mg/liter O_2	89.6	148
pH	6.0	5.4
Microbe number	++++	+++

136.

AUTHOR: Fomin, M. F.

ORG: none

TITLE: Mathematical method for calculating the amount of product required for food rations from a limited selection of foods

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 370-382

TOPIC TAGS: space food, food requirement

ABSTRACT: A set of formulas was developed for easy selection of the components of a ration with a certain caloric content from products available in space flight. Starting from the caloric ratio between proteins, fats and carbohydrates (4.1, 9.3 and 4.1 respectively) and considering the rations required for proteins and fats of animal and plant origin, a number of foods with known contents of these values can be selected for composing the diet (21 such foods are enumerated). These may consist of basic and nonbasic products. Addition of at least one nonbasic product, 50 g onion, is considered necessary. Table 3 shows values calculated by these formulas for a 2700 calory diet. This example shows the feasibility of calculating the composition of a diet for space flight from these formulas. Final selection requires the services of a dietician. Orig. art. has: 3 tables.

Table 3. Calculated data for basic products and one nonbasic product, i. e. onion.

Product	weight of product in g	Carbohydrates g	Vegetable fat	Animal fat	Vegetable protein	Animal protein
A_6 onion	50	4.8	-	-	1.5	-
A_1 potatoes	1482.2	348.2	-	-	29.7	-
A_{11} Chlorella	42.32	3.0	1.27	-	6.35	-
A_{12} beef	74.1	-	-	8.15	-	60
A_{15} chocolate	39.617	21.0	14.73	-	2.45	-
A_{17} butter	56.1	-	-	55.85	-	-
Total.....		377	16	64	40	60
Total calories		377	16	64	40	60

137.

AUTHOR: Kustov, V. V.; Tiunov, L. A.

ORG: none

TITLE: Problems of space toxicology

SOURCE: AN SSSR. Izvestiya. Seriya biologicheskaya, no. 4, 1968, 605-609

TOPIC TAGS: toxicology, space medicine, space environment simulation, spacecraft contamination

ABSTRACT: This article is basically a literature survey concerned with problems of toxicology in hermetically sealed environments (i.e. spacecraft cabins and experimental chambers). There are two basic sources of harmful contaminants in closed atmospheres: plastics and other polymeric and synthetic materials, and human or animal products. Contaminants falling into these categories are enumerated. The determination of maximum permissible concentrations of the many potential contaminants poses a number of problems. Criteria for exposure to many of these substances have been established for industry; however, exposures in industrial situations amount to only 8 hr per day or 40 hr per week, whereas exposure during a space flight or chamber experiment is continuous. The validity of extrapolating values determined for industry is questionable. There is also doubt as to whether the experimental methodology used to determine permissible concentrations of toxic substances for industrial applications is wholly suitable for determining concentrations for continuous exposures; it appears that considerably greater accuracy is necessary in the latter case. A related problem is that of adapting the methods of industrial toxicology to make them applicable to the study of sealed environments. It is highly important to add to the usual criteria for determining toxicity the effect of toxic contaminants on enzyme systems. Continued research on this subject is obviously necessary, and should include strictly controlled experiments with human subjects.

[WA-22] [EL]

138.

AUTHOR: Lebedev, M. D. (Captain, Medical Service)

ORG: none

TITLE: Some peculiarities of reactions of leukocytes in submarine personnel during cruises

SOURCE: Voyenno-meditsinskiy zhurnal, no. 11, 1967, 67-68

TOPIC TAGS: man, leukocytosis, naval medicine, leukocyte, bodily fatigue

ABSTRACT: Digestive leukocytosis and myogenic leukocytosis were studied in 16 healthy sailors during a cruise of average duration, with considerable time spent underwater, under good microclimatic conditions. Observations were made in shore barracks before sailing (64), aboard the submarine while cruising (80), aboard the submarine in port (78), and in barracks after cruise (48). Rations and living conditions of all examinees were uniform. Number of leukocytes and leukocytic formulas were determined in eight motor mechanics on empty stomachs and 15 minutes after eating and in eight sailors of different specialties upon arising (from sleep) and after physical exercise. The initial content of leukocytes in peripheral blood constituted 6066 ± 363/mm^3 and dropped to 4687 ± 363/mm^3 before going to sea. Feeding the examinees on shore caused a 21.3% increase of leukocytes. During the first three days at sea, food also caused less pronounced leukocytosis (14.7%). Comparison of leukocytes at various parts of the period of investigation shows that cruise conditions reduce the number of leukocytes and depress digestive leukocytosis, due to appetite reduction, heart burn and constipation and also, possible, to psychic factors and fatigue. This condition is normalized upon return to port. Fifteen minutes of physical exercise caused leukocytosis in all examinees. The increase of leukocytes per mm^3 peripheral blood was 32.5% at the shore base, 16.2% on the submarine, and 29.3% at the shore base upon return from the cruise. Supression of myogenic leukocytosis during the cruise may be explained by prolonged limitation of motor activity and nervous psychic factors.

139.

AUTHOR: Levashov, V. V.; Finogenov, A. M.

ORG: none

TITLE: Basic specifications for preparations designed for the cosmonaut's personal hygiene

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 420-424

TOPIC TAGS: cosmonaut, spacecraft personal equipment, cabin decontamination

ABSTRACT: After a survey of data, the following recommendations are made for cosmonaut skin preparations: 1) they should be capable of removing skin gland excretions, horny scales, dust and other external contamination; 2) permit normal functioning of the skin and help maintain optimal or tolerable physicomechanical skin properties and biochemical and physiologic constants; 3) exert a bacteriostatic activity on the cosmonaut's skin flora; 4) their systematic and prolonged use should cause no irritation, discoloration or pigmentation of the skin, hyperkeratosis, peeling or sensitization to UV or ionizing radiation; 5) they should impart a feeling of freshness and lack odor; a mild perfume, preferably a natural smell adapted to the individual cosmonaut's taste, is admissible; 6) they should contain no toxic, highly active or volatile compounds; 7) the ingredients should be fully compatible with vital systems on board the spacecraft and should be easily absorbable by sorbents or filters if they happen to enter the cabin atmosphere; 8) raw materials should conform to the usual rules for standardization and manufacturing conditions; 9) they should be prepared in liquid or semisolid form under sterile conditions and packed in tubes provided with labels and indications for use; 10) they should contain a minimal amount of water; 11) the container should be light, compact and afford easy and reliable use under conditions of weightlessness and acceleration; and, 12) conditions for use and storage should be the same as those for liquid food products in standard tubes.

140.

AUTHOR: Petrovykh, V. A.; Kudrova, R. V.; Kuznetsov, M. I.; Lobzin, P. P.; Popov, I. G.; Romanova, I. A.; Syzrantsev, Yu. K.; Terpilovskiy, A. M.; Udalov, Yu. F.; Chelnokova, N. A.

ORG: none

TITLE: Some aspects of the nutritional state of humans under conditions of a prolonged horizontal position followed by acceleration

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 355-363

TOPIC TAGS: space nutrition, biologic acceleration effect, biologic weightlessness effect

ABSTRACT: Tests were conducted in three healthy young men assuming a constant horizontal position for 10 or 15 days at 21-28 C, simulating a condition of weightlessness. Alimentation consisted in 125 g protein, 105 g fats and 307 carbohydrates for a total of 2745 calories, slightly below their normal 3124, and was served in four daily meals. Tests for

Table 3. Urinary elimination of some endproducts of protein metabolism per day (mean values in g)

Test individual	Experimental conditions	N_2 in food	Elimination in urine: total N	urea	ammonia	amine N	uric acid
A	initial values	16.8	15.3	10.19	0.854	0.363	0.855
	in inactivity	16.69	17.0	13.25	0.785	0.528	1.125
B	same	16.8	16.4	12.32	0.85	0.466	0.77
		16.62	17.0	13.2	1.27	0.545	1.178
C	same	16.8	15.5	10.5	0.68	0.304	0.94
		16.0	16.1	13.0	0.938	0.406	1.075

vital functions involved monitoring of the general state of health, stomach enzymatic activity (uropepsin in the urine) blood, urinary and water balance tests. Enzymatic and intestinal functions were normal, despite the inactivity. The nitrogen balance was considerably changed (see Table 3). Blood, lipids and serum cholesterol were unchanged during the test; the latter was slightly higher after the experiment. The vitamin metabolism was essentially improved, and the acid-base balance unchanged. Some decrease was observed in lung ventilation, energy output decreased by 10%, and urinary calcium and phosphorus elimination was higher under inactivity. The body weight remained unchanged. While the test individuals drank more water, they eliminated less. Exposure to acceleration caused no metabolic changes except for a greatly reduced vitamin C excretion after acceleration (despite a high intake); vitamin B_1 and B_6 excretion were also reduced. It was concluded that prolonged inactivity and acceleration at the above alimentation caused no changes in enzymatic stomach activity, blood lipids or sugar, which latter decreased after the experiment had terminated. Urinary nitrogen elimination increased due to inactivity. So did calcium and phosphorus elimination. The food was adequate except for vitamins B_1, B_2 and B_6. Orig. art. has: 8 tables.

141.

AUTHOR: Popov, I. G.; Savinich, F. K.; Kozar', M. I.; Finogenov, A. M.; Borshchenko, V. V.

ORG: none

TITLE: Study of human skin during prolonged restrictions on personal hygiene

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 413-420

TOPIC TAGS: hygiene, skin physiology, skin disease, cosmonaut, spacecraft personal equipment

ABSTRACT: Tests were conducted in 16 young men kept for 23-60 days in a 5-20 m^3 closed space at 20-25 C and 40-60% humidity under ventilation of 0.1 m/sec. They received three warm meals per day and did physical exercises corresponding to a 500 kg energy output. They were not permitted to wash or otherwise clean body parts covered with clothes (80% of the body); face, neck and hands were periodically rubbed with a water-alcohol mixture. Underwear was worn 24 hours and was not changed

during the experiment. The socks were changed after 20-22 days. Contamination was determined by accumulation of chlorides and organic matter on body and clothes before and after the experiment. This was found to consist mainly of human secretions or eliminations while contamination from food, dust or microbial aerosols was minor. Mean daily values were close to identical despite the increase in overall contamination, Individual differences were more significant. Mean contamination by chlorides was 117-403 mg/day, by organic matter 334-886 mg O_2/day. The clothes absorbed about 90% chlorides and 80% organic matter (due to the adsorbent fabric and the cut of underwear). In noncovered body parts, skin salts increased in 5 days to 450 microg/cm^2. The chemical composition of lipids was somewhat changed: the acid number increased by 21% while saponification and iodine number decreased, and the pH shifted toward the acid range (pH 5.12-5.68). Microbial seeding increased consistently in the first 2-3 weeks to 3-3.5 fold, then remained constant except for soles, perineum and buttocks where the microbial flora increased 7-12 times. Bactericidal activity of the skin against coli was 90-95% before, against 60-70% after a 30 days experiment. No functional changes were found in clinical examination. Skin infections under these conditions are shown in Table 3. Impetigo was most frequent and developed mainly at sites subjected to pressure, e.g. buttocks and thighs, but it did not affect the individuals working capacity. These skin diseases cannot be ascribed only to poor sanitary conditions, since a good part developed on the face and noncovered parts of the neck subjected to cleaning. Such occurrence points to the necessity for increasing resistance of the organism by appropriate diet and improved programs for work and rest. Further improvements are recommended for furniture and fabrics, use of textiles with

Table 3. Skin affections in individuals under restricted skin hygiene

Duration of experiment (days)	Volume of the room (m^3)	Number of Participants	Skin diseases (number of test individuals) Impetigo	Furuncles	Streptococcal intertrigo	Acne Vulgaris
23	20	3	1	-	-	-
30	7	6	5	-	-	1
30	5	3	3	2	1	1
60	7	4	3	1	-	2
	Total	16	12	3	1	4

Duration of experiment (days)	Volume of the room (m^3)	Number of Participants	Dermatitis	Fungal Infection of the foot
23	20	3	1	1
30	7	6	-	-
30	5	3	-	1
60	7	4	2	-
	Total	16	3	2

bacteriostatic or bactericidal properties, and regulation of the microclimate. It was concluded that the restrictions imposed on personal hygiene during space flights may be compensated by improving environmental hygienic conditions, particularly underwear. Washing should be restricted to parts not covered by underwear and those which are easily contaminated (feet, buttocks, thighs). Skin affections are trivial and do not affect the general condition or physical fitness. Medication on board should anticipate the appearance of such troubles. Orig. art. has: 3 tables.

142.

AUTHOR: Smirnov, K. V.; Lepskiy, A. A.

ORG: none

TITLE: Feeding of experimental animals during space flights

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 23-25

TOPIC TAGS: spacecraft, biologic space flight, biosatellite, space food, force-feeding, gastric fistula, gastrostoma, digestive function, dog/(U)Cosmos-110 spacecraft

ABSTRACT: In order to test the feasibility of force-feeding dogs through a gastric fistula, the secretory and motor functions of the stomach, the enzyme activity of intestinal fluids and feces, and the urinary and defecating functions were studied in eleven 6—8 kg dogs, eight of which had gastric and three of which had intestinal fistulas. The dogs were given single 600—750 g daily feedings consisting of a balanced homogenized mixture for periods of 15—30 days. During the period of force-feeding, a statistically reliable drop in gastric juice acidity (free acidity 8 (unspecified Soviet) units, bound acidity 19.2 units, and general acidity 26.7 units) was observed, accompanied by a rise (7.1 units) in digestive power of the gastric juice. These parameters normalized after completion of the experiment. The periodic motor activity of the stomach did not change during fistula feeding, nor were there any substantial changes in the enterokinase and alkaline phosphatase activity in intestinal juice and feces. Defecation and urination remained normal, and food was digested normally. The protein content of blood serum, the albumin-globulin coefficient, erythrocyte number, hemoglobin content, and overall weight of the animals fluctuated within normal limits. After the 2nd and 3rd day during the time of force-feeding, the dogs exhibited salivation, chop licking, and burping. The lack of substantial changes in gastric functional activity can be explained by physico-chemical properties of the homogenized, high-protein food mixture. It is concluded that force-feeding of a nourishing homogenized mixture containing secretion-stimulating additives provides a reliable method of supplying food and water to dogs in spaceflight, as the successful experiment on the Kosmos-110 testifies. [BM]

143.

AUTHOR: Smirnov, K. V.; Lukasheva, M. V.

ORG: none

TITLE: Secretory function of the stomach during prolonged confinement to a sealed chamber of limited size

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 62-63

TOPIC TAGS: human physiology, isolation chamber, hypodynamia

ABSTRACT: Six healthy males (25—32 yr old) took part in an experiment where they were confined to a small, sealed chamber for 14—17 days. During the course of the experiment, the subjects' motor activity was limited. They were fed lyophilic products. Gastric probing was done with M.A. Gorshkov's thin tube based on the method of N.I. Leporskiy. The quantity of gastric juices, obtained during an hour following stimulation, was determined. A study was made of acid secretion, enzyme secretion activity of the stomach, and also of the quantity of uropepsinogen in the urine. An analysis of the gastric juices indicated that by the end of the experiment the quantity of gastric juices in all subjects had sharply decreased, the pepsin level increased, and the quantity of uropepsinogen decreased. Thirty days following the experiment the quantity of gastric juice still had hot stabilized. The pepsin level had decreased and the amount of uropepsinogen remained at a high level. The results of the experiment indicate that confinement in a small, sealed chamber can result in changes which will last for some time. These data have a practical significance for developing a feeding schedule for individuals working under such conditions.

[WA-22] [AC]

144.

AUTHOR: Udalov. Yu. F.; Kudrova, R. V.; Kuznetsov, M. I.; Lobzin, P. P.; Petrovykh, V. A.; Povov, I. G.; Romanova, I. A.; Syzrantsev, Yu. K.; Terpilovskiy, A. M.; Rogatina, L. N.; Chelnokova, N. A.

ORG: none

TITLE: Metabolism in restricted mobility and the effect of a qualitatively different alimentation

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7. 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 348-355

TOPIC TAGS: space food, hypodynamia, protein metabolism, man, nitrogen

ABSTRACT: Tests were conducted in 6 young healthy males divided into two groups, each serving as his own control in a preliminary 3-8 days test period. The test individuals were subjected to 7 days inactivity in a horizontal position under comfortable environmental conditions without isolation (to exclude mental strain). The first

Table 1. Food value of ration consumed by test individuals under hypodynamia (average per day)

Group	Total protein in g	Animal protein g	Animal protein %	Content, in g		Calories
				Fats	Carbohydrates	
First....	120.3	101.0	84	101.2	297.2	2653
Second*..	70	68	98	67.1	266.0	2002

* Additional daily intake of 4 mg vitamin A, 200 mg ascorbic acid, 100 mg rutin, 4 mg each of thiamine, riboflavin, pyridoxine and folic acid, 20 mg pantothenic acid, 30 mg nicotinamide, 50 microg cyanocobalamin and 50 mg alpha tocopherol.

Table 2. Nitrogen metabolism under hypodynamia and feeding of different rations (daily average during the test)

Indices	First ration (3 experiments)		Second ration (4 experiments)	
	Usual activities	Hypodynamia	Usual activities	Hypodynamia
Total urinary nitrogen, g/day	14.9	17.1	12.9	14.2
Urea nitrogen of 24 hrs urine	10.9	13.1	9.29	11.5
UREA, total nitrogen (%)	73	77	75	81
Ammonia nitrogen of urine from 24 hr urine, g/day	0.76	0.85	0.52	0.47
Ammonia nitrogen, total nitrogen (%)	5.1	4.85	4.3	3.3
Amine nitrogen of urea, g/day	0.387	0.535	0.345	0.380
Creatine, g/day	1.62	1.64	1.48	1.68
Creatine, g/day	0.07	0.06	0.09	0.136
Blood amine nitrogen , mg%	-	-	6.02	7.4
Residual nitrogen in blood, mg%	-	-	36.4	34.1

group received normal food, the second a composition corresponding more closely to human metabolic processes (Table 1). Indices for nitrogen metabolism were determined in blood and urine; electrolyte balance, vitamin metabolism and other vital functions were monitored. Transition from normal activities to inactivity was accompanied by a 2-22% drop in the basal metabolism, depending on the amount of prior physical activity rather than the quality of the food. Lung ventilation decreased for an unchanged respiratory rate. The main changes involved the nitrogen metabolism (increased N_2 elimination), and these again were unrelated to the food ingested and probably related to a decrease in muscle tissue and slower resynthesis of tissue proteins. In this respect the second ration had a favorable effect (see Table 2). Lesser elimination of unoxidized products, i.e. 13.2 g 0_2 as against 16.0 during hypodynamia, may be explained by the better balance in the protein part of the ration and the higher amount of vitamins of the B group. Protein assimilation was hardly affected by inactivity. Water elimination was higher in activity than during rest, decreasing from 89 to 41% for the water load test. The vitamin metabolism was unchanged or improved, particularly for the second ration. It was concluded that the second ration had a better effect on the protein metabolism and shows that a maximally balanced nutrition will lead to lesser metabolic changes upon transition from activity to inactivity. Orig. art. has: 3 tables.

145.

AUTHOR: Vashkov, V. I.; Nikiforova, Ye. N.; Ramkova, N. V.; Adamov, R. V.

ORG: none

TITLE: Methods and means for maximal reduction of microflora in a small space to be used for prolonged human experiments

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 408-412

TOPIC TAGS: man, space environment simulation, space bacteriology, antiseptic, cabin decontamination

ABSTRACT: Since bacterial flora in the environment is more dangerous for test individuals under conditions of hypodynamia and lack of sunshine, certain measures were developed for the purpose of decreasing microbial seeding in the cabin. Smooth nonporous material is to be used for objects, walls and floors, and a smooth cover should be used for mattresses. Ventilation should be provided with a bacterial filter (fabric FPP-15). Bactericidal bulbs (BUV) and UV light should be installed. Careful washing of the cabin is required before each experiment, followed by treatment with 6% hydrogen peroxide solution and exposure to UV light for two hours. The objects must be treated in the same way, then carried into the cabin by individuals dressed in sterile clothes, after which the UV light is switched on again. Then the ventilation is switched on to change the air 14-16 times, after which the cabin is ready for use. Soft objects are subjected to steam disinfection at 97-98 C, 60 kg/m^2 for 30 minutes. Clothes and accessories are sterilized in a steam autoclave at 126 C for 30 min. Everything is packed in 2 sheets of paper. Dishes and cutlery are sterilized by dry heat, books by UV light. The test individuals' preparation consists of a hot shower using hexachlorophene soap or a 2% chloramine solution; then they don sterile clothing. Experimenters who must enter the small space during the experiment wear sterile clothes and carry sterilized instruments. Tests have shown that after washing with 6% hydrogen peroxide solution there are practically no microbes on surfaces or in the air.

SECTION 7. BIORHYTHMS

146.

AUTHOR: Agadzhanyan, N. A.; Rafikov, A. M.

ORG: none

TITLE: Diurnal variations in altitude tolerance and the role of the adrenocortical function

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 8-9

TOPIC TAGS: circadian cycle, hypoxia, adrenocortical hormone, animal experiment, altitude chamber, endurance test

ABSTRACT: Studies of diurnal variations in reactions of animals revealed that tolerance to various stress factors, as well as resistance to harmful substances is not equal at various hours of the day. Diurnal variations in altitude tolerance were studied on 118 white rats. Every 3 hr, 6 rats were elevated in a baro-chamber at a rate of 2 m/sec to a 12,000 m altitude where they remained until complete cessation of respiration. Thirty minutes before the experiment, 4 of them received prednisolone (15 mg/kg body weight) intraperitoneally while the 2 controls received distilled water. The survival rate showed that highest tolerance was between 0900 and 1200 hr; after 1200 hr it decreased slightly and remained stable until 1800 hr, after which it decreased rapidly and reached its minimum between 2400 hr and 0300 hr, when most control animals perished during the ascent. After 0300 hr the tolerance improved again. From 0900 to 2100 hr, prednisolone somewhat reduced the survival time, while it increased the survival time significantly from 2100 to 0900 hr when the adrenal glands produce the least amount of corticosteroid hormones, which apparently are the main cause of low altitude tolerance during the night. These results were obtained during various seasons and were confirmed during mountain acclimatization experiments with white mice. [WA-22] [EF]

147.

AUTHOR: **Alyakrinskiy, B. S.**

ORG: none

TITLE: Principles and research methods of the cosmic day problem

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 68-76

TOPIC TAGS: working condition, biologic rhythm, adaptation, psychologic training

ABSTRACT: The author discusses factors determining the work — rest regime for cosmonauts, including the characteristics and after-effects of the work at control panels, artificial light, characteristics of muscular activity, and number of crew members and their individual adaptability. He also reviews the results of experiments and observations on adaptability to changed circadian rhythms, offers a variety of day lengths and emphasizes the importance of experiments in which only one factor is changed at a time. As an object of further research programs he recommends such factors influencing adaptation as drugs, afferentation changes, psychological training, and the creation of methods for determining individual adaptability. [EF]

148.

AUTHOR: Alyakrinskiy, B. S.

ORG: none

TITLE: The ways and principles of the development of biorhythm studies and its importance in the organization of spaceflights

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 3-7

TOPIC TAGS: circadian cycle, adaptation, cosmonaut selection, sleep, cosmonaut work schedule

ABSTRACT: The development of biorhythm studies dates back to 1729 and consists of three periods: the discovery of the universality of periodicity in organic life, the discovery of the "biologic clock" and some primary mechanisms generating the rhythms, and the period beginning with transmeridional flights. Desynchronization observed after shifts of 4—5 hr, or more, becomes chronic in 78% of flight personnel and may cause nervous stress. Adaptation varies individually. In spaceflights, the following factors will have an important effect on the designing of work-and-rest-schedules and adaptation to them: the peculiarities of the cosmonaut's activity which demand that the duty shift at the control panel should not exceed 3—4 hr; the decrease of psychic productivity which appears toward the end of the shift and persists for a

while as an aftereffect; the necessity of 24-hr duty at the control panel; the quality and intensity of light and of the air temperature in the cabin; the number of crew members; the hypodynamic factor; individual adaptability; and possible complications or even emergency situations which might upset the schedules. A classification of day schedules based on the terrestrial 24-hr day has been established. Extended or reduced day schedules, which differ from the 24-hr day by not more than 4 hr, are called circadian days. Days of fixed duration, and phase synchronization belong to a more inclusive category of static days, which includes circadian or non-circadian days. Dynamic or "migrating" days constitute another category, whose schedules are subject to continuous or periodic shifts. The third category, called compound days, is subdivided into compound-static, compound-migrating, and compound-statomigrating days. Experimental data prove that the following conditions are necessary for a successful adaptation to any of these schedules: accurate completion of the schedule; a positive motivation and an understanding of the importance of accurate adherence to the schedule; interest in accomplishing the task; application of auto-massage before sleep; capacity of complete relaxation and detachment from the current activity before sleep; proper selection of subjects according to their individual sleep abilities; and good somatic and neuropsychic condition of the subjects. [WA-22] [EF]

149.

AUTHOR: Andrzheyuk, N. I.; Veselova, A. A.; Gurovskiy, N. N.; Dushkov, B. A.; Iseyev, L. R.; Kosmolinskiy, F. P.; Kozar', M. I.; Krutova, Ye. M.; Manovtsev, G. A.

ORG: none

TITLE: Study of the effect of different regimens of work and rest in conditions of relative isolation

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 105-117

TOPIC TAGS: space environment simulation, space flight biologic effect

ABSTRACT: The effect of different regimens of activity on the work capacity and physiological state of three 23—30-yr-old males in a sealed chamber 23m^3 in size for two 15-day periods is reported. Room temperature was 24—27°C, humidity was approximately 70%, O_2 content was 21%, and CO_2 content ranged from 0.4 to 1.0%. In experiment I, there was an 8-hr period of uninterrupted sleep beginning at different hours (0000, 0800, and 1600), and 16 hr of

activity including work, "duty", and independent activity (physical exercise, eating, and medical examinations). Periods of wakefulness included hours of the astronomical night in two subjects. In experiment II which was begun one month after completion of the first, the total sleep, "duty", and independent activity periods were equal to those in experiment I. However, changes in activity took place at 6-hr intervals and an 18-hr "day" cycle was established. Effects of the different

Table 1. Distribution of time in the experiments

Subject	Experiment	Total time (hours)	Total sleep time (hours)	Total time of independent activity (hours)	Total duty time (hours)	Number of sleep periods	Number of independent activity periods	Number of duty periods
M S I	I	360	120	120	120	15	30	30
M S I	I	360	120	120	120	15	30	15
M S I	II	360	120	120	120	20	40	40
M S I	II	360	120	120	120	20	40	20

sleep and activity regimens were determined by comparing body temperature and weight, mental efficiency (problem solving and memory), neuromuscular activity, cardiovascular function tests, respiratory function tests, urine levels of ascorbic acid, 17-hydroxycorticosteroids and 17-ketosteroids, and lysozyme content in the saliva. It was determined that no marked physiological changes resulted from the stay in the chamber when a 24-hr regimen of sleep and activity was observed as in experiment I. However, when the periods were rotated (i.e. shifted) every 6 hr as in experiment II, changes were noted in cardiovascular function, neuromuscular activity, and mental efficiency. Elevated urine levels of ascorbic acid, 17-hydroxycorticosteroids and 17-ketosteroids, and elevated salivary lysozyme content indicate increased endocrine system activity and point to the development of neuroemotional stress, especially in experiment II. Orig. art. has: 1 table. [XF]

150.

AUTHOR: Bayevskiy, R. M.; Chernyayeva, S. A.; Berezina, G. A.; Boldov, V. A.; Kudryavtseva, V. I.; Nikulina, G. A.; Polozhentsev, S. D.; Tazetdinov, I. G.

ORG: none

TITLE: Investigation of the physiological condition of men exposed to isolation and hypodynamia during the shift to a new work and rest schedule

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 12-13

TOPIC TAGS: circadian cycle, isolation chamber, hypodynamia, performance test, psychophysiology

ABSTRACT: During experiments lasting for 3 of 6 days, subjects placed in a chamber with uncomfortable conditions (2% CO_2, 30°C, and 70—90% humidity) observed a schedule consisting of 4-hr periods of rest, sleep, and work during which they performed intense work based on visual tracing. During the experiments, EKG, the exactness of visual discrimination, the rate of reactions to tactile signals, and the pulse rate were recorded. Before and after the experiment, the subjects were subjected to a series of tests including psychological tests with the recording of the writing motions, tests with respiration arrest, and dynamography. Analysis of the cardiac rhythm showed that only two subjects who showed the highest tolerance to the experimental conditions and the highest work capacity retained diurnal periodicity throughout the experiment; in two others, it was considerably reduced, while in other two subjects who showed the lowest tolerance to the experimental conditions, a pronounced disruption of the diurnal periodicity of cardiac rhythms was observed. The psychophysiological investigation revealed that the work capacity decreased during the first two days, improved during the fourth and fifth days, and decreased again during the sixth day. The rate of reactions to tactile signals and the pulse rate showed also phase-like changes. A gradual increase of bradycardia, respiration rate, and a more pronounced autonomic reaction to psychophysiological loads were also observed. Significant distortions of the cardiointervalogram pattern observed toward the end of the experiments indicate changes in the cardiopulmonar interaction and disruption of the neurohumoral regulation. A decrease in writing speed and accuracy of time evaluation were also noted. At night, the deviations were more pronounced. These results prove that an interference with the rhythm of the biological clock significantly reduces the resistance of the mechanisms regulating physiological functions. [WA-22] [EF]

151.

AUTHOR: Bayevskiy, R. M.; Kukolevskaya, Ye. V.; Tishler, V. A.

ORG: none

TITLE: Some results of applying mathematical methods to evaluate cardiac self-regulatory function in the study of diurnal periodicity under conditions of hypodynamia and isolation

SOURCE: Simpozium po probleme. "Primeneniye matematicheskikh metodov dlya analiza ritma serdechnykh sokrashcheniy", Moscow, 1966. Matematicheskiye metody analiza serdechnogo ritma (Mathematical methods of analyzing heart rhythm). Moscow, Izd-vo "Nauka", 1968, 92-98

TOPIC TAGS: cardiology, biorhythm, hypodynamia, isolation test, mathematic analysis

ABSTRACT: Diurnal variations in a number of cardiac indices reflecting the dynamics of extracardiac influences on the S-A node were studied on the basis of EKG's recorded from two men subjected to hypodynamia and isolation for 5 and 15 days. EKG's were recorded for ~2 min every 1.5 hr, around the clock. The subjects wore an EKG chest harness at all times. Dynamic series of R-R intervals were recorded on punch cards and analyzed according to a computer program developed by B. A. Pryakhin which included a series of statistical indices, frequency polygon, and autocorrelation function. Results are discussed in terms of daily variation and variations observed during the whole course of the experiment. Particular interest is shown in very slow waves (periods of 1—5 1/2 hr). Dominance of the sympathetic system leads to shortening of the periods of these waves. During isolation and hypokinesia, the inhibiting process is enhanced so that conditions are created in the first hours of sleep for the appearance of spontaneous sympatheticoadrenal activity. Experimental data on depth of sleep indicate that deepest sleep occurs during the first 1—2 1/2 hr and that depth of sleep then decreases over hours 2 1/2—5 1/2 owing to increased sympatheticoadrenal activity. This may be of interest to those engaged in sleep research. Orig. art. has: 3 figures. [EL]

152.

AUTHOR: Bayevskiy, R. M.; Nikulina, G. A.; Polozhentsev, S. D.

ORG: none

TITLE: Shift of the work and rest schedule as a functional test of the resistance of regulatory mechanisms of physiological functions

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 14-15

TOPIC TAGS: circadian cycle, adaptation

ABSTRACT: To determine criteria for the evaluation of the resistance of the biologic clock during the shift of a work and rest schedule, 35-hr and 72-hr experiments were conducted with 9 healthy 23—35-yr-old men who observed schedules consisting of 4-hr cycles of work, sleep, and rest. Physiological data were recorded every four hours. In the beginning of the experiments, the curves of the pulse, arterial pressure, body temperature, and leukocyte and eosinophil numbers correlated. After 12—18 hr, desynchronization occurred. Two types of reaction were observed after 24—30 hr: in some cases the synchronization was restored, in other cases desynchronization persisted. These results correlate with data obtained in previous experiments where highest tolerance to hypodynamia combined with high temperature humidity and CO_2 content was observed in subjects of the first reaction type, and the lowest in representation of the second reaction type. The reaction type is an important criterion in the evaluation of the resistance of the biologic clock, which depends on the condition of the regulatory mechanisms, and apparently correlates with individual tolerance to various adverse factors. Consequently, the shift of work and rest schedules can be used as a functional test of the resistance of regulatory mechanisms. [WA-22] [EF]

153.

AUTHOR: Boriskin, V. V.

ORG: none

TITLE: Diurnal periodicity of basic physiological functions in personnel stationed in Antarctica

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 18-19

TOPIC TAGS: circadian cycle, biologic ecology, Antarctic climate, adaptation

ABSTRACT: Forty various physiological reactions are known to be subject to diurnal fluctuations, although it is not known which external factors cause the diurnal periodicity. Investigations were conducted in the Novolazarevskaya Station in Antarctica where the personnel is exposed to altered light conditions as well as partial isolation and hypodynamia. At 0800, 1300, 1900, and 2400 hr, the axillary temperature, pulse rate, blood pressure, and respiration rate were recorded during polar day, polar night, and transitional time, as well as before the departure of the expedition in Leningrad. The results showed that biological rhythms were determined by the daily schedule. Before noon and in the evening the functions reached maximum values, the minimum values being observed in the morning and before sleep. The biorhythms of the specialist in auroras adjusted to his inverted schedule, but since the shift of schedule was gradual, the adaptation time could not be established. The illumination changes during polar day and night and corresponding changes in physical loads had no apparent influence on the diurnal periodicity.

[WA-22] [EF]

154.

AUTHOR: Devishvili, V.M.; Dushkov, B.A.; Korobkov, A.V.; Mirskiy, M.M.; Ratishvili, G.G.; Ratov, I.P.

ORIG: none

TITLE: Investigation of the motor function of man exposed to an altered daily rhythm

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 159-167

TOPIC TAGS: experiment, biologic rhythm, myology, musculoskeletal system, adaptation, physical training

ABSTRACT: This article is based on experiments with an 18-hr daily rhythm in hermetically sealed cabins. The authors observed the effects of the altered daily rhythm on muscular functions and used complex methods to register the parameters of simple motion reactions and muscular activity. The ability to perform the correct muscular expenditure and appreciation of time in seconds were also observed. Special attention was given to the capacity of intentionally straining and relaxing the skeletal muscles, and the latent time of these actions was recorded. The considerable variations observed in the parameters of muscular strength, muscular endurance, sensation of muscular articulation, and time appreciation are due to individual differences in adaptability to the altered daily rhythm. The fact that the altered daily rhythm did not induce significant changes in the strength and endurance of the basic muscular groups indicates that the organization of motion activities of the subjects during the experiment was appropriate. [EF]

155.

AUTHOR: Dushkov, B. A.

ORG: none

TITLE: Change in rhythmic activity and in movement coordination during confinement to a small-capacity closed chamber

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 27

TOPIC TAGS: circadian cycle, performance test, isolation test, psychophysiology

ABSTRACT: The purpose of this experiment was to study human movement coordination under the effect of altered daily rhythmic activity. Studies were run before, during, and after 17- and 19-day stays in a sealed chamber. The subject's performance in walking was studied kinocyclographically. During the period of confinement to the chamber, performance of a specially selected system of simple and complex motor acts was studied. Kinocyclographic analysis of performance in walking demonstrated that after prolonged chamber confinements, the following were disturbed: the rigid frequency of motor rhythmic cycles, and the durability of the fine coordinating interrelationships of the structures forming the motor act. A disturbance of the rhythm and amplitude proportions of these structures was also noted. Qualitative analysis of the biodynamic elements of the locomotor act during and after chamber confinements indicates significant changes in the perception of muscular exertion, of time intervals, and of spatial parameters. It was discovered that prolonged hypodynamia has a disturbing effect on structures comprising the motor act, and impairs coordination of biodynamic details of the neuromotor apparatus. This should be considered when organizing the rest and labor regimen in specific conditions, when it is necessary to maintain prolonged high motor activity and such physical qualities as speed in movement, dexterity, and mobility. [WA-22] [AC]

156.

AUTHOR: Dushkov, B. A.; Zolotukhin, A. N.

ORG: none

TITLE: Index changes in the dynamics of human work capacity during a prolonged confinement to a small-capacity chamber

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 28-29

TOPIC TAGS: isolation test, circadian cycle, psychophysiology, performance test

ABSTRACT: The purpose of this experiment was to study the work capacity dynamics of a pilot during a 30-day confinement to a small-capacity chamber. The subject's mobility was substantially limited and he was partially isolated. Work capacity was evaluated by indices of muscular force and stamina, musculo-articular sensitivity, and sense of time. There was also a test given which involved the searching, counting and reverse counting of numbers (using the red and black table method). All physiological parameters were measured. Tests were conducted before, during, and after the experiment, and also during the recovery period. For the majority of each day, the subject was in a reclining or semi-reclining position. Analysis of experimental data shows that over a 30-day period, a substantial change in force reactions, time reactions, and psychic functions takes place. It was found that in comparison with pre-experimental test results, starting with the 11th day there was a certain improvement in psychic functions (attention capacity, visual perception speed, shifting attention, etc.). Immediately after the experiment, however, there was a significant deterioration in these indices. Beginning with the 13th day, the subject's resistance to physical stress sharply decreased. The 30-day confinement brought about a certain adaptation on the part of the subject to the position of reclining on his back. A deterioration of movement coordination in sitting and standing positions was observed. In the recovery period the reactions of time and force begin to normalize. The results of the experiment demonstrate the unique characteristic of rhythmic change in vital activity and of human work capacity dynamics during prolonged confinement to a small chamber. The changes that result in time and force reactions, and in psychic functions are necessary to consider in the design and development of optimum work and rest schedules for individuals who will be confined for long periods of time to small-capacity chambers. [WA-22] [AC]

157.

AUTHOR: Gerd, M. A.

ORG: none

TITLE: Human work capacity at various periods of wakefulness

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 20-21

TOPIC TAGS: circadian cycle, performance test, psychophysiology

ABSTRACT: The task of the experiment was to make a comparative study of human work capacity during various periods of the day. Work capacity was studied at the beginning, middle, and end of six tests lasting 15—20 days. The subjects were 7 healthy males ranging in age from 25 to 30 yr; they observed (2 or 3 together simultaneously) specially developed regimes. The following methods were used for judging work capacity: work with tumblers on a conveyor belt, the clamping of planks with screws and nuts, work with a telegraph key, searching-out of appropriate letters in various codes, oral and written calculation, work with a black and red chart, and the pictogram of A. R. Luriya. Each method was used in tests that were given twice daily. Results were that work performance at night slowed down if compared with performance in the morning, during the day, and at night in 44, 73 and 40% of the cases, respectively. Acceleration was registered in 30, 13, and 40% of the cases. It can be seen that work at night was less productive than at the other period of the day. The number of incidents where there was a slowing down in reaction at night was no greater at the beginning of the experiment than it was in the middle or at the end of the experiment. Thus, a worsening of work capacity did not occur solely because of the shift to a new regime, but was evident throughout the entire experiment. The slowing-down level of work at night was maximum at the beginning of the experiment but the number of incidents involving substantial slow-down in speed decreased constantly throughout the course of the experiment. On the other hand, the number of incidents involving relative minimal slow-down was evident throughout the entire experiment. This slowing-down did not diminish insofar as the subjects' adaptation to a new regime was concerned; in fact, it even increased somewhat. The author concludes that results from tests conducted at night show that the reason for worsening of work capacity is disturbance of daily rhythm activity and rest.
[WA-22] [AC]

158.

AUTHOR: Gerd, M.A.

ORG: none

TITLE: Working capacity and higher nervous activity of man following various work and rest schedules

SOURCE: Ocherki psikhofiziologii truda kosmonavto (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 126-136

TOPIC TAGS: biologic rhythm, higher nervous activity, adaptation, physiologic fatigue, EEG

ABSTRACT: This paper is based on experiments performed in conditions imitating certain features of a spacecraft with a three-man crew. The working capacity of the subjects was controlled during the experiment, and the condition of higher nervous activity was tested before and after the experiment. Reactions of the subjects whose sleep was scheduled during daytime slowed down considerably in the beginning of the experiment, normalized as the subjects adjusted to the new situation, and slowed down toward the end of the experiment as a result of fatigue. The EEG tests showed a predomination of stimulatory processes which developed and then disappeared rapidly. The inhibition processes were also weakened. [EF]

159.

AUTHOR: Gurovskiy, N.N.

ORG: none

TITLE: Characteristics of cosmonaut work activities during prolonged spaceflights

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 5-13

TOPIC TAGS: working condition, physiologic stress, space psychology, adaptation, work organization

ABSTRACT: The article deals with the problem of composing a work schedule for cosmonauts. The task is complicated by the fact that there are no experiences that can be taken for a basis, and that the psychological and physiological condition of a cosmonaut during a prolonged spaceflight (under the effects of weightlessness, confinement, monotony, and the feeling of being cut off from the Earth) would be different from that in any laboratory experiment. A rational organization of rest time should compensate for the lack of movement and strain of constant attentiveness during the shift at the control panel. [EF]

160.

AUTHOR: Kharabuga, S. G.

ORG: none

TITLE: Study of the effect of the daily schedule on daily periodics

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 67-68

TOPIC TAGS: circadian cycle, training exercise, human physiology

ABSTRACT: The study deals with the effect of stereotyped strenuous muscular activity on the daily rhythm of motor and sympathetic functions. The following were studied: muscular strength of the wrist, time of motor reaction (registering the latent and motor periods), tapping (maximal frequency of wrist motion on the telegraph key), accuracy of motion, body temperature, pulse rate, and "sense of time". Fifty-two highly qualified student athletes participated in the experiment. On the day of the experiment, the subjects did not fulfill their normal muscular activity. Data obtained was processed according to the Fisher-Student method. Four types of daily changes were noted: double-peak, peak-plateau, single-peak, and an extended double-peak. The highest indices occurred during strenuous muscular activity regardless of the time of day. During the absence of a clear-cut schedule of motor activity, the observed synchronization of changes can be disturbed. Least accurate motion was noted in the morning. It gradually increases and levels off during the afternoon. Change in pulse rate and body temperature did not vary from that noted by other authors. Graphically, they are depicted by a curve with the peak at midday. The indices of the "sense of time" correspond to body temperature and pulse rate. These indices are only slightly affected by the daily schedule of motor activity. The dependency of non-continuity of changes in motor functions on the daily schedule of motor activity indicates that the functional condition of the neuromuscular apparatus can be improved by means of purposeful changes in the daily schedule. This assumption was verified by data from the EMG and EEG. [WA-22] [AC]

161.

AUTHOR: Koreshkov, A. A.

ORG: none

TITLE: Effect of various work and rest schedules on the psychophysiological functions of man

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 34

TOPIC TAGS: circadian cycle, isolation chamber, adaptation, psychophysiology

ABSTRACT: Rational composition of work and rest schedules facilitates man's adaptation to isolation in small chambers. To investigate the effect of various schedules on the human organism, experiments were conducted in soundproof chambers, where the subjects stayed for extended periods observing normal, the inverted, and interrupted (polyphase) schedules. The results proved that schedules differing from the terrestrial 24-hr day caused disruptions in psychological and physiological functions, and that the more the schedule deviated from the terrestrial day, the greater the disruptions it caused. [WA-22] [EF]

162.

AUTHOR: Korotayev, M. M.; Mikhaylovskiy, G. P.; Tsyganova, N. I.

ORG: none

TITLE: Changes in the human organism's reactivity during a prolonged stay in a small chamber

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 35-36

TOPIC TAGS: isolation chamber, hypodynamia, blood chemistry, circadian cycle

ABSTRACT: Experiments with 20 healthy 22—31-yr-old men consisted of confinement to a small room for 14—30 days, during which the subjects received mostly dehydrated food. Most of them lost weight during the experiment. In addition to the usual clinical methods of investigation, some biochemical and immunological studies of the blood were made to test the reactivity of the organism. After the experiment, some increase of bilirubin, $\alpha_1 + \alpha_2$ globulins and calcium, as well as a slight decrease of cholesterin, albumins, and β-globulin content was observed, although these changes were statistically uncertain. The general blood protein, γ-globulin, sugar, and potassium content varied insignificantly. The increase of sugar content

in the blood after glucose administration can be explained by an inhibition of the pancreas function, which may be caused by changes in the interaction between the locomotor system and internal organs (specifically pancreas and adrenal glands), resulting from hypokinesia. A pronounced decrease of the properdine level in blood was also noted after the experiment. These changes of the organism's reactivity must be considered during the planning of work and rest schedules for personnel confined to small rooms. [WA-22] [EF]

163.

AUTHOR: Kosilov, S.A.; Dushkov, B.A.

ORG: none

TITLE: Physiological basis for adaptation to specific work conditions

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies of the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 14-32

TOPIC TAGS: physiologic fatigue, biologic rhythm, adaptation, physical stress, space psychology, hypnosis, electrosleep

ABSTRACT: The author presents a detailed discussion of physical and mental fatigue, adaptation to altered circadian rhythms and mechanisms of such adaptation. The complicating effects of weightlessness and emotional tension on fatigue and biorhythms are emphasized, and the use of hypnosis, electrosleep and drugs is suggested as a means of facilitating adaptation to the working conditions prevailing during prolonged spaceflights. [EF]

164.

AUTHOR: Kosmolinskiy, F.P.; Dushkov, B.A.

ORG: none

TITLE: Rational establishment of cosmonaut work schedules

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow. Izd-vo "Meditsina", 1967, 32-39

TOPIC TAGS: cosmonaut work schedule, hypodynamia, sensory deprivation

ABSTRACT: The authors review the known data on work-rest schedules in relation to fatigue and environmental factors. They then consider the effects of various spaceflight factors (hypodynamia, sensory deprivation, eye fatigue, crew size, mission duration, etc.) which have to be taken into account with development of proper work-rest schedules for specific mission profiles. [BM]

165.

AUTHOR: Kosmolinskiy, F. P.; Kozar', M. I.

ORG: none

TITLE: Some indices of the stress reaction during chamber experiments with various work and rest schedules

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 37-39

TOPIC TAGS: circadian cycle, isolation chamber, hypodynamia, sensory deprivation, physiologic fatigue, test method

ABSTRACT: To evaluate the degree of physical fatigue resulting from prolonged isolation, sensory deprivation, monotony of stimulation, hypodynamia, hygienic discomfort and similar factors, the sedimentary color reaction of urine developed by Kimbarovskiy (1950) and the test of the lysozymic activity of saliva are recommended. These two methods were used to determine the functional condition of subjects observing an altered work and rest schedule during a prolonged stay in sealed chambers. In five 3—15-day-long experiments, several day schedules composed of 6-hr and 3-hr periods of sleep, rest, and work, as well as the regular schedule with 8-hr periods

were tried. No significant changes were observed in the experiment with the regular schedule, while in experiments with interrupted, and especially shifted schedules, the intensity of the Kimbarovskiy reaction exceeded the initial values 3—4 times, and the results of the saliva lysozyme test were 3—10 times lower than the initial. The increased intensity of the Kimbarovskiy reaction, and the inhibited lysozymic activity correlated with the obvious fatigue of the subjects and with the results of other physiological and biochemical tests. The simplicity and high informativity of the Kimbarovskiy and lysozymic tests make them very advisable. [WA-22] [EF]

166.

AUTHOR: Kuznetsov, O. N.; Lebedev, V. I.; Litsov, A. N.

ORG: none

TITLE: Concerning individual psychological features of human adaptation to altered daily regimes

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 40-41

TOPIC TAGS: circadian cycle, psychologic adaptation, psychophysiology, performance test

ABSTRACT: Prediction of human work capacity and well-being under conditions of altered daily regimes requires study of the personal psychological aspects of adaptation to such changes. Certain scientists connect the differential features of the reorganization of physiological functions and work capacity primarily with endogenous factors and typological features of animals and humans. The principal difference in the adaptation of animals and humans to altered daily regimes either has not been analyzed or indicates the inhibitory role of the second signaling system of man in adaptation to altered daily regimes in an unchanging daily social situation (Ye. I. Brant, O. M. Margolina, 1949; G. M. Gambashidze 1961 — 1963 — 1965; K. M. Bykov, A. Slonim, 1960). The authors of this study consider the individual psychological features of adaptation to altered daily regimes to be a particular characteristic of the adaptability of the individual to new conditions. In man, this process is always a goal-oriented, conscious, and motivated process. Analysis of the individual features of adaptation to altered daily regimes under conditions of solitary confinement in a soundproof chamber permitted manifestation and analysis of the differential characteristics of such adaptation as they depend on the personalities of the subjects. Three fundamental, successive steps can be schematically distinguished in the individual's adaptation to altered daily regimes: 1) subjective awareness of the task of adaptation to the structure of the regime and of the relationship between the regime structure and its components, 2) elaboration of a plan (K. Pribram) [sic] and tactics of conduct, and the adoption of a volitional decision to implement them, and 3) daily execution of the decisions, with feedback correction. Individual features or peculiarities were noted at all stages of adapta-

tion, but the definitive element was the strictness in maintaining the prescribed and subjectively adjusted daily periods of work and sleep. The activity of the individual in overcoming the inertia of the daily stereotype was manifested in the internal and external forms of heightening the tonus of the cerebral cortex. Except for elements of peculiarity in the method of adaptation (V. S. Merlin), the authors discovered no significant correlations between adaption to altered daily regimes and the typological features of higher nervous activity in their experiments. Generally, the subjects had various types of strong will. Significant differences in the reorganization of physiological functions and work capacity were found to be dependent on goal-orientation, consciousness, volitional qualities, and motivation. [WA-22] [AC]

167.

AUTHOR: Kuznetsov, O. N.; Lebedev, V. I.; Litsov, A. N.; Khlebnikov, G. F.

ORG: none

TITLE: Methodic particularities of extended surdochamber experiments for investigation of the regularity of human adaptation to altered diurnal schedules

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 42-43

TOPIC TAGS: circadian cycle, isolation chamber, adaptation, medical experiment, test method

ABSTRACT: Prolonged soundproof chamber experiments with altered diurnal schedules represent an adequate model for the study of the regularity of human adaptation to altered schedules. A standardization of environmental conditions and of the activities during work and wakeful rest periods, as well as a combination of physiological and psychological investigations in a single method, facilitate the analysis of the adaptive processes. In order to exclude the effect of adaptation to experimental conditions (sensory deprivation, "social loneliness", discomfort, lack of feedback, artificial light, etc.) on adaptation to altered schedules, several methods were used, such as a control experiment with the usual diurnal schedule, or a sudden or announced shift to the unusual schedule on the third day of the experiment, when the first phase of adaptation is completed. Single soundproof chamber experiments are preferable to group experiments, because they reveal the individual adaptivity, which will be masked by personal interrelations and influences in a group. [WA-22] [EF]

168.

AUTHOR: Kuznetsova, S. S.

ORG: none

TITLE: Diurnal rhythm of radiosensitivity in mice and rats

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 44

TOPIC TAGS: circadian cycle, irradiation biologic effect, radiation sensitivity, basal metabolism, leukocyte, blood count

ABSTRACT: Precise diurnal rhythms have been determined for most biochemical processes on the cellular and tissue levels, as well as for most physiological functions. To investigate diurnal changes in radiosensitivity, experiments with mice and rats were conducted exposing them to LD 50/30 of γ irradiation at eight different times of the day. The results showed two peaks of death rate: at 0900 and from 2100 to 2400 hr, and a death rate amplitude from 25% (at 0300 hr) to 80% (2100 hr). The difference in LD 50/30 values determined for different hours of day was 270 rad, and the mean value equaled 713 rad. A comparison of basal metabolism, the leukocyte number in peripheral blood, and radiosensitivity revealed a positive correlation of the radiosensitivity fluctuations with the diurnal rhythm of basal metabolism, and a negative one with fluctuations in the leukocyte number. [WA-22] [EF]

169.

AUTHOR: Lebedev, V. (Candidate of Medical Sciences)

ORG: none

TITLE: Man in space

SOURCE: Nauka i zhizn', no. 3, 1968, 25-59

TOPIC TAGS: electromagnetic field, electromagnetic biologic effect, earth magnetic field, manned space flight, mental disorder

ABSTRACT: The effects of the Earth's magnetic field on mental processes, performance, biorhythms, and the cosmonaut's life in a spacecraft are discussed. Human behavior in the Earth's magnetic field is the subject of magnetobiology, a science still in its developmental stage. Various statistical studies in Germany and the USA during periods of magnetic storms shows an increase in nervous and mental disease, in the number of suicides and in car accidents in 1958 and 1964, periods of magnetic storms. Studies are reported on the effect of electromagnetic waves of varying length on the animal and human central nervous system, on protein metabolism, and on the behavior of experimental animals exposed to centrimeter waves. The action mechanism can only be assumed, e.g. electromagnetic effect on the body's surface electric

potential, on the biologic clocks of animals and man and primarily or secondarily on the central nervous system. Since the Earth's magnetic field is known to pulse at a frequency of 8-16 pulses/sec, it has been proposed that the alpha rhythm of the brain which has the same frequency is related to the Earth's pulse and that disturbances of the Earth's magnetic field may lead to biologic processes that disturb the alpha rhythm (Soviet scientist A. Presman, "wrong information"). The author determined experimentally that changing the alpha rhythm in humans will also accelerate or decelerate counting; however, test subjects were able to correct their count when this fact was pointed out to them. The author concludes that biologic clocks are in some way related to magnetic fields. Biologic cycles have evolved with life on earth, and experiments have shown that they remain essentially unchanged under changing conditions. Thus, social adaptation to another hourly rhythm (say from the USA to Europe) requires only 2—3 days, while physiological adaptation takes 15 days. Light and temperature are the main factors in animals, but in man social factors must be considered. Maintaining customary conditions of biologic rhythm is therefore important in spaceflights. The man-machine relationship is discussed. It was determined that a constant watch at the controls for more than 5—6 hr weakens attention; this period is probably shortened in spaceflight. The author recommends 4 hr of work, 4 hr active rest and 4 hr sleep as the best rhythm. Installation of a soundproof sleeping compartment is required for sound sleep. It is concluded that a correctly planned and scientifically well-founded activity schedule will maintain the crew's working capacity throughout the spaceflight and increase the reliability of the man-machine system.

[WA-22] [06]

170.

AUTHOR: Litsov, A. N.

ORG: none

TITLE: Diurnal dynamics of some physiological functions and work capacity in man in conditions of isolation

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 83-86

TOPIC TAGS: isolation chamber, diurnal variation, electroencephalography

ABSTRACT: Results are reported on a study of diurnal periodicity to determine the times of change in basic physiological functions and work capacity during acute changes in sleep and wakefulness, and to determine the most adequate indices for reflecting the process of adaptation to changed diurnal regimens. Eight healthy males, aged 25—38 yr, were placed in an isolation chamber for 9—11 days. Diurnal patterns were determined by the EEG, heart and respiratory rate, body temperature fluctuations during the waking period, and motor activity during sleep. Indices of work capacity included manual and mental performance tests. Sleep was studied by actographic descriptions of the sleep act, EEG, and observations with infrared vision. A consistent diurnal rhythm in heart rate, body temperature, EEG, and respiration was maintained during normal distribution of sleep and wakefulness in

the isolation chamber. Work capacity increased during the day and decreased during the morning and evening hours. There was little change in the sleep pattern. There was some effect on diurnal periodicity of remote physiological functions. It was determined that an increase in the pulse rate, respiration, body temperature, and maximum work capacity during the day correlated with predominance of frequent rhythms and minimum values of total energy in the EEG (partial EEG desynchronization). On the other hand, a decrease in pulse rate, respiration, and motor activity correlated with the increase in total energy and increase in the slow rhythm of the EEG (synchronization of the EEG). The coordinating changes in the CNS, and the autonomic and motor parameters reflect the level of the general tone of the CNS regulating the process of homeostasis in response to bodily activity during the 24-hr period. It is concluded that a 10-day stay in a limited area during normal sleep and waking periods does not disturb the diurnal dynamic stereotype of physiological function and work capacity. Orig. art. has: 1 figure. [XF]

171.

AUTHOR: Litsov, A. N.

ORG: none

TITLE: Experimental investigation of the dynamics of certain physiological functions and work capacity of man under the condition of regular or altered diurnal schedules

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 45-46

TOPIC TAGS: circadian cycle, adaptation, human physiology, performance test, sleep, isolation chamber

ABSTRACT: A comparative study of the dynamics of physiological functions and work capacity of subjects observing normal and altered diurnal schedules was done in a series of 9—11 day-long one-person experiments. In subjects observing the normal diurnal schedule (sleeping from 2300 to 0800 hr), the dynamics of physiological functions and good sleep (according to objective and subjective methods) remained unchanged, in spite of the unusual conditions. Three basic stages of adaptation were noted in subjects observing altered schedules: the initial stage (retention of the old rhythm), the apparent adaptation (appearance of the new rhythm and fading away of the old rhythm), and the stage of fine adaptation (fixation of the new rhythm). Various physiological functions and various aspects of work capacity require different lengths of time for adaptation. Indices of adaptation appear in the EEG on the 1st—3rd days, in pulse rate and body temperature on the 4th—6th days, in respira-

tory rate on the 6th—8th days: in simple reactions on the 2nd—3rd days, in selective reactions and resistance to signal interference on the 3rd—4th days, in time tests on the 4th—7th days, and in mental work capacity on the 5th—8th days. The quality and duration of sleep were also affected in subjects with altered schedules. In the first days, the duration of sleep did not exceed 4—5 hr/day, normalizing toward the 5th—8th day, but sleep remained superficial during the daytime. The results of these experiments prove that adaptation depends on the degree of deviation of the schedule (from normal), on the distribution of work and rest periods, and on the regimentation of the activities. It also becomes evident that the evaluation of adaptation must be based on indices reflecting the dynamics of physiological functions and work capacity, as well as on the quality of sleep. [WA-22] [EF]

172.

AUTHOR: Matova, M. A.

ORG: none

TITLE: Studying shifts in biorhythms when there is an abrupt change in the geographic zone of habitation

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdyka", 1967. Materialy. Moscow, 1967, 50-51

TOPIC TAGS: circadian cycle, adaptation, cosmonaut work schedule

ABSTRACT: Individuals moving rapidly across several time zones were used in this study of biorhythms. Teams of athletes were used as subjects for the following reasons: 1) athletes represent a uniform contingent and can easily be classified (sex, age, type of sport, and proficiency); 2) the activity of athletes is conducted on a strict schedule of work and rest in the pre-competition period; 3) members of the athletic collective are subjected to systematic medical control. All of this enables a comparison of the condition of the athletes prior to and after flight, including their performance in athletic activity. Observation indicates that during rapid change in the geographic zone of habitation as a result of desynchronization in physiological and physical rhythms, significant shifts result in the organism's condition. Environmental factors, changes in natural lighting, new climatic conditions, and new scheduling play the main role in the process of desynchronization. At the present time, these data are being compared with B.S. Alyakrinskiy's results from special studies on man's adaptation to an unusual work and rest schedule in a spacecraft. The athletes' condition can serve as a good model for studying the process of adaptation to new schedules. This is necessary for the creation of optimal work-rest schedules and for the elimination of the disruptive desynchronization. It is important not only in sports but in other areas as well, where work-rest schedules present difficult problems. [WA-22] [AC]

173.

AUTHOR: Myasnikov, V.I.

ORG: none

TITLE: Effect of altered daily activity schedule on the human organism during confinement

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 107-125

TOPIC TAGS: biologic rhythm, adaptation, physiologic fatigue, sleep

ABSTRACT: The author underlines the importance of a carefully organized work and rest schedule for cosmonauts and points out the difficulty of the task. He then describes a series of confinement experiments with different work and rest schedules and discusses the physiological and neuropsychological effects. Changes in physiological functions producing fatigue, poor sleep, reduction of working capacity, slowness of reaction, dozing during work time and hallucinations, could seriously impare the fulfillment of a mission. In order to make any given schedule effective, means should be found to keep the duration and depth of sleep under control. [EF]

174.

AUTHOR: Myasnikov, V. I.

ORG: none

TITLE: The importance of sleep in orzanizing the cosmonaut's schedule of daily activity

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 52-53

TOPIC TAGS: circadian cycle, adaptation, sleep, cosmonaut work schedule

ABSTRACT: Efficient organization of a work-rest schedule for spacecraft crews during prolonged flight or expeditions to other planets is unthinkable without a serious study of the problem of biorhythms. The human organism is limited in its capacity in the reorganization of the physiological cycle of wakefulness and sleep both from the standpoint of time and maintaining psychophysiological comfort. An analysis of published data indicates that reorganization of the habitual schedule requires from one to two weeks. This reorganization is accompanied by specific functional disturbances such as feelings of hunger, somnolence, and insomnia. If man's activity is not strictly scheduled in the new cycle and he is permitted to sleep as much as he wants, then the reorganization from one schedule to another is accomplished more quickly and more painlessly. In an experiment with the "free schedule" (where the subject himself

planned his time), an increase in the duration of sleep was noted (1.0—1.5 hr) in comparison to the duration of sleep of subjects' working a normal schedule (working at day, sleeping at night). As a result, in the course of 7 days, the subject "passed" the time cycle by 12 hr and reorientated himself in a shorter time. The basic of this phenomenon is that man's "physiological clock" works more accurately the more often it is regulated (the principle of reenforcement) with periodic changes in the environment, Under conditions of artificial lighting, with the absence of reenforcement, the habit of sleeping for a certain amount of time was preserved. This effect of "natural sliding" from one schedule to another can be used as a departure point in reorganizing the daily activity cycle in spaceflight conditions.[WA-22] [AC]

175.

AUTHOR: Myasnikov, V. I.

ORG: none

TITLE: On the problem of the diurnal rhythm of physiological functions in man in conditions of isolation

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and spece medicine), 128-133

TOPIC TAGS: diurnal variation, space environment simulation, space flight biologic effect

ABSTRACT: The article reports the effect of the normal diurnal periods of night sleep and day wakefulness, day sleep, and rotated (i.e. shifted) periods of sleep and wakefulness on the diurnal rhythm of heart rate, respiration, and body temperature in 23—35 yr-old male subjects isolated for 10—15 twenty-four-hour periods. Five subjects were assigned to the usual night sleep period, 9 to the day sleep period, and 4 to the rotated (i.e. shifted) regimen of sleep and wakefulness. All subjects slept 9 hr per diem. Room temperature was 19—23°C, relative humidity was 40—70%, CO_2 was 0.03—0.05%, and O_2 concentration was 20—25%. Respiration was recorded every 15 min. The M-24 microamperometer was used to record the frequency of respiratory movements. Pulse frequency was determined by EKG's 4 times per diem. Body temperature was recorded immediately after sleep and at the end of the work day. Analysis of the results showed that prolonged stay in a closed restricted space has marked effect on the organism. Heart rate increased by as much as 20 beats per min toward the end of the 15-day experiment in the day sleep group, and by 10—12 beats per min in the night and the rotated (i.e. shifted) sleep subjects toward the end of

the 10-day experiment. Diurnal changes in external respiration were noted during the 6th day in subjects sleeping during the day. Body temperature and pulse frequency registered immediately upon awakening were always less than at the end of the period of wakefulness, irrespective of the actual clock time. The functional changes in the body are caused by the simultaneous action of isolation, hypodynamia, and alterations in the primary shifts of sleep and wakefulness and lead to a decrease in the capacity of the body to endure physical stress. Orig. art. has: 2 figures. [XF]

176.

AUTHOR: Panferova, N. Ye.

ORG: none

TITLE: Change in the daily rhythm of human functions during limited muscular activity

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 54-55

TOPIC TAGS: hypodynamia, test method, human physiology, circadian cycle

ABSTRACT: The effect of limited muscular activity on the daily rhythm of a complex of functions was studied in this experiment. These functions were pulse and respiration rate, arterial pressure, and body temperature. The most limited state of muscular activity can be achieved in a position of "mediophysiological calm". This position was created by placing the subjects in a recumbent position in a water immersion or in a specially constructed chair. Physiological indices were measured every 2 hr except during periods of sleep. The daily schedule was kept as close to normal as possible. A mandatory condition of all the tests was a maximal observance of immobility. Six healthy males (20— 25 yr) took part in the experiments, and a total of 6 tests were run. Three were tested in the chair and the other three in the water immersion. During the experiment, the daily rhythm of body temperature changed. The increase in body temperature during the day became less pronounced and in a number of cases it was essentially not noted or it decreased. Towards evening, body temperature increased. Change in daily rhythm of pulse frequency, respiration, and arterial pressure were observed by the indices of the investigated daily values. Pulse frequency and respiration rate did not change during the experiment; the maximal, and to a lesser degree, the minimal arterial pressure decreased. The average quadratic deviations in pulse frequency and maximal arterial pressure decreased evidently at the expense of less severe daily fluctuations. The average quadratic deviation in respiration rate and minimal arterial pressure increased. There was no dependency noted between daily changes of body temperature and other functions. With an increase in body temperature, other indices may not shift or they may shift in the opposite direction. Dissociation of the daily rhythm in the studied indices verifies that regulation of the daily rhythm of body temperature, pulse frequency, respiration rate, and arterial pressure is based on various mechanisms. Limited muscular activity affects the daily rhythm of these functions and consequently the mechanisms of regulation. The most pronounced distrubance is in the daily rhythm of body temperature. It can be assumed that the nature of shifts in daily rhythms is related to neurotic phenomena caused by limited muscular activity. [WA-22] [AC]

177.

AUTHOR: Panferova, N. Ye.; Tishler, V. A.

ORG: none

TITLE: Daily fluctuations in human orthostatic resistance

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 56-57

TOPIC TAGS: isolation chamber, performance test, circadian cycle

ABSTRACT: The purpose of this study was to investigate the rhythm of daily fluctuations of reactions in arterial pressure and pulse frequency to orthostatic tests. For a period of 3 days, the subjects were confined to a special chamber and observed the following schedule: breakfast from 0900 to 0930 hr, lunch from 1400 to 1500 hr, dinner from 2030 to 2100 hr, and sleep from 2400 to 0800 hr. During the day the subjects observed a schedule of free motor activity and performed light physical tasks. Three times a day during the course of the experiment (at 1000, 1700, and 2300 hr), after a 15-min period in the horizontal position, the subjects conducted a 5-min orthostatic test and a 3-min clinostatic test in the standing position. Prior to, during and following the orthostatic test, boood pressure and pulse frequency were measured. It was noted that adaptability of the subject to orthostatic tests changed during the day. At 1000 and 1700 hr, during the orthostatic test, pulse rate increased 15—20 beats/min, systolic pressure in one subject increased 8 mm Hg, and in the second subject increased 5 mm Hg. The diastolic pressure increased 12—16 mm Hg. During the orthostatic test at 2300 hr, pulse rate increased 24—28 beats/min, systolic pressure decreased 6—8 mm Hg, and diastotic pressure in one subject was the same at that in the morning. In the second subject it decreased 3 mm Hg and then gradually increased Thus, in the evening, resistance to orthostatic tests decreased. However, the decrease in resistance was within normal physiological limits and was not very pronounced. Evidently, the decrease in adaptability to orthostatic tests in the evening under normal conditions of comfort does not substantially affect efficiency in the standing position. [WA-22] [AC]

178.

AUTHOR: Romashkin-Timanov, V. I.; Peskov, N. N.

ORG: none

TITLE: Combined effect of hypodynamia and certain extreme factors on the functional conditions of human central nervous and cardiovascular systems

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 58-59

TOPIC TAGS: hypodynamia, central nervous system, cardiovascular system, performance test

ABSTRACT: To investigate the functional condition of the CNS and the cardiovascular system during hypodynamia, experiments were conducted on 25 young men who spent 4 weeks in small rooms with 23—28°C temperature, 55—70% humidity, increased CO_2 content (up to 1.2%), and presence of carbon monoxide (0.003—0.005 mg/ℓ). After 14 days of work in these conditions, their visual galvanic chronaxy increased by 58%; and in some cases five days after the end of the experiment, it was still above initial values. The greatest changes were observed in the optical adequate chronaxy (which exceeded the initial values by 60% on the second day after the experiment, and by 44% on the fifth day), and in the rate of differentiation of light signals which had to be 3—10 times stronger than before the experiment. A decrease of maximum and minimum values of arterial blood pressure was also observed, as well as an increase in pulse reaction and restoration time after a standard functional test. The increase of latent periods in ortho- and clinostatic reflexes leads to the assumption that some changes in the neural regulation of the cardiovascular system take place under these conditions. The data obtained indicate that a reduction of the functional possibilities of the cardiovascular system, the CNS, and particularly the decline of analytical and synthetical functions of its higher sections, should be considered during the designing of work and rest schedules of specialists working for an extended period of time in small rooms. [WA-22] [EF]

179.

AUTHOR: Shilov, V. M.; Kozar', M. I.

ORG: none

TITLE: Changes in the immunological reactivity of man exposed to various day schedules in a sealed chamber

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 71-72

TOPIC TAGS: circadian cycle, isolation chamber, phagocytosis

ABSTRACT: Immunological reactions are widely used to evaluate the effect of environmental factors on the organism, fatigue in sportsmen, and changes in reactivity caused by emotional factors. In this case, immunological reactions were used along with physiological, psychological, and biochemical investigations, to evaluate the effect of various work and rest schedules on the human organism. Two 15-day-long experiments in sealed chambers with 3 subjects in each, were arranged to investigate the effect of a 24-hr schedule (8 hr of sleep and alternating 4-hr periods of work and rest) and an 18-hr schedule (6 hr of sleep and alternating 3-hr periods of work and rest). Certain moderate changes in the phagocytic reaction and in the lysozymic saliva activity of subjects observing the 24-hr schedule can be explained by the unusual enviromental conditions. In subjects observing the 18-hr schedule, a pronounced drop of the phagocytic activity of blood neutrophils and saliva lysozyme titer was observed. The data of the immunological investigation coincide with the psychophysiological evaluation, indicating that the more a schedule deviates from the normal, the more difficult it is to withstand. [WA-22] [EF]

180.

AUTHOR: **Stepanova, S. I.**

ORG: none

TITLE: Certain requirements in work and rest schedules in laboratory conditions

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 64-65

TOPIC TAGS: circadian cycle, adaptation, test method

ABSTRACT: Man's efficiency in new working conditions depends on the degree to which he has mastered the new working schedule. Speed of adaptation to unusual daily rhythms is subject to significant individual differences. Man adapts more easily to new work schedules that approximate those of normal terrestrial conditions. One basic requirement is a consideration of the individual differences in each subject. It is necessary to ease unusual sleep schedules by occupying the subject's free time with various tasks. The task must be interesting to the subject. The subject should realize the purpose of each method he uses and he should attempt to conscientiously execute all tasks. Methodologies should be individually selected with one purpose in mind so that the subject will not have a negative attitude toward the work being performed. Subjects should completely and efficiently master the methodology prior to performing the task. The subject should be required to punctually comply with the preset schedule. Noncompliance with the requirements may not have a noticeable effect on the subject in short tests (7—8 days), but can cause serious disruptions in efficiency and health in prolonged tests (more than 8 days) and may threaten success (chronic desynchronization). All of these points should be considered in the creation of a work-rest schedule for individuals required to live and work under conditions of an altered daily rhythm. [WA-22] [AC]

181.

AUTHOR: Svyadoshch, A. M.; Romen, A. S.

ORG: none

TITLE: The effect of autosuggestion on certain cyclic processes

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 60-61

TOPIC TAGS: psychologic conditioning, psychologic training, psychophysiology, circadian cycle, adaptation

ABSTRACT: The tests run in this experiment on 155 subjects indicate the possibility of affecting muscular tone, skin temperature, pain and tactile sensitivity, simple reaction time, perception rate, flow of trace images, fatigue, and the ability to fall asleep and awaken at set times in unusual circumstances, by means of autosuggestion. The following cyclical processes were studied: sleep and wakefulness rhythm, intake of food, and physiological functions. Rapid transition from one time zone to another requires reorganization of the cyclic rhythm in the organism. Time required for the reorganization process varies from individual to individual. For 3 subjects after a flight from Moscow to Karaganda (a time difference of 3 hr), reorganization required 4—5 days and was evidenced by disturbances in sleep, in intake of food, and in physiological processes. These subjects completed a six-month course in autogenic training and had mastered the technique of autosuggestion. After the course they could adjust to a new schedule in one day by means of autosuggestion. A healthy 35-yr-old subject who had completely mastered the technique of autosuggestion was required to shift his daily rhythm by 7 hr for a period of 5 days. This subject had practiced autogenic training for 6 yr and had never worked at night. His new schedule required that he go to bed at 1700 hr (instead of the usual 2400 hr), and get up at 0100 hr (instead of the usual 0800). In addition, he had to alter his daily schedule of work, rest, eating, etc. Transition to the new schedule and subsequent return to the former schedule was easily accomplished within one day. [WA-22] [AC]

182.

AUTHOR: Veselova, A.A.; Gurovskiy, N N.; Dushkov, B.A.; Zhuravlev, V.V.; Zaloguyev, S.N.; Iseyev, P.R.; Karelina, Z.M.; Kozar', M.I.; Kosmolinskiy, F.P.; Krutova, Ye. M.; Manovtsev, G.M.; Nefedov, Yu. G.; Shilov, V.M.

ORG: none

TITLE: Effects of various work and rest schedules on the functional condition of man during prolongned confinement in hermetically sealed cabins.

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 76-106

TOPIC TAGS: biologic rhythm, adaptation, physiologic fatigue

ABSTRACT: Experiments with 24-hr and 18 -hr day schedules in hermetically sealed cabins have shown a general decrease in mental and physical capability: concentration diminished; the subjects needed more time to memorize assigned tasks and forgot them more easily; the thinking processes became slower and less effective. Body temperature, weight and respiration showed slight deviations, while arterial pressure, pulse rate, muscular force and tonus, motor coordination, erythrocyte resistance, and natural immunity showed considerable unfavorable changes. In the 24-hr-day experiment, functional changes were more pronounced in subjects whose rest periods were scheduled during the astronomical day, while the most significant deviations were observed in the 18 hrs.-day experiment. [EF]

183.

AUTHOR: Zagradskiy, V. P.; Sidorov, O. Yu.; Sulimo-Samuyllo, Z. K.

ORG: none

TITLE: Some peculiarities of work regime in sealed rooms with increased CO_2 content

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967, Materialy. Moscow, 1967, 30-31

TOPIC TAGS: environment test chamber, isolation chamber, hypercapnia, performance test

ABSTRACT: In emergency situations, the inhabitants of sealed habitations may be exposed to breathing atmospheres with an increased CO_2 content for an extended period of time. Arising hypercapnia causes functional shifts in the cardiovascular, respiratory, and nervous systems, which produces unusual reactions to mental or physical strain, and to extreme factors. Experiments conducted in atmospheres with a CO_2 content of 1—6% showed that any physical or mental work (even of short duration) caused an extended increase in respiratory frequency, lung ventilation, tachycardia, and a disruption of fine movement coordination. In such situations, it is not recommended to follow the normal work schedules. Short periods of work should be followed by longer periods of rest, and after the normalization of the atmosphere, intense physical efforts should be avoided. [WA-22] [EF]

AUTHOR: Allik, T. A.; Ivashkina, I. N.

ORG: Central Scientific Research Institute of Physical Culture and Department of Animal Biochemistry of the Biology and Soil Division of Moscow University im. M. V. Lomonosov (Tsentral'nyy nauchno-issledovatel'skiy institut fizicheskoy kul'tury i kafedra biokhimii zhivotnykh biologo-pochvenno fakul'teta, Moskovskiy universitet)

TITLE: Effect of subcutaneous administration of noradrenalin on oxygen consumption of mice conditioned to cold and physical exercise

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 3, 1968, 21-24

TOPIC TAGS: mouse, hypothermia, oxygen consumption, adrenergic drug, biologic oxidation, temperature adaptation

ABSTRACT: Experiments were conducted on 79 white male mice divided into three groups. The first group was conditioned to cold (-15°C); the second group was conditioned to physical exercise over 45-50 days with a daily training period of 1½ hrs; and, the third group served as a control. Oxygen consumption of animals was measured per unit of weight every 10 minutes for half an hour before the experiment. The mean

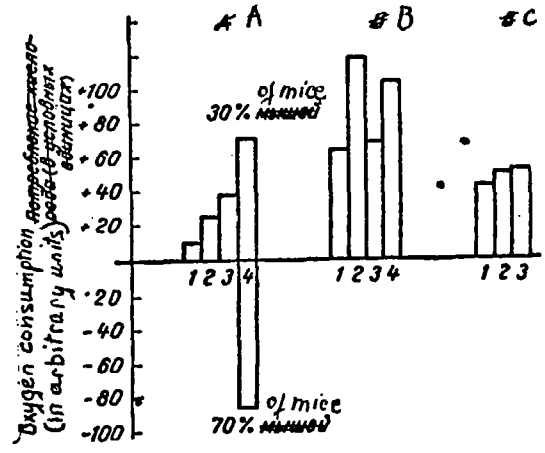


Figure. Change of oxygen consumption of A--control mice, B--mice conditioned to cold, and C--mice conditioned to physical exercise following subcutaneous administration of noradrenalin in doses of (1) 0.5, (2) 1.5, (3) 5 and (4) 10 mkg/g body weight.

Horizontal line--initial oxygen consumption level.

oxygen consumption value per 1 g body weight for an hour was considered to be 100. Then the animals were administered noradrenalin in doses of 0.5, 1.5, 5 and 10 mkg/g and oxygen consumption was measured every 10 min up to the time it became normal. Findings show (see Fig.) that oxygen consumption of control animals increases parallel to size of the noradrenalin dose. But, the largest noradrenalin dose (10 mkg/g) sharply reduces oxygen consumption in 70% of the control animals and increases oxygen consumption for 1½ hrs in 30% of the control animals. Oxygen consumption of animals conditioned to cold, increases sharply for all noradrenalin doses. A 10 mkg/g dose sometimes induced the death of control animals as well as that of animals conditioned to cold; the control animals always died during sharply reduced oxygen consumption, but, the cold conditioned animals always died during high oxygen consumption. Oxygen consumption of mice conditioned to physical exercise is four times higher than of control animals following the smallest noradrenalin dose, and for the other doses oxygen consumption is closer to that of cold conditioned animals. During laboratory conditioning of animals it was found that 25-30% of the animals are capable of withstanding a -15°C temperature for 10 hrs the very first day of conditioning Thus, approximately 30% of control animals react to noradrenalin. In additional experiments it was established that the control animals displaying the highest oxygen consumption reaction following noradrenalin administration are the ones with the highest survival rate when subjected to low temperatures. On the basis of literature data, the authors suggest that with conditioning of animals, two parallel processes take place: increased supply of oxidation substrates to the cells under the influence of noradrenalin, and intensification of free oxidation measured by the amount of oxidized substrate or by oxygen consumption rate. Possibly, from the viewpoint of tissue respiration, conditioning of warmblooded animals to cold represents an increase of the free oxidation rate in the mitochondria. The reaction of an animal to noradrenalin appears to be a more convenient method of determining free oxidation rate change than the method of blocking phosphorylating oxidation. The paper was presented by Member of AMN SSSR, S. Ye. Severin. Orig. art. has: 1 figure.

185.

AUTHOR: Alyukhin, Yu. S.

ORG: Laboratory of Thermoregulation, Institute of Physiology im. I. P. Pavlov, AN SSSR, Leningrad (Laboratoriya termoregulyatsii Instituta fiziologii AN SSSR)

TITLE: Oxygen pressure in the ambient medium, and electrical activity of the brain during hypothermia

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 9, 1968, 998-1005

TOPIC TAGS: hypothermia, hypoxia, hyperoxia, atmospheric pressure, biopotential, oxydative metabolism, thermobar chamber, high pressure chamber

ABSTRACT: Changes in the oxygen metabolism of the brain during hypothermia were experimentally determined by the reaction of the cerebral electrical activity to changes in oxygen content in the ambient medium. The experiment was conducted in a thermal pressure chamber, where unanesthetized white rats were cooled at a rate of 0.1°C/min. The atmospheric pressure was gradually reduced to 360 or 220 mm Hg. In a high pressure chamber, low temperature was combined with a 3 or 6 atm O_2 pressure. The hypothermic control consisted of low temperature at normal atmospheric pressure and hypoxic control of rarefied atmosphere at 30°C to maintain the body temperature close to the normal level. One hundred-one rats were used. In hypothermic control, the area of cortical biopotentials (S) constantly decreased in direct proportion with cooling. The frequency of cortical biopotentials (F) increased at cortical temperature (Ct°) 36—25°, and then decreased. Bioelectric activity (A) ceased about Ct° 14°C. In both variations of hypoxic control S increased significantly. At 360 mm Hg atmosphere some animals survived for 2 hr and showed an enlarged S for 3.5 more hr. At 220 mm Hg atmosphere, F was below normal and A ceased after 22 min of exposure. In an experiment with a 360 mm Hg atmosphere, at Ct° 30—22° both S and F were inferior to the hypothermic control values. Below this temperature the values did not differ from those of the control. In the 220 mm Hg atmosphere which set on at Ct° 26°, the S values equaled those of the control, while F values were lower until Ct° reached 18°. From the on, no differences were observed until the cessation of A, which occurred after 114 min of exposure. In the high pressure chamber, the rats were exposed to a 3 atm O_2 pressure at Ct° 17°, and to 6 atm at Ct° 22°. No significant differences from the control values were observed. A comparison of these results reveals an increased tolerance of the brain to hypoxia in hypothermic conditions, which indicates that hypothermia does not cause cerebral hypoxia. It is also evident that during hypothermia the O_2 content of the atmosphere does not significantly influence the cessation of bioelectric cerebral activity. Orig. art. has: 4 figures. [WA-MIO-69-1] [EF]

186.

AUTHOR: Andreyeva, V. M.; Sorokina, Ye. I.

ORG: Central Scientific Research Institute of Health Resorts and Physiotherapy, Moscow /Director-Yu. Ye. Danilov/(Tsentral'nyy nauchno-issledovatel'skiy institut kurortologii i fizioterapii)

TITLE: Dynamics of bioelectric activity of the brain during electrosleep therapy of patients with neurogenic functional disturbances in the cardiovascular system.

SOURCE: Zhurnal nevropatologii i psikhiatrii, v. 68, no. 4, 1968, 516-522

ABSTRACT: In this experiment, sleep was induced by the orbital-mammiform method using N. M. Liventsev's system. Bioelectric activity of the brain was recorded on a 15--channel "Al'var" EEG. The patients in the study were 20--42 yr old, and length of illness ranged from 2 to 10 yr. The authors studied the bioelectric activity of the brain in patients with neurasthenia and diencephalic disorders (cardiovascular disorders comprising the majority). The studies were conducted to clarify the mechanism of treatment and of single exposures to electrosleep. Impulse frequencies used were 5, 15, 20, and 40--60 sec. A total of 45 patients was studied; 30 with neurasthenia, and 15 with diencephalic orders. The experimental data confirm that the effect of electrosleep on the functional state of the CNS depends on impulse frequency, and indicate the possibility of increasing the therapeutic effect of electrosleep by selecting the appropriate frequency. It was also established that the two groups of patients showed different reactivities to electrosleep. For the neurasthenic patients the optimal frequency for electrosleep was 5--15 impulses per sec and for patients with diencephalic disorders, the frequency was lower (5 impulses per sec). The results, according to the authors, reveal to a certain extent the mechanism of electrosleeep. There are still many aspects of this mechanism which are unclear, specifically those concerning the direct influence of electrosleep on the brain and the very fine processes taking place simultaneously in the sub-cortex. It seems to the authors that their data can serve as indirect verification of the direct effect which electrosleep has on sub-cortical structures, including the hypothalamus. Orig. art. has: 3 figures. [WA-22] [AC]

187.

AUTHOR: Bernshteyn, V. A. (Alma-Ata)

ORG: none

TITLE: Volume of blood plasma at different levels of nonmedicinal hypothermia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 74-75

TOPIC TAGS: rat, blood plasma, hypothermia, hemoglobin

ABSTRACT: Eighty unanesthetized white rats of both sexes were divided into four groups. Group I consisted of control animals. Group II animals with moistened hair were placed for five minutes in a refrigerator at 5 C (in this time their rectal temperature dropped by approximately 1 C). The animals of groups III and IV were chilled in a bath with ice water until the rectal temperature dropped to 30 C (in 6 min on the average) and to 16 C (in 15 min). Immediately upon completion of the chilling process the rats were decapitated. The volume of blood plasma was determined by Evans blue. The optical density of the blood plasma obtained after decapitation was measured with a photoelectric colorimeter. Total plasma volume was calculated according to degree of dilution of the Evans blue. In normal rats (group I) the average plasma volume (M $\pm$ m) was equal to 4.6 $\pm$ 0.10 ml per 100 g of body weight. In the initial period of development of hypothermia (group II) this index rose insignificantly. On the other hand, during the decline of rectal temperature to 30 C (group III) and to 16 C (group IV) the volume of blood plasma was clearly reduced to 3.9 $\pm$ 0.12 and 4.2 $\pm$ 0.11 ml per 100 g respectively. It had previously been demonstrated that during hypothermia no clear correlation developed between the amount of hemoglobin released from the spleen and shifts in its concentrations in the circulating blood. The figures obtained for plasma volume (in addition to the figures for hemoglobin released by the spleen) made it possible to explain fully the blood hemoglobin shifts in the initial period of development of hypothermia (group II) and at 16 C (group IV). Namely, when the concentration of blood hemoglobin established by this method of calculation corresponded in group II to 13.9 and in group IV to 16.1 g%, direct determination yielded 14.0 and 16.1 g%. Analysis in group III was complicated, where direct determination showed 14.9 and calculation 17.5 g%. Possibly, this discrepancy can be explained by redistribution of water inside the vascular system itself.

188.

AUTHOR: Dadashev, A. G. (Baku)

ORG: none

TITLE: Effect of ACTH and hydrocortisone on nonconditioned interoceptive metabolic reflexes in normo- and hypothermia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 124-125

TOPIC TAGS: autonomic nervous system, unconditioned reflex, dog, rabbit, ACTH, cortisone, hypothermia, reflex activity

ABSTRACT: These effects were studied in rabbits and dogs by measuring blood sugar, following stimulation of rectal or stomach receptors, in three test series. After 5 days ACTH administration, these reflex values decreased. Maximal change of blood sugar levels prior to ACTH was seen after 15 min, following ACTH after 30 min stimulation. Hypothermia caused further depression of reflex values. Changes in the amount of epinephrine-like substances (ELS) after ACTH both in normo- and hypothermia paralleled those of the blood sugar; ELS changes preceded maximum sugar changes in the blood. In the second test series, changes in values and character of unconditioned interoceptive reflexes due to stomach irritation were studied in normal or hypothermia after 10 days ACTH administration. These values were depressed in hypothermia. If ACTH was stopped on the third day of hypothermia, values increased. This increase may be interpreted as increased sensitivity of autonomic centers and endocrinal glands due to the hypothermia and the additional removal of the ACTH effect on hypothalamus, pituitary and adrenal glands. The animals recovered fully after a month. In the third test series, the effect of hydrocortisone treatment on these reflexes was studied. Rectally induced reflexes decreased in rabbits after 5 days under normo-, and after 10 days of hydrocortisone under hypothermia. The latter reaction was also seen for stomach stimulation. It was concluded that, since ACTH causes reflex decrease of ELS and stimulates adrencortical hormones, the functional state of the whole adrenal gland may be assumed to be increased. Earlier studies by the author have shown that increased adrenal function leads to depressed values for unconditioned metabolic reflexes both in normo- and in hypothermia.

189.

AUTHOR: Derkovskiy, M. M.

ORG: none

TITLE: Some problems of thermal calculations of craniocerebral hypothermia

SOURCE: Moscow. Pervyy meditsinskiy institut. Trudy po novoy apparature i metodikam, no. 4, 1966. Obosnovaniye i klinicheskoye primeneniye novoy apparatury v anesteziologii i reanimatologii (Principles and clinical use of new apparatus in anesthesiology and reanimation), 151-158

TOPIC TAGS: hypothermia, man, hypoxia, biologic model, cerebrum, mathematic model

ABSTRACT: Cooling of the skull and brain for prevention of the sequelae of acute hypoxia is under experimental clinical investigation at the Laboratory of Pathologic Physiology, Experimental Division of the Institute for Clinical and Experimental Surgery, Ministry of Health RSFSR, and equipment has been created for prolonged craniocerebral hypothermia to 31-32 C. This equipment is described, and calculation of the parameters required for its operation are presented, based on initial data by V. A Bukov; Personnel from the Moscow Engineering Combinat for Cooling Equipment (Director Ye. A. Andrachnikov) participated in the construction. Cooling of the head for time ΔT requires removal of heat Q_{ox1} from blood entering the brain at temperature T_c. As a result brain and blood in the head have a temperature T_M. This blood returns to the heart and mixes with blood of body temperature T_T. Consideration of this scheme leads to a first formula for temperature of the mixed blood, which is further developed to yield

$$K_T S_T \left(\frac{T_{T0}+T_T}{2}-T_H\right)\Delta t - Q_{xT0}\cdot l^{-\frac{b}{T_T}}\Delta t + G_{KT}C_K(T_T-T_c)\Delta t = M_T C_T (T_{T0}-T_T) \qquad (6)$$

(for explanation of terms see Table 1). Results are shown in Table 2. Distribution of heat in the body is calculated by Fourier's formula, and the human body is considered a rather high cylinder with a 10 cm radius. A decrease of 5 C in central organs may be distributed over 150 min, while at 1 cm from the surface it is distributed 10 times as fast. Experimental results confirmed that the temperature in the outer layers of the brain decreased much faster than in the inner layers. In 62 tests with dogs, it was found that temperature decrease of the brain membranes in dogs was somewhat slower than in humans, due to the

Table 1. Initial values for calculation

Calculated Parameter	Designation	Value and measuring unit
Brain mass	Mm	1.35 kg
specific heat capacity of brain	Cm	0.8 kcal/kg/C
blood requirement in the brain	G km	1.0 kg/min
specific heat capacity of blood	Ck	0.87 kcal/kg/C
heat released in the brain at 37 C	Qxro	0.275 kcal/min
mean brine temperature in the helmet	Ta	-15 C, increased to -10 C after 30 min
helmet surface	Sr	0.05 m^2
coefficient of heat transfer in the head (from brain to the thermal carrier)	Kr	60 kcal/m^2/hour/C
body mass (without head)	Mt	60 kg
specific body heat	Ct	0.85 kcal/kg/C
blood requirement in the body	G kt	4 kg/min
heat liberated by the body at 37 C in consideration of surface		0.89 kcal/min
body surface (without head) for a 65 kg man of 170 cm		1.6 m^2
coefficient of heat transfer from body to medium (air)		1.9 kcal/m^2/hour/C
temperature of environmental air		20 C

Table 2. Calculated data for cooling of brain and body.

	Mean temperature °C		
Min.	Brain T_M	Body T_T	Heart T_C
0	37.0	37.0	37.0
10	34.6	37.0	36.6
20	34.0	36.8	36.2
30	33.6	36.6	35.9
40	33.2	36.4	35.7
50	33.1	36.3	35.6
60	33.0	36.1	35.4
70	32.8	35.8	35.2
80	32.5	35.6	35.0
90	32.3	35.4	34.8
100	32.1	35.2	34.6
110	31.9	35.0	34.4
120	31.7	34.8	34.2
130	31.5	34.6	34.0
140	31.3	34.4	33.8
150	31.1	34.2	33.6
160	30.9	34.0	33.4
170	30.7	33.8	33.2
180	30.5	33.6	33.0

presence of 3 cm thick muscles. The experimental values were close to theoretical. V. I. Vinogradov and V. A. Katsitadze participated in the tests on the 62 dogs with the experimental cooling equipment. Orig. art. has: 6 formulas, 2 tables and 2 figures.

190.

AUTHOR: Dolgova, Z. Ya.

ORG: Semipalatinsk Medical Institute (Semipalatinskiy meditsinskiy institut)

TITLE: Characteristics of the hormonal activity of the adrenal glands during a decrease in temperature of the organism's internal environment

SOURCE: Konferentsiya biokhimikov Respublik Sredney Azii i Kazakhstana, 1st. Alma-Ata, 1966. Trudy (Transactions of the conference of biochemists of the Republics of Central Asia and Kazakhstan). Tashkent, Izd-vo "Fan", 1967

TOPIC TAGS: hypothermia, endocrinology, high temperature effect, low temperature effect, adrenal gland, cortisone, adrenocortical hormone

ABSTRACT: The functional activity of the adrenal cortex was studied in white rats during slight (29—32C rectal) and deep (19—22C rectal) hypothermia, and the adrenal function of cooled animals was examined under conditions of altered hormonal balance. The adrenals were removed, weighed, and the free cholesterol determined in the left adrenal and the ascorbic acid (AA) in the right adrenal. The effect of changed hormonal conditions on the organism's metabolic reactions during hypothermia was studied by injecting the animals with ACTH or cortisone. It was found that slight hypothermia is accompanied by a considerable increase in the cholesterol level and a decrease in AA concentration. During deep hypothermia the cholesterol and AA content of the adrenals decrease sharply. A decrease was found in the cell lipids of the adrenal cortex and in the AA in the zona glomerulosa during deep hypothermia. The relative weight of the adrenals increases during deep hypothermia and there is a considerable increase in the thickness of the adrenal cortex. These changes are considered to be the result of intensified production of corticosteroid hormones due to the organism's increased need for adrenal cortical hormones during hypothermia. The injection of ACTH does not change the reaction of the adrenals to cold and does not promote conservation of their functional reserves. The injection of cortisone before artificial hypothermia promotes normalization of the cholesterol and AA level of the adrenals. The results of the studies showed that the functional activity of the adrenal glands is increased during hypothermia. Orig. art. has: 1 table.

191.

AUTHOR: Gershenovich, Z. S.; Emirbekov, E. Z.

ORG: Department of Biochemistry, Rostov State University (Kafedra biokhimii, Rostovskogo gosuniversiteta); Department of Biochemistry, Daghestan State University, Makhach-Kala (Kafedra biokhimii, Dagestanskogo gosyniversiteta)

TITLE: Nitrogen metabolism in the gopher brain during hypothermia, and the combined action of hypothermia and hyperoxia

SOURCE: Ukrayins'kyy biokhimichnyy zhurnal, v. 40, no. 3, 1968, 270-273

TOPIC TAGS: hypothermia, hyperoxia, cerebrum, cerebellum, nitrogen metabolism

ABSTRACT: Two series of experiments were performed; one, gophers were cooled to body temperatures of 30 C, 20—19 C, and finally 11—10 C in the course of 60—65 min. Controls were normothermal gophers. In the

Table 1. Content of ammonia, glutamine, glutamic acid, and γ-amino butyric acid in gopher cerebrum and cerebellum during hypothermia, hyperioxia (4 atm), and their combined action in mg% (M ± m)

Organ	free ammonia	amide nitrogen of glutamine	glutamic acid	γ-amino butyric acid
		Control		
Cerebrum	0,488±0,049	6,98±0,343	129±4,2	26,3±0,9
Cerebellum	0,536±0,050	6,73±0,433	122±8,1	18,9±0,8
		Cooling to 30°C		
Cerebrum	3,445±0,270	6,50±0,350	104±1,2	19,0±1,0
Cerebellum	1,636±0,080	9,58±0,096	103±4,5	28,5±1,4
		Cooling to 20—19°C		
Cerebrum	3,007±0,147	10,95±0,465	146±2,9	26,0±1,0
Cerebellum	2,088±0,013	12,10±0,082	106±5,1	13,6±0,6
		Cooling to 11—10°C		
Cerebrum	2,214±0,033	10,35±0,333	129±2,4	22,5±1,2
Cerebellum	1,877±0,032	7,86±0,215	121±7,4	26,9±0,9
		Hyperoxia		
Cerebrum	0,98±0,111	7,81±0,398	180±6,28	28,9±1,20
Cerebellum	0,60±0,030	7,09±0,474	184±5,28	28,6±1,22
		Cooling to 20—19°C + and hyperoxia		
Cerebrum	3,16±0,190	10,6±0,403	148±6,92	39,3±1,16
Cerebellum	2,23±0,037	9,34±0,367	110±8,00	7,1±0,76

Content of amide groups in total proteins of gopher cerebrum and cerebellum during hypothermia, hyperoxia, and there combined action in μg/mg dry protein

experimental conditions	nitrogen of labile groups		nitrogen of tightly bound amide groups		total nitrogen of amide groups	
	cerebrum	cerebellum	cerebrum	cerebellum	cerebrum	cerebellum
Control	2,12±0,077	1,88±0,102	3,31±0,180	3,66±0,167	5,43±0,200	5,51±0,176
Cooling to 30°C	1,55±0,040	1,56±0,030	3,63±0,044	3,59±0,036	5,18±0,015	5,16±0,010
Cooling to 20--19°C	1,55±0,034	1,68±0,066	4,22±0,200	4,10±0,066	5,78±0,190	5,83±0,092
Cooling to 11--10°C	1,17±0,054	1,32±0,065	3,50±0,090	3,42±0,050	4,67±0,013	4,75±0,065
Hyperoxia	1,34±0,027		5,95±0,044		7,29±0,059	
Cooling to 20--19°C + and hyperoxia	1,46±0,30		4,41±0,47		5,87±0,125	

other series, gophers were cooled to 20—19 C and exposed to oxygen (4 atm) for 30 min in a pressure chamber. The gophers were then decapitated, and their brains were frozen and removed. The content of free ammonia, glutamine, glutamic acid, and γ-amino butyric acid was measured in the cerebral hemispheres and cerebellum. Labile and bound amide groups were also measured in the total proteins of the cerebral hemispheres and cerebellum. Results are present in Tables 1 and 2. Orig. art. has: 2 tables. [WA-22] [PW]

192.

AUTHOR: Grunner, O.

ORG: Priessnitz sanatorium, Lazne Jesenik (lecebna Priessnitz, Lazne Jesenik)

TITLE: Changes in electrical skin conductance and in the recalorification test (reactivity of skin capillaries) after electrosleep application in neurotics

SOURCE: Activitas nervosa superior, v. 10, no. 2, 1968, 193-194

TOPIC TAGS: electrosleep apparatus, skin physiology, sleep research, sleep therapy, sleep machine, neurosis

ABSTRACT: For the past four years insomnia in neurotics has been treated with electrosleep at the Priessnitz Sanatorium in Czechoslovakia. The equipment used is Elektroson - 1, a portable generator with pulsed current. The pulse amplitude administered during the treatment is 0.3—0.8 ma, pulse duration 30—60 cps, and the exposure duration is one hour. Treatments are administered every second day for 21 days. Fifty neurotics and twenty controls were observed. After the first session, 9.4% of the neurotic insomniacs could sleep; after the tenth (and final) session, 82% were sleeping. After the last treatment with electrosleep, changes in the electroconductivity of the skin were evaluated under psychological stress as well as were changes in the recalorification of the skin capillaries. In all but two cases of the control group an obvious decline in the electrical conductivity of the skin was observed under psychological stress after electrosleep administration was simulated. In the fifty cases of true electrosleep adminstration, no definite decrease of electric conductivity of the skin was recorded; however, there was a tendency towards normalcy where the values had been pathological. In six cases, a deterioration of the values of electrical conductivity was observed together with intolerance of the procedure. High pathological values of electric conductivity of the skin after psychic stress were related to extremely high skin reactivity. Orig. art. has: 2 tables. [WA-22] [KS]

193.

AUTHOR: Hanka, Rudolf (Engineer); Pocta, Jaroslav (Lieutenant Colonel; Doctor of Medicine; Candidate of Sciences); Lebl, Miroslav (Engineer)

ORG: [Hanka] National Technical Museum, Prague, /headed by Eng. Frantisek Vesely (Narodni technicke museum); [Pocta] Anesthesia and Resuscitation Section of the Central Military Hospital, Prague, /headed by Lt. Doctor of Medicine Jiri Pokorny, Candidate of Sciences (Anesteziologicke a resuscitacni oddeleni Ustredni vojenske nemocnice); [Lebl] Neuro-surgical Clinic, KU Prague, /headed by Prof. Doctor of Medicine Zdenek Kunc, Doctor of Sciences (Neurochirurgicka klinika KU)

TITLE: Methods of electroanesthesia [Published at the occasion of the 60th anniversary of Major General Prof. Doctor of medicine Zdenek Kunc, Candidate of Sciences]

SOURCE: Vojenske zdravotnicke listy, no. 2, 1968, 55-56

TOPIC TAGS: electric anesthesia, electrosleep apparatus

ABSTRACT: Experiments with various methods of electroanesthesia are summarized. The authors consider non-sinusoidal, alternating, periodical or non-periodical current in combination with direct current as the best current combinations, or the simultaneous use of several frequencies of a sinusoidal periodical current. Based on their own observations, they divided the electroanesthesia course into six phases. They call particular attention to the instantaneous return to full consciousness after switching off the electric current. The success of electroanesthesia depends chiefly on ideal placement of the electrodes and on the reliability of the equipment. The work is of experimental character. Orig. art. has: 3 figures. There is a bibliography of 11 titles. [Based on author's abstract] [KS]

194.

AUTHOR: Isaakyan, L. I.; Rozhaya, D. A.; Trubitsyna, G. A.

ORG: Group for the Physiology of Gas and Heat Metabolism/ Head of the group--R. P. Ol'nyanskaya/(Gruppa fiziologii gazoobmena i teploobmena)

TITLE: Thermogenesis in certain rodent species during recovery from repeated exposure to hypothermia

SOURCE: AN SSSR. Institut fiziologii. Trudy, v. 12, 1968. Sravnitel'naya i vozrastnaya fiziologiya (Comparative and growth physiology). 65-70

TOPIC TAGS: rodent, hypothermia, hibernation, biologic metabolism, hypercapnia

ABSTRACT: The relationship between total heat production, body temperature and shivering during spontaneous recovery from repeated hypothermia was studied in hibernating and non-hibernating rodents. Tests were conducted in mice, rats, golden hamsters, and voles subjected for 10—20 days to combined hypercapnia and cooling in a closed space for 50—60 min daily or longer until a body temperature of 17—19°C had been reached. For recovery, they were kept at 23 or 10°C. Criteria were: oxygen consumption, body temperature and the EMG of shivering. Results revealed no changes in oxygen consumption for hamsters and rats, which adapted easily to experimental conditions, while mice and voles showed a decrease in oxygen metabolism which dropped to 65% after 5—7 exposures. Body temperatures of the latter returned to no more than 25°C after 2—5 exposures, and death occurred when the animals were to warm up at 10°C. Species-specific differences also appeared in shivering which was depressed in mice and voles after 2—4 exposures. Distinct differences were seen during warm-up at 10 C in the thermostable species after the first hypothermia. Warming up took 80—100 min in hamsters and 3 hr in rats after the first, 60 and 90 min respectively after the second exposure. A distinct relationship was also found between shivering and heat production. It was concluded that shivering from cold increases in golden hamsters and decreases in white rats after repeated hypothermia. In hamsters a considerable hypermetabolic effect and adaptation are apparently closely related to the shivering mechanism while the thermoregulatory role of shivering is less important in rats; another thermoregulatory source seems to be at work. However, both can use adaptive motor mechanisms to control hypothermia, and this was particularly apparent in tests with 20 exposures where warming took no more than 30—50 min. The study is being continued. Orig. art. has: 3 figures and 2 tables.

[WA-22] [06]

195.

AUTHOR: Ivanov-Muromskiy, K. A. (Candidate of biological sciences; Head)

ORG: Laboratory of Neurobionics, Institute of Cybernetics, AN UkrSSR, Kiev (Laboratoriya neyrobioniki Instituta kibernetiki AN UkrSSR)

TITLE: Electronarcosis: facts, hypotheses, perspectives

SOURCE: Priroda, no. 6, 1968, 39-47

TOPIC TAGS: electronarcosis, anesthesiology, biocybernetics

ABSTRACT: This article presents a rather nonspecialized survey of the history, current state, and developmental prospects of electronarcosis. An attempt is made to provide a cybernetic explanation of the processes involved in electronarcosis; data obtained at the author's laboratory substantiate the concept of electronarcosis as a process of self-regulation of the cerebral cortex mediated by nonspecific subcortical systems. Several active researchers in electronarcosis at Ivanov-Muromskiy's laboratory are mentioned: O.N. Luk'yanova, K. I. Kuz'mina, and V. I. Lavrinenko. It has been determined at this laboratory that the most suitable frequency for impulses of a given shape is 1000 Hz; other parameters, however, have not been definitively determined. Considerable attention is being given to a variety of forms of electronarcosis; using interference currents with and without electromagnetic fields, and using impulse currents in combination with electromagnetic fields. Also, studies are underway on non-surgical applications of electronarcosis: in the postoperative period, and in the treatment of a number of pathological conditions, including acute coronary insufficiency, bronchial asthma, and renal colic. Considerable attention is given to the possibilities for use of electronarcosis following nuclear holocaust. Exposure to electrosleep during or immediately after irradiation (doses as great as 30—60 thousand R) has been shown to increase the viability of animals. The advantages of electronarcosis, as opposed to conventional anesthesia, for the patient suffering radiation effects, are enumerated. The simplicity of application of electronarcosis in emergency situations is also mentioned. Orig. art. has: 6 figures and 1 formula.

[EL]

196.

AUTHOR: L'vova, S. P.

ORG: Dagestan State University im. V. I. Lenin (Dagestanskiy gosudarstvennyy universitet)

TITLE: Some features of carbohydrate-phosphorus metabolism of the brain and blood during hibernation and waking from it

SOURCE: AN SSSR. Doklady, v. 179, no. 5, 1968, 1225-1226

TOPIC TAGS: biologic metabolism, phosphorus compound, hibernation, animal physiology

ABSTRACT: The content of glucose, inorganic phosphate, creatine phosphate, and ATP was studied in the brain and blood of animals hibernating and upon awaking to relate metabolism and hypothermia. Citellus pigmaeus Pall. was observed at the following stages: alert (rectal temperature 37—38C), entering hibernation (24C), after one week and after two months of hibernation (17C and 10C, respectively), and upon awaking (37—38C). At the end of September test animals were placed in individual cells in a cold site. Animals were decapitated periodically thereafter, the heads frozen in liquid nitrogen, and proteins precipitated in 5% trichloroacetic acid. The extract was examined for phosphates, glucose, and lactic acid. Glucose was determined by the Hagedorn-Jensen method; inorganic phosphorous by colorimetry; the content of creatine phosphate was determined by the difference between the sum of inorganic P and creatine phosphate (determined colorimetrically) and inorganic P. Lactic acid was determined by the Barker and Sammerson method. Results, presented in Table 1, show that carbohydrate-phosphorus exchange plays an important role in mechanisms for brain metabolism adaptation which regulate body adaptation to low temperature.

Table 1

The content of glucose, inoraganic phosphorus, creatine phosphate, and ATP in the brain and blood of C. pigmaeus during hibernation and upon awaking (M ± m in milligram percentages)

	Control 37—38°	Falling asleep 24°	one week's sleep 17°	one week's sleep 10°	2-months' sleep 17°	2-months' sleep 10°	Awaking 37—38°
	Brain study (9—10 animals)						
Glucose	88,14±4,69	58,17±2,69	66,89±3,66	133,2±1,94	59,5±2,74	97,83±3,02	09,6±4,0
$P_{inorganic}$	19,5±0.74	36,0±1,74	20,07±0,86	18,3±1,8	12,2±0,74	17 ±0.8	30,92±2,14
Creatine P	3,88±0,47	14,02±0,9	3,41±0,47	19,8±1,07	7,55±1,0	15,07±0,7	20,2±1,74
ATP + ADP	13,7±1,22	25,7±1,2	22,42±1,72	22,08±1,5	25,03±0,79	13,22±0,37	24,4±0,9
Lactic acid	36,23±2.55	15,8±2,15	—	—	6,85±0,92	—	—
	Blood study (7—10 animals)						
Glucose	98,3±3,76	75,6±2,33	40,66±3,11	67,4±1,84	66,8±3,59	301,6±15,84	503±4,36
$P_{inorganic}$	2,9±0,28	2,12±0,4	4,54±0,32	6,84±0,49	8,55±0,83	6,8±0,35	1,44±0,03
P_{labile}	6,6±0,44	1,15±0,5	11,44±0,45	14,4±0,45	12,36±0,83	7,2±0,48	—

This report was presented by Academician A. I. Oparin on 24 July 1967. Orig. art. has: 1 table.

197.

AUTHOR: Shcherbachev, I. P.

ORG: Army Medical Academy im. S. M. Kirov, Leningrad (Voenno-meditsinskaya akademiya)

TITLE: Effect of Gutamine on the thermoresistance of mice

SOURCE: Farmakologiya i toksikologiya, v. 31, no. 1, 1968, 107-110

TOPIC TAGS: mouse, body temperature, antipyretic drug, hypothermia, hyperthermia

ABSTRACT: Gutamine (guanyl thiourea) in 3 doses (50, 75, and 100 mg/kg) was injected subcutaneously to determine its effect on the resistance of mice to temperatures -40, 40, 50, and 75°. The experiments were carried out in a thermochamber into which the animals were placed for 90 min. After introduction of the compound the temperature resistance was determined by length of survival in the chamber. Gutamine was found to lower body temperature. With dosage 100 mg/kg the hypothermic effect continued for approximately 4 hrs; with 50 mg/kg, for 2-2½ hrs. Reduction of body temperature averaged 3.5°. At low external temperatures the resistance of the experimental animals was less than that of the controls. The compound had no influence on the resistance of the animals to air temperature of 40°, but the resistance was increased at temperatures of 50° and 75°. A dosage of 75 mg/kg produced the greatest effect by reducing the life span at low temperatures and increasing it with highest temperatures. The rate of change in both experimental and control animals remained the same during the abrupt changes in external temperatures (-40° and 75°). Although body temperature was higher in experimental animals than in controls at 75°, fewer animals perished. Depressed chemical thermoregulation led to a reduction in heat production and a lowering of body temperature. Consequently, there was a lowering of resistance of the organism to low external temperatures and an increase of resistance to high temperatures. Orig. art. has: 1 table and 2 figures.

198.

AUTHOR: Smirnov, A. I. (Head of research; Corresponding member AMN SSSR); Belyavskaya, Ye. A.; Kovaleva, T. N.

ORG: Physiological Group /Research head, Corresponding member AMN SSSR A. I. Smirnov/, AMN SSSR (Fiziologicheskaya gruppa AMN SSSR)

TITLE: Influence of extra cardiac nerves on the functional state of the cardiovascular system under general hypothermia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 1, 1968, 31-34

TOPIC TAGS: nervous system, cardiovascular system, hypothermia, dog, anesthesia, animal experiment

ABSTRACT: The authors studied the influence of the vagus and the sympathetic nerves on the functional state of the heart and vessels under general hypothermia (rectal temperature plus 32 —→ plus 24°) in acute experiments on 35 dogs under morphine-urethane anesthesia. It was shown that under moderate hypothermia repeated stimulation of the peripheral segment of the vagus exerts a positive influence both on the functional state of the heart and on the stability of the arterial pressure, while stimulation of the proximal segment of the sciatic nerve or the loop of Vieussens increases functional disorder of the specific cardiac muscles, produced by hypothermia. Orig. art. has: 3 figures and 3 tables. [Authors' abstract] [NT]

199.

AUTHOR: Smotrov, V. A.

ORG: Department of Normal Physiology, Medical Institute, Donetsk (Kafedra normal'noy fiziologii Meditsinskogo instituta)

TITLE: Effect of hypothermia on the summation and other indices of unconditioned reflexes

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 9, 1968, 1018-1024

TOPIC TAGS: hypothermia, unconditioned reflex

ABSTRACT: The effect of artificial hypothermia on the summation processes of the flexor reflex was investigated experimentally on 40 anesthetized and spinally anesthetized cats during moderate (32°C) and deep (25°) hypothermia. In addition, to minimize the effect of hypothermia on the conductivity of the afferent nerve of the lower extremity, in 10 anesthetized cats the radix posterior (L_7) cut through

its distal portion was stimulated instead of the afferent nerve. To investigate the conductivity of afferent nerves during hypothermia, the afferent nerve was stimulated in 8 anesthetized cats, and the biocurrents were recorded from the radix posterior cut at its entrance into the spinal cord. The results showed that reflectory excitability caused by single or rhythmical stimuli increased at 32°and decreased at 25°. The zone of optimum and pessimum frequency shifted toward higher ranges at 32° and toward lower at 25°. Thus in anesthetized cats the pessimum during stimulation of the afferent nerve was observed at 150 Hz before cooling, at 240 Hz at 32°, and 79 Hz at 25°; during stimulation of the radix posterior at 112, 166, and 59 Hz; and in spinally anesthetized animals at 161, 212, and 86 Hz, respectively. Biocurrents recorded at the radix anterior during a 100 Hz stimulation showed a pessimum at 37° (before and after cooling), while at 32° no such condition was observed. During a 60-Hz stimulation, the pessimum appeared at 25°, and was not recorded at 37°. The summation time and the summation constant of Lapicque decreased at 32° and increased at 25°, thus showing respectively a decreased and increased lability of the central apparatus of the flexion reflex. At all temperatures the threshold of excitability of the radix posterior showed minimum values, and that of the afferent nerve, maximum. At the radix posterior a stimulation of threshold intensity caused a pessimum at 600 Hz during initial condition, and at 528 Hz during 32° and 25°. This indicates that the lability of the afferent nerve is higher than that of the flexion center at all temperatures. The biocurrent frequency of the radix posterior coincided with the stimulation frequency even during extended application, so that no pulse multiplication was observed during hypothermia. In all experiments initial values coincide with those obtained after regaining 37° body temperature, which proves that shifts observed during hypothermia are due to temperature only, and are not influenced by repeated application of the stimuli. The obtained results indicate a possibility of control over the excitability and lability during experimental hypothermia, by means of further investigation of the summation. Orig. art. has: 4 tables and 3 figures. [WA-MIO-69-1] [EF]

200.

AUTHOR: Trinyak, N. G.

ORG: Department of Surgical Training and Pathological Physiology, Chernovitskiy Medical Institute /Scientific Instructor Docent A. D. Yukhimets/ (Kafedra fakul'tetskoy khirurgii i patologicheskoy fiziologii Chernovitskogo meditsinskogo instituta)

TITLE: Development and course of acute pulmonary edema during hyper- and hypothermia accompanying ether anesthesia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 66, no. 7, 1968, 40-41

TOPIC TAGS: hyperthermia, hypothermia, anesthesia

ABSTRACT: Intraperitoneal administration of a 6% solution of ammonium chloride (40 mg /100 g body weight) led to acute pulmonary edema and death of the animals. Overheating (rectal temperature 39--41°C) increased pulmonary edema, while ether anesthesia and hypothermia (rectal temperature 20--23°) prevented it. Orig. art. has: 1 table.

[WA-22] [EL]

201.

AUTHOR: Vasil'yev, P. V.; Glod, G. D.

ORG: none

TITLE: Some physiologic aspects of hypothermia applied to cosmic medicine

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 443-450

TOPIC TAGS: hypothermia, rat, dog, space medicine, respiratory physiology, temperature adaptation

ABSTRACT: In addition to a survey of literature, the authors present tests on dogs and rats involving non-dangerous prolonged artificial cooling under spontaneous respiration and blood circulation. Various methods were used to prevent reflex reaction of the organism to cold: combinations of a "lytic" mixture, short acting barbiturates, urethane anesthesia, relaxants and changes of the gas medium (hypercapnia and hypoxia). Thorough attention was given to gas metabolism, respiration and blood circulation. These studies revealed great differences in the course of hypothermia depending on the method applied. In no case was it possible fully to prevent the untoward symptoms of physiologic compensatory mechanisms in the

first hypothermic stages, such as increased cardiac and respiratory rate, increased oxygen requirements or shivering, but these reactions could be depressed by blocking agents. In tests on rats the best blocking agent for these thermoregulatory mechanisms was a medium with gradually increasing hypercapnia-hypoxia; this shortened and weakened the initial reaction. Rapid reversibility was retained under these conditions and was reflected in the rather high oxygen content of the arterial blood. Enzymatic systems remained unaffected by temperatures to 20 C. Liver succinedehydrogenase activity paralleled changes in tissue temperature; at 20 C the rats needed only 1/5 of the initial oxygen value, and the activity of the enzyme decreased 4 fold under these conditions. In dogs the best means for blocking reflex reactions was the so-called lytic mixture (5 mg/kg aminasine, 5 mg/kg pipol'fen, 1 mg/kg promedol and 0.5 mg/kg metamizil) together with short-acting barbiturates and a regulated CO_2 anesthesia. Vital functional values were much better than those obtained with urethane anesthesia. Minute volume and respiratory coefficient were higher while oxygen requirements were lower; blood circulation was rather depressed, but hemoglobin was fully utilized. There was lesser disturbance of the homeostatic state. The method used for rats was also highly effective in other rodents. Dogs under hypercapnia required less barbiturates, which facilitated reversion of the hyp othermia. Inhalation anesthesia proved very convenient, for it afforded interference at any stage of the hypothermic process. Tissue respiration was highly resistant to cold, and the tissues were capable of using oxygen in close to pre-experimental amounts. Duration of the reversible hypothermia varied from a few hours to a few days. Critical body temperature limits (rectal) were 18-20C for rats and 23-25 C for dogs at an ambient temperature of 15-18 C. However, none of the methods tried meets requirements for use in space flight. It was concluded that in artificial hypothermia under spontaneous respiration, pathologic phenomena are determined by functional disturbance of organs providing oxygen for the tissues. A further conclusion from literature data and the authors' own experiments was the statement that such work has only furnished some approaches towards developing methods for hypothermia in rats and dogs. These are: blocking of thermoregulatory mechanisms, automation of processes for achieving artificial hypothermia, monitoring of basic physiologic functions, and long maintenance of the hypothermic state and its reversion. Artificial cooling could be applied in space flight for: transport of biologic objects during prolonged flights and for protection from extreme factors, including protection of cosmonauts during accidents resulting in food, oxygen or water shortages. The best solution would be a state of artificial hibernation. Orig. art. has: 1 table.

202.

AUTHOR: none

ORG: none

TITLE: Electrosleep devices

SOURCE: Meditsinskaya gazeta, no. 76, 20 Sep 68, p. 3, col. 4

TOPIC TAGS: electrosleep apparatus, sleep therapy

ABSTRACT: The Moscow "EMA" Factory for Medical Equipment is producing various devices for electrosleep therapy. The existing ES-1p model is portable and may be used at home. It is used in treatment of hypertension, headache, insomnia, some forms of schizophrenia, epilepsy, ulcers, and other conditions for which sleep therapy is indicated. The new ES-2 device has improved technical characteristics in comparison with the ES-1p. It has direct pulse reading with provision for measuring the current prescribed for each patient. This year the factory will issue the first experimental models of the still further improved ES-3 device. This multichannel electrosleep generator allows simultaneous treatment of four patients and is equipped with a meter which measures the current dose for each patient in turn. [EL]

SECTION 9. SELECTION AND TRAINING

203.

AUTHOR: Antoshchenko, A. (Colonel, Medical service); Chekirda, I. (Senior lieutenant, Medical service)

ORG: none

TITLE: At first in the water -- then in space [Underwater cosmonaut training]

SOURCE: Aviatsiya i kosmonavtika, no. 10, 1968, 75-77

TOPIC TAGS: cosmonaut training, underwater activity

ABSTRACT: In April of 1965, the authors, V. V. Znachko, and G. V. Shcherbakov proposed a method for underwater training of cosmonauts in which zero buoyancy would be obtained with a special suit by means of compressed air and ballast. Four men, ages 25—40 yr, participated in a total of 106 experiments in a specially designed pool containing a model spacecraft in which various extraterrestrial activities were modeled. The experiments were arranged in order of the difficulty of the operations involved and were concerned with: purposeful movement and coordination, location of subjects in working areas, leaving and reentering the model craft, repair work, moving equipment to the exterior of the craft from inside, and rescue operations. The subjects were subsequently exposed to weightlessness during parabolic flights, and examination of their coordination indicated that the underwater training, had been effective. Observation of planned activities performed underwater often led to better ideas as to how these activities should be carried out in space. The investigation clearly showed that for many zero-G operations can be very satisfactorily simulated underwater. Orig. art. has: 1 figure. [WA-22] [EL]

204.

AUTHOR: Bayevskiy, R. M.; Kozerenko, O. P.

ORG: none

TITLE: Changes in cardiac function during orthostatic tests and problems in predicting the reactions of cosmonauts in flight

SOURCE: Simpozium po probleme: "Primeneniye matematicheskikh metodov dlya analiza ritma serdechnykh sokrashcheniy", Moscow, 1966. Matematicheskiye metody analiza serdechnogo ritma (Mathematical methods of analyzing heart rhythm). Moscow, Izd-vo "Nauka", 1968, 62-68

TOPIC TAGS: cardiology, cosmonaut selection, cosmonaut training, orthostatic test, physiologic stress

ABSTRACT: A comparative analysis was made of material obtained before and during the flight of V. F. Bykovskiy and V. V. Tereshkova to determine the validity of the hypothesis that ability to adapt to weightlessness may be predicted from the individual's reaction to orthostatic tests. Since cardiac function may be readily assessed and reflects not only the condition of the cardiovascular system but also of the organism as a whole, variational pulsometry was used to show changes in cardiac rhythm related to changes in sympathetic and parasympathetic innervation, while cardiointervalography was used in the evaluation of transient processes. Orthostatic tests lasted 15 min with the subject standing at attention. Tests were conducted before and after various training exercises and experiments; of especial interest were results obtained after prolonged hypodynamia. Tereshkova's reactions were found to be inadequate after 3-day hypodynamia, showing transient slow waves which were not seen in Bykovskiy. In all, data from tests made before and after 3-day isolation and hypodynamia in a mock-up of the Vostok cabin showed that Tereshkova's adaptational capacity, as measured by orthostatic tests, was less than Bykovskiy's. In flight, Bykovskiy's cardiac function was quite stable, though on the 35—38th and 48—51st orbits he showed increased parasympathetic innervation; Tereshkova's homeostatic mechanisms, however, functioned less adequately and her cardiac indices were less stable. Thus, it does appear possible to predict cardiac reactions to space flight on the basis of performance during orthostatic tests, particularly following hypodynamia. Orig. art. has: 3 figures and 1 table. [EL]

205.

INVENTOR: Bogdanov, V. A.; Gurfinkel', V. S.; Panfilov, V. Ye.

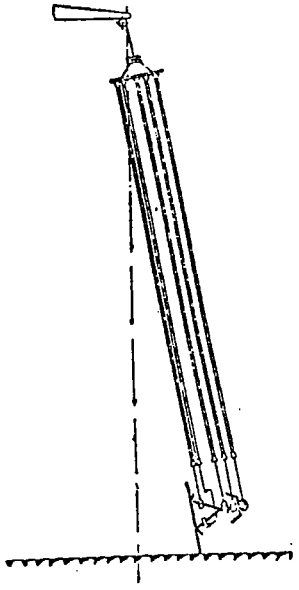
ORG: none

TITLE: Device for simulating decreased gravitation under normal terrestial conditions

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 13, 1968, 60-61

TOPIC TAGS: biologic gravity effect, antigravitation, simulation test facility

ABSTRACT: An Author Certificate has been issued for a test device which simulates decreased gravitation. It consists of a bearing surface and suspension system including cables, belts, and helmet, and clamps. It allows the subject five degrees of freedom in a large enough volume to allow him to learn to function [under conditions of decreased gravitation], to carry out tests, and to allow studies to be made of his postural and motor activity in a given inclined position. The inertia of the suspension system is also decreased by having the bearing surface and the suspension system at an angle to the direction of the earth's gravitational force [see Figure]. The suspension system includes hinged bars to which elastic rings are connected, made for example, of rubber shock-absorbing cable. Orig. art. has: 1 figure. [Translation of patent abstract] [WA-22] [EL]



206.

AUTHOR: Kosmolinskiy, F.P.; Shcherbina, Z.D.

ORG: none

TITLE: Sensory deprivation during spaceflight

SOURCE: Ocherki psikhofiziologii truda kosmonavtov (Studies on the psychophysiology of the work of cosmonauts). Moscow, Izd-vo "Meditsina", 1967, 39-58

TOPIC TAGS: sensory deprivation, space psychology, cabin environment, psychologic selection, physical exercise

ABSTRACT: Effects of sensory deprivation expressed as emotional, sympathetic, and brain-function changes are discussed, and their mechanisms are described. Experiments of Western scientists are criticized as irrelevant to the situations actually possible in a spacecraft. The difference of the psychological state of an experiment subject and a cosmonaut fulfilling his mission is also regarded as very important. Construction of a spacecraft satisfying individual needs of the cosmonauts, physical exercise, use of drugs, careful choice of psychologically compatible crew members, and their instruction concerning the possible symptoms of sensory deprivation are suggested as preventive measures. [EF]

207.

AUTHOR: Marishchuk, V. L.

ORG: none

TITLE: Voluntary overcoming of emotional tension

SOURCE: Simpozium "Biologicheskiye ritmy i voprosy razrabotki rezhimov truda i otdykha", 1967. Materialy. Moscow, 1967, 47-49

TOPIC TAGS: emotion, psychologic conditioning, psychologic training, training exercise, psychophysiology, performance test, sleep, cosmonaut training

ABSTRACT: Under the effect of emotional stress, a condition of tension arises which results in a temporary decrease of psychic and motor function stability, a temporary discoordination of visceromotor reflexes, and the appearance of sympathetic reactions. Sleep disruptions, fatigue, and asthenic emotions are the common aftereffects. Involuntary muscle strain of which the person is not aware, increase of respiration rate, and other indices comprise the external symptoms of this condition. A working hypothesis (analogous to the James-Lange theory) was developed, according to which a voluntary muscle relaxation, mimics of composure and confidence, and restoration of rhythmic respiration with an elongated expiration phase, reduce the stress reaction. Special physical training consisting of voluntary straining and relaxing various groups of muscles, developed the ability to control external manifestation of emotions. Experiments proved that a previous straining of muscles facilitates voluntary relaxation, which is essential for the retention of fine motion coordination under emotional stress. Control over the muscles, mimics, and respiration induced normalization of pulse rate, blood pressure, and galvanic skin reaction 2—3 times more rapidly than in untrained subjects. It also increased psychic function stability which was proved in tests requiring adequate distribution and shift of attention, as well as rapid action, and memorizing of words and numbers. Muscle relaxation exercises combined with autogenous training proved effective for inducing sleep during or after emotional stress. The author recommends that these methods be included in cosmonaut training. [WA-22] [EF]

208.

AUTHOR: Yuganov, Ye. M.; Gorshkov, A. I.

ORG: none

TITLE: Conditioning the vestibular analyzer to the effect of Coriolis acceleration

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 58-64

TOPIC TAGS: vestibular conditioning, cosmonaut training, biologic acceleration effect, Coriolis force

ABSTRACT: A study was made of a training program designed to decrease the sensitivity of the vestibular analyzer to Coriolis acceleration. Eleven young, healthy men of ages 20—30 yrs were involved in the training program. The duration of the program was 1—2 mo, averaging 24—45 training days. Coriolis forces were produced by having the subject seated in an electrically driven rotating chair and requiring him to incline and raise his head either in a frontal or sagittal plane at a certain rate. The chair rotated at the rate of one revolution per second and the subject moved his head at the rate of one movement per second. Training was carried out in two sessions daily separated by a 10-min interval, six times per week. The effectiveness of training was evaluated every 10 days. The degree of training was determined by changes in length of post-rotational nystagmus, the time to appearance of illusions of motion, and the expression of sympathetic reactions. Under this program a training effect was clearly evident after 10 days. Vestibular tolerance continued to improve until the 30th day of training. Training periods longer than 30 days do not appear to increase vestibular tolerance appreciably. It was also found that by 2 months after the termination of the training program, vestibular sensitivity had returned to its original values. Orig. art. has: 4 tables. [EL]

SECTION 10. ALTERED GAS ENVIRONTENT

209.

AUTHOR: Abdurakhmanov, F. A. (Dushanbe)

ORG: none

TITLE: Blood channel of the peritoneum of dogs under experimental acute hypoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 6-7

TOPIC TAGS: hypoxia, dog, blood circulation, blood volume, internal organ, altitude chamber, anoxia

ABSTRACT: Dogs were subjected to effects of reduced atmospheric pressure corresponding to heights of 11,000 to 12,000 meters in an altitude chamber for one hour and then kept in the chamber until death. Aqueous India ink was injected into the blood vessels of the peritoneum and total preparations of peritoneum were impregnated with silver nitrate by a modification of the Bilzhkovski-Gross-Passkazavy method to study the peritoneum of the posterior abdominal wall, the mesenterium tenue, the great omentum and the peritoneal ligament of the urinary bladder. Acute oxygen deficiency at reduced atmospheric pressure caused reactive changes in the blood channel of the peritoneum, showing general dilation of all components of the venous channel, resulting in constriction of the terminal network of the blood vessels, with capillaries acquiring a convolute form, contours roughened and capillaries distended. Outlets of formed elements of the blood ranging from 25-100 microns could be seen along the blood vessel ducts, indicating permeability pathology. This was most obvious in the blood channel of the peritoneum covering the kidney, where blood engorged and dilated venous vessels form crowded networks resulting in equilization of the venules and capillaries (the latter increasing up to 18-20 microns). Venous elements of the channel predominate. The arterial components have rough edges and are dilated slightly. The lymphatic vessels and capillaries of the peritoneum react to anoxia as do the venous vessels. The lymphatic vessels are clearly dilated, their valves are flattened and protrusions of various sizes and shapes are seen. The silver impregnated solution reveals dilation of the perivascular arterial channel and the venous channel and also the arteriovenous vessels, especially in their venous sections. Changes of the blood vessels of the lacteal spots of the great omentum and ligaments of the urinary bladder are seen. Here the venous vessels form a complex network; separate blood capillaries are increased up to 20-30 microns instead of the normal 7-10 microns. These data indicate that morphological changes in the peritoneum blood channel during anoxia are analogous to those seen during venous congestion.

210.

AUTHOR: Adzhikulov, E. (Frunze)

ORG: none

TITLE: Effect of caffeine sodiobenzoate on arterial pressure and respiration of the rabbit under hypoxic conditions

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 13

TOPIC TAGS: rabbit, barometric pressure, hypoxia, central nervous system stimulant, blood pressure, biologic respiration

ABSTRACT: The effect of caffeine on the blood pressure and respiration of rabbits at an altitude of 3200 m and in different stages of adaptation was studied. Ten percent caffeine sodiobenzoate was tested in doses of 0.1, 0.5 and 1 ml/kg. Under the effect of such doses of caffeine arterial pressure decreased and the respiration rate increased in animals which had adapted to the altitude. These doses did not induce an effect in animals which had not adapted to this altitude, nor in animals studied at an altitude of 760 m. Consequently, animals which had adapted to an altitude of 3200 meters became more sensitive to caffeine. In connection, it can be supposed that doses of caffeine which are therapeutic at low altitudes can prove to be toxic with higher altitues.

211.

AUTHOR: Agadzhanyan, N. A.; Gayevskaya, M. S.; Zemskov, V. M.; Kalinichenko, I. R.; Knyazeva, G. D.; Kolesnikova, M. F.; Konstantinova, I. V.; Sergiyenko, A. V.; Slez, L. M.; Smirnov, V. P.

ORG: none

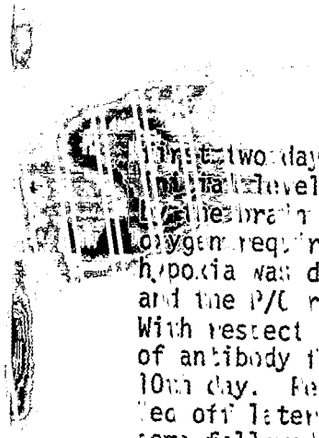
TITLE: Effect of high oxygen concentrations on the animal organism

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 30-37

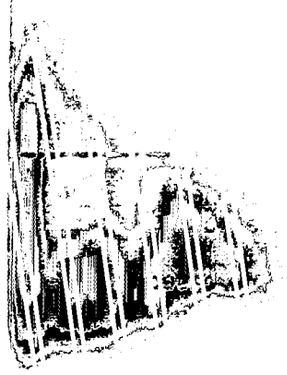
TOPIC TAGS: rat, oxygen toxicity, physiologic oxygen effect

ABSTRACT: Tests were conducted in rats kept in a cell with controlled air and temperature and exposed for 3 days to 95% or 11 days to 89% oxygen at normal atmosphereic pressure. The following was measured: behavior, weight, respiration, oxygen requirements, oxidative and phosphorylation activity, ammonia and glutamine content in brain tissue, antibody formation, changes in nonspecific resistance to endotoxin and pathomorphological changes. Resistance to acute hypoxia was also determined in some animals. During the first 1 1/2 days the animals showed increased response to stimulation; thereafter their condition deteriorated, and 52% of the rats died on the third day under 95% O_2, causing the experiment to be stopped. In the second series, only 12% died on the third day, and total mortality was 24%. In the

first two days, respiratory rates decreased by 20%, then increased to 165-170% of initial levels; total oxygen requirements were unchanged while absorption of O_2 and P_2 by the brain tissue increased. The ratio P/O remained unchanged. On the third day, oxygen requirements decreased by 30% with a further decrease to 50%. Resistance to hypoxia was dignificantly depressed. Oxidative phosphorylation in the brain decreased and the P/O ratio dropped to 40%; ammonia and glutamine increased in brain tissue. With respect to immunologic changes, rats of the first series showed sharp depression of antibody formation; this was less pronounced in those of the second series on the 10th day. Resistance to endotoxin was sharply depressed in the beginning, but leveled off later. Histologic examination revealed pulmonary changes starting with emphysema followed by Destructive changes in vascular walls, generalized lung edema and fluid in the lungs which contained a large amount of albumin with few erythrocytes. Aftereffects in the first series consisted in increased oxygen consumption on the 2-7th day. Phosphorus and oxygen requirements were still increased in brain tissue the 13th day; the P/O coefficient was normal. Antibody formation returned to normal on the 4-5th day. In the second series, oxygen consumption was still low and cerebra oxygen consumption below normal after 7-10 days while that of phosphorus was increased (increased P/) coefficient pointing to reparatory processes). A comparison of morphologic, physiologic and other studies led to the conclusion that emphysema in the first two days increased the respiratory surface thus slowing down respiration and increasing oxygen consumption. Pathologic changes in the lung on the third day decreased surface and gas exchange, and these led to death in many animals. Depressed immunity is also due to pulmonary pathology, since macrophagal elements and histiocytes failed to develop and leukocytal reaction was fully depressed. Orig. art. has: 2 tables and 3 figures.



first two days, respiratory rates decreased by 20%, then increased to 165-170% of initial levels; total oxygen requirements were unchanged while absorption of O_2 and respiration tissue increased. The ratio P/O remained unchanged. On the third day oxygen requirements decreased by 30% with a further decrease to 50%. Resistance to hypoxia was significantly depressed. Oxidative phosphorylation in the brain decreased and the P/O ratio dropped to 40%; ammonia and glutamine increased in brain tissue. With respect to immunologic changes, rats of the first series showed sharp depression of antibody formation, this was less pronounced in those of the second series or the 10th day. Resistance to endotoxin was sharply depressed in the beginning, but leveled off later. Histologic examination revealed pulmonary changes starting with emphysema followed by destructive changes in vascular walls, generalized lung edema and exudation in the lungs which contained a large amount of albumin with few erythrocytes. Alterations in the first series consisted in increased oxygen consumption on the 2-7th days. Phosphorus and oxygen requirements were still increased in brain tissue on the 3th day; the P/O coefficient was normal. Antibody formation returned to normal on the 4-5th day. In the second series, oxygen consumption was still low and cerebral oxygen consumption below normal after 7-10 days while that of phosphorus was increased (increased P/) coefficient pointing to reparatory processes). A comparison of morphologic, physiologic and other studies led to the conclusion that emphysema in the first two days increased the respiratory surface thus slowing down respiration and increasing oxygen consumption. Pathologic changes in the lung on the third day decreased surface and gas exchange, and these led to death in many animals. Depressed immunity is also due to pulmonary pathology, since macrophagal elements and histiocytes failed to develop and leukocytal reaction was fully depressed. Orig. art. has: 2 tables and 3 figures.



212.

AUTHOR: Agadzhanyan, N. A. (Moscow); Rafikov, A. M. (Moscow); Sergiyenko, A. V. (Moscow)

ORG: none

TITLE: Possibilities of increasing nonspecific resistance of the body to hypoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 12-13

TOPIC TAGS: rat, hypoxia, altitude simulation, adrenocorticotrophic hormone, adrenal gland

ABSTRACT: There are many indications that the functioning of the hypophyseal-adrenocortical system is one of the important links in the mechanism for increasing nonspecific resistance of the body. This led to attempts to use hormone preparations from the adrenal and pituitary glands as a means of protecting the organism from hypoxia. The authors investigated the effect of a single administration of one or the other hormone on the resistance to hypoxia of animals retaining their adrenal glands. An aqueous prednisolone solution in doses of 1.5 mg/kg and 15 mg/kg, ACTH in a dose of 2.5 units per rat, and cortin in a dose of one unit per rat were administered. The experiments were conducted in a pressure chamber with rates of ascent equal to 25 m/sec and 300 m/sec. Findings show that with a rate of 25 m/sec ACTH and cortin do not influence survival time, while prednisolone in a 15 mg/kg dose increases it by 2.2 times, and in a 1.5 mg/kg dose still decreases it somewhat. At a rate of 300 m/sec a small dose of prednisolone proves effective, but a large dose noticeably decreases survival. The effectiveness of prednisolone for protection from hypoxia depends on two factors: the rate of decompression and the dose administered. The fact that the hormone dose which proves to be effective at one rate induces worsening at another rate indicates that the hormone acts in a nonuniform way on the entire aggregate of physiological processes forming the organism's protective reaction to stress. The absence of an effect with administration of ACTH and cortin (in contrast to prednisolone) in the experiments can be explained as the result of insufficient doses.

213.

AUTHOR: Akhmedov, K. Yu. (Dushanbe)

ORG: none

TITLE: Lung volumes in permanent inhabitants of mountains (3600 meters)

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 45-48

TOPIC TAGS: man, physiologic oxygen effect, biologic aging, respiratory system, hypoxia, barometric pressure

ABSTRACT: Overall lung volume of four age groups (56 men) was studied and the data obtained were statistically processed. Analysis of these data showed that aging was accompanied by a decrease of vital lung capacity with preservation of the increased residual volume. The decrease of vital capacity of the lungs was due to a decrease of the values of the reserve volume of expiration, making the overall capacity in the aged much less than in the young. The basic mechanism affecting lung capacity volumes at high altitudes is the increase of functional residual capacity generally and the residual volume of the lungs particularly. The decrease of vital capacity of the lungs with age led to a uniform increase of the relationship of the residual volume to the overall capacity. Investigation of one year's duration of young permanent inhabitants of Murgab, attending school in Dushanbe, showed that their lung volume was within normal limits for inhabitants of the plains but showed a marked decrease of reserve exchange of expiration and increased residual volume and overall capacity of the lungs upon their return to the mountain. The ratio of residual volume to overall lung capacity was increased up to 30% from the initial 20%. These data indicate the changes of lung volume are completely reversible for groups up to age thirty (material was not available for evaluation of other groups). Orig. art. has: 1 table.

214.

AUTHOR: Aliyev, M. A. (Frunze)

ORG: none

TITLE: Neurohumoral mechanisms of acclimatization and adaptation of the organism to alpine climate

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 20-22

TOPIC TAGS: adaptation, dog, hypoxia, rat, cerebral cortex, parasympathetic nervous system, altitude simulation

ABSTRACT: Rats with previouly elaborated stereotype conditioned reflexes, transported from "plains" to alpine conditions (3200 m), displayed a phase state (equalizing and parodoxical phases) as a predecessor to protective inhibition in the cerebral cortex, which lowers cortex sensitivity to oxygen deficiency and to inadequate meteorological conditions. The inter-relationship of excitation-inhibition processes was normalized within 1-5 to 30 days' adaptation to alpine conditions. Acclimatization processes proceeded simultaneously in the low lying centers of the central nervous system. The sensitivity of the adrenergic systems of the reticular formation was greatly diminished in dogs within the first two weeks under alpine conditions (2000-3000 m); under alpine conditions the organism responds to adrenalin and mezaton by low pressor reactions. The reticulo-adrenergic pressor effect was lower under alpine than under "plains" conditions in spite of uniform "plains" and "alps" doses of these stimulants. Aminazine, acting selectively on the reticular formation in the first days of stay of dogs in the alps, caused more pronounced pressor reaction than under lowland conditions, indicating participation of the reticulo-adrenergic system in the acclimatization process. Chronic experiments on dogs showed that the organism, under alpine conditions, becomes less sensitive to nezaton and adrenalin and more sensitive to aminazine and stelazine, indicating predominance of the parasympathetic effects over the sympathetic in alpine conditions. Electrolytes and their relationship in the blood were changed in the first days of acclimatization of dogs at 2150 m, indicating participation of the adrenal glands in adaptation to alpine conditions. Desoxycorticosterone acetate injections under "plains" conditions quickly disturbed blood circulation and, under alpine conditions, protected the organism from extreme intensification of the cardiovascular and respiration systems and helped normalize the oxygen regime. These data indicate that the essence of the neurohumoral mechanisms of acclimatization includes participation of the cerebral cortex, the reticular formation, the sympathetic and parasympathetic sections of the nervous system, and also humoral substances during adaptation to alpine conditions.

215.

AUTHOR: Amirov, N. Sh. (Moscow)

ORG: none

TITLE: Mechanism of resistance to absorption of amino acids from the small intestine under hypoxemic conditions

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 28-29

TOPIC TAGS: rat, hypoxia, amino acid, digestive system, small intestine

ABSTRACT: Experiments were made on male rats weighing 180-200 grams for 18-20 hours after last feeding to determine if resistance to absorption of amino acids is an active biological process ensuing with oxygen need. After opening the stomach cavity under pentobarbital narcosis, the small intestine was ligated and 0.1 ml of blood extracted from the portal vein for determination of ammine nitrogen. Three ml of 10% peptone solution was injected into the small intestine and the animals were placed in an hermetic chamber and fed an hypoxemic gas mixture. After one hour, the rats were removed, the stomach cavity reopened and the increase of amine nitrogen was determined. Control animals breathed air after the peptone solution injection. No significant changes of amine nitrogen content in the blood of rats receiving the hypoxemic mixture (10% O_2) in comparison to control animals was noted, nor were there changes of increase of amine nitrogen in hyperoxemic conditions (60% oxygen). Experiments on dogs by the M. E. Marshak and G. N. Arenev method (1958), to explain the role of blood flow changes in the small intestine during absorption under hypoxemic and hyperoxemic conditions, failed to reveal changes of blood flow in hyperoxemic conditions but indicated some tendency to increased blood flow in separate parts of the small intestine. This was assumed to be one of the causes of resistance to absorption of amino acids of the small intestine under hypoxemic conditions. As shown in previous acute experiments, there is probably a direct dependence between the blood flow in the regional vessels and absorption in the small intestine, but it is also possible that the reduction of the level of oxygenation causes compensatory increase of the quantity of erythrocytes ensuring the necessary oxygen supply to the organs. The literature describes the increase of quantity of erythrocytes in the blood under hypoxemic conditions, which occurs due to ejection from the blood depot and due to stimulation of hemopoiesis. Therefore, the increase of blood flow and the developing compensatory polycythemia ensures normal absorption of amino acids from the small intestine under hypoxemic conditions.

216.

AUTHOR: Antonov, I. I.

ORG: none

TITLE: Temperature dependence of organs and tissues of the body on external temperature and oxygen partial pressure changes

SOURCE: Moscow. Tsentral'nyy institut usovershenstvovaniya vrachey. Trudy, v. 95, 1966. Voprosy aviatsionnoy meditsiny, normal'noy i patologicheskoy fiziologii (Problems of aviation medicine, normal and pathological physiology), 96-102

TOPIC TAGS: rabbit, hypoxia, hyperoxia, temperature adaptation, liver, internal organ, brain tissue, muscle physiology, skin physiology, simulated altitude

ABSTRACT: In six experimental series on rabbits (109 experiments) the following were studied: effect of reduced pO_2 corresponding to 8000 m at temperatures of 10°, 17—20°, 30° and 40°C, and also the toxic effect of increased oxygen pressure (6 atm). Pressure chambers and eight specially made thermocouples were used according to P. M. Gramenitskiy's method. One thermocouple was introduced into the rectum to a depth of 3 cm, two were introduced into the surface and deep layers of the brain, and a fourth was attached to the skin between the shoulder blades; four thermoneedles were introduced into the subcutaneous tissue, hip muscle, liver and kidney. Animals were observed to determine their general state and also time of spasms, which served as an index of animal resistance to increased oxygen pressure. Findings show that with hypoxemia or hyperoxemia and normal external temperature, the temperature of the brain, liver, kidneys, muscles, subcutaneous tissue, skin, and rectum do not change in the same way. Brain temperature is particularly changeable; its change correlates directly with the effect of high or low oxygen partial pressure, which leads to a disruption of the normal temperature relationships between various brain layers and to a change of the general condition of an animal. Temperature of liver and kidneys is relatively constant during the entire time of the toxic effect of increased oxygen pressure and oxygen insufficiency, and basically reflects blood temperature change. Skin temperature change with increased or decreased oxygen pressure correlates directly with external temperature and its change is the result of reflex adaptive reactions to external stimuli. Muscle temperature change correlates directly with muscle tone, which is responsible for its rise at the time of spasms, and tremor and is related to increased metabolic rate. With high or low oxygen pressure, environmental temperature greatly affects the degree of normal temperature relationships between organs and tissues. The optimal temperature zone for rabbits is 30°C, which increases the resistance of animals to the toxic effect of compressed oxygen and oxygen insufficiency and maintains the internal temperatures within the norms. Any deviation of temperature higher or lower sharply aggravates the general condition of animals and leads to a disruption of normal temperature relationships. Orig. art. has: 2 figures. [06]

217.

AUTHOR: Ardashnikova, L. I.

ORG: Laboratory of Physiology and Pathology of Respiration and Blood Circulation/ headed by Corresponding Member AMN SSSR, M. Ye. Marshak/ (Laboratoriya fiziologii i patologii dykhaniya i krovoobrashcheniya); Institute of Normal and Pathological Physiology/ directed by Corresponding Member AMN SSSR A. M. Chernukh/ AMN SSSR, Moscow (Institut normal'noy i patologicheskoy fiziologii AMN SSSR)

TITLE: Change mechanisms of arterial pressure and heart contraction rate during acute hypoxic hypoxia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 3, 1968, 25-29

TOPIC TAGS: cat, blood pressure, heart rate, physiologic oxygen effect, hypoxia, hypoximia

ABSTRACT: The purpose of the study was to determine the significance of chemoreceptor excitation, hypocapnia and increased respiratory minute volume (RMV) in changes of arterial pressure and heart contraction rate appearing during hypoxia. Experiments were conducted on cats under urethane narcosis (0.8-1 g/kg). RMV, pneumogram, impulsation in the diaphragm, arterial pressure in the femoral artery and pulse rate according to EKG were recorded. Before the experiment both depressor nerves were sectioned at the site where they branch out from the laryngeal nerve. In each of the five variants of the experiment the animals breathed a hypoxic air mixture containing only 7% oxygen. In the first and second variants under natural breathing conditions, RMV was increased. In the first variant RMV increase was accompanied by hypocapnia which was averted in the second variant by adding 3% carbon dioxide to the breathing mixture. In the third, fourth and fifth variants hypoxemia was induced with artificial respiration and controlled RMV. In the third variant RMV was maintained at its initial level; and in the fourth and fifth variants RMV was maintained at an increased level comparable to RMV for natural breathing under hypoxic conditions. The hypocapnia which appeared in the fourth variant was averted in the fifth variant by the addition of carbon dioxide to the breathing mixture. Thus, the significance of hypocapnia with the same RMV could be determined by comparing the results of the first and second variants, and also by comparing the results of the fourth and fifth variants. The significance of an increased RMV could be determined by comparing the results of the third, second and fifth variants. Findings show (see Figs 1 and 2) that bradycardia appears in all the variants and is

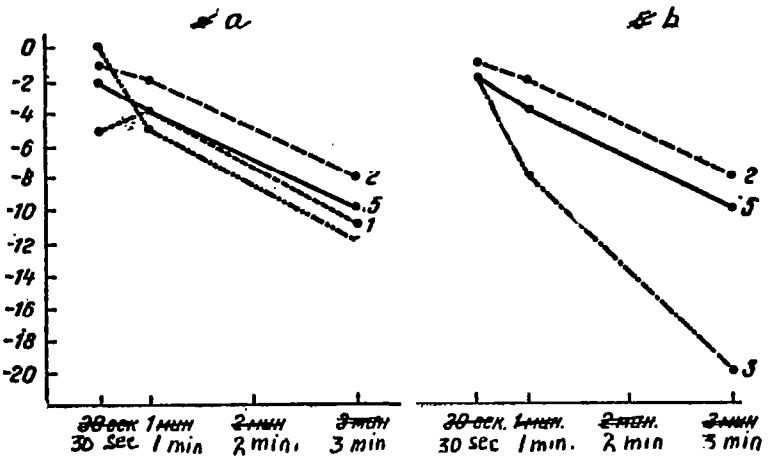


Fig. 1. Changes of the heart contraction rate during hypoxia in different variants of the experiment (designated by the number).

Horizontal axis--time; vertical axis--changes of heart contraction rate per minute.

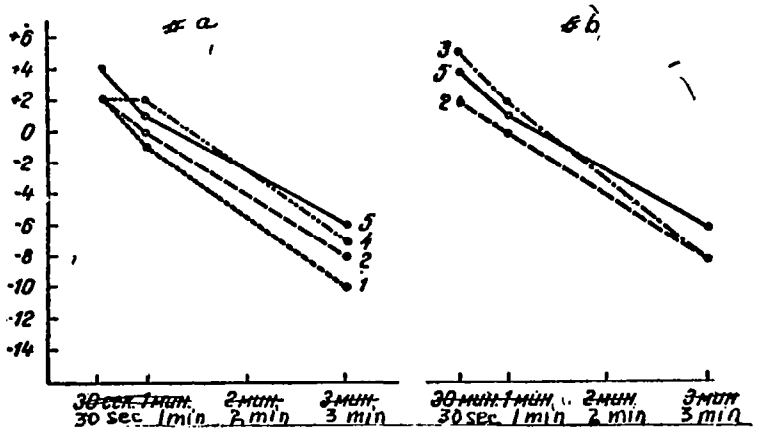


Fig. 2. Changes of arterial pressure during hypoxia in different variants of the experiment.

Horizontal axis--time; vertical axis--changes of arterial pressure (in mm)

considerably more marked in the third variant, that is, under conditions in which RMV is not increased during hypoxia. The presence or absence of hypocapnia essentially did not affect any of the results. Arterial pressure during the 30th second of hypoxemia was slightly increased in all the variants. Apparently this reflects the pressor reflex from the chemoreceptors of the carotid sinus zone. At the end of the first minute arterial pressure changes were not the same, and at the end of the third minute arterial pressure was lowered in all the variants. Thus, hypocapnia does not play an important role in lowering of arterial pressure. In fact, the lowering of arterial pressure which appeared during hypoxia is not related to chemoreceptor excitation, RMV or hypocapnia. Chemoreceptors of the carotid sinus which are very important in controlling respiration are far less important in controlling circulation during hypoxia. The paper was presented by Academician V. V. Parin. Orig. art. has: 2 tables and 2 figures.

218.

AUTHOR: Ardashnikova, L. I. (Moscow)

ORG: none

TITLE: Mechanisms of changes in respiration and blood circulation during hypoxemic hypoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 31-33

TOPIC TAGS: biologic respiration, blood circulation, physiologic oxygen effect, cat, hypoxia

ABSTRACT: The assumption that regulation of the respiration and circulation systems is independent during hypoxia is discussed. Adequate stimulation of chemoreceptors of the sinocarotid regions causing considerable increase of the minute volume of circulation had little effect on the arterial pressure level, while adequate stimulation of the mechanoreceptors of these regions resulted in great arterial pressure change with little effect on the minute volume of respiration, indicating that these two types of regulation are not uniform. Excitation of the sinocarotid region chemoreceptors does not occur in hemic hypoxia. In this case there is no increase in minute volume of respiration, but there is a significant increase in the

minute volume of the heart, showing that an increase of the minute volume of the heart during hypoxia may occur without participation of the chemoreceptors, but their excitation is necessary for an increase in the minute volume of respiration. The minute volume of respiration remains high under prolonged reduced partial oxygen pressure, due to excitation of the sinocarotid region chemoreceptors. Long stays in the Alps resulted in the minute volume of the heart returning to near normal, indicating that constant excitation of the chemoreceptors does not lead to an increase in the minute volume of the heart. Experiments on cats to investigate the effect of hypoxia (7% O_2) on changes of arterial pressure and frequency of cardiac contractions under natural and artificial respiration with the minute volume of respiration at normal and high levels, showed that hypoxia either was accompanied by hypocapnia or the latter was prevented by the addition of CO_2 to the gas mixture. Analysis of the results showed that an increase in the minute volume of respiration masks the bradycardia which rises if the minute volume of respiration level is kept constant. Arterial pressure was reduced somewhat in all variants of the experiment, indicating that the pressor reactions arising during perfusion of the isolated sinocarotid region blood by depleted oxygen are not significant in the regulation of arterial pressure during general hypoxia. Hypocapnia was not essential to changes of arterial pressure and frequency of cardiac contractions during brief acute hypoxia. This indicates that, in distinction to the great significance of the chemoreceptors in the regulation of respiration during hypoxemic hypoxia, the regulation of blood circulation is determined by other mechanisms which depend on the different values of respiration changes and blood circulation during hypoxemic hypoxia. Changes of respiration are directed to the support of partial oxygen pressure in arterial blood, but blood circulation is directed to normalization of the partial oxygen pressure in the blood of the capillaries and tissues and also the primary supply of blood to the vital organs.

219.

AUTHOR: Aref'yeva, T. O. -- Aref'yeva, T. A.

ORG: Department of Pathology of Hypoxic and Hyperoxic States, Institute of Physiology im. O. O. Bohomol'ts AN URSR, Kiev (Viddil patologiy hipoksychnykh ta hiperoksychnykh staniv Instytutu fiziologiy AN URSR)

TITLE: Effect of hyperoxia on periodic breathing in frogs

SOURCE: Fiziolohichnyy zhurnal, v. 14, no. 4, 1968, 487-493

TOPIC TAGS: hypoxia, respiratory system, frog, hyperoxia

ABSTRACT: This investigation was conducted to ascertain disturbing effects of circulatory hypoxia on breathing of frogs (*Rana esculenta L.*), and to determine the effect of hyperoxia on the periodic breathing caused by oxygen deficits due to different disturbances in blood circulation. Conditions of circulatory hypoxia were created by ligature, under ether anaesthesia, of pulmonary arteries, carotid arteries, and thoracic aorta. Respiration was recorded pneumographically, and respiratory movements, with the kymograph. Hyperoxic conditions were simulated by feeding oxygen at a rate of 4.25 1/hr into a polyethylene chamber. The degree of disturbance in the function of the frog's respiratory center depended on the degree of circulatory disruption. The greatest disturbances in respiratory function were observed with the ligatures on the pulmonary arteries, which resulted in the appearance, 1-25 min after ligature application, of apnea lasting from 10 sec to 2 min 7 sec. Subjection of the frogs with ligatures on pulmonary arteries to hyperoxia reduced the length of the periodic breathing pauses to 10-65 sec. Dermal respiration was found to have an important role in relieving hypoxia when the pulmonary circulation was shut down. Ligature of the carotid arteries or thoracic aorta caused less severe partial disturbances in cranial circulation, and hence less acute hypoxia leading to Cheyne-Stokes respiration. Hyperoxia resulted in the disappearance of the periodic breathing induced by these types of circulatory insufficiences in the frogs. Thus increasing the saturation of frogs' blood with oxygen appears to remove the hypoxic state, regardless of its cause, and normalize function of the respiratory center. Orig. art. has: 5 figures. [WA-22]

220.

AUTHOR: Asyamolova, N. M.; Malkin, V. B. (Doctor of medical sciences)

ORG: none

TITLE: Effect of a recurrent stay in the mountains on the tolerance of alpinists to acute hypoxia

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 65-72

TOPIC TAGS: hypoxia, adaptation, altitude chamber, blood count

ABSTRACT: To investigate the effect of repeated exposures to high altitudes on tolerance to acute hypoxic hypoxia, 12 alpinists were tested in a barochamber 18—23 days after their return from a mountain expedition. During this expedition, 5 alpinists had ascended 6995-m-high peak, while others stayed on 4000—6000-m levels, periodically performing heavy physical work. A comparison of the results of this test with those obtained before the trip revealed a slight increase in tolerance in nine alpinists, no significant difference in one, and a decrease in two others. In one of the latter subjects, a 25-sec-long stay at 7000 m in a barochamber resulted in the Adams-Stokes syndrome and an 18-sec heart arrest. During his stay in the mountains (6200 m), this man felt well and performed heavy physical work even better than the others. However, during the second test in the barochamber, he had to be given oxygen. The other, a first-class alpinist and a highly qualified sportsman, tolerated before the expedition 4 min on the 7000-m level exhibiting clonic spasms of the writing hand and considerably decreased consciousness. He participated in the ascent to the peak but his condition was so bad that he could not descend by himself. During the second test, on a 6000—7000-m level, pronounced extrasystole was observed, as well as a hypoxic condition similar to that of the first test. No correlation between the increase in tolerance and increase in hemoglobin and erythrocytes could be established. In two subjects who showed the highest tolerance, the hemoglobin and erythrocyte levels decreased considerably. In external respiration, EKG, and EEG, no significant differences between the two tests were observed. These results led to the conclusion that in persons repeatedly exposed to high mountain conditions, a 5—6-week stay at 6000—7000 m can only slightly improve the tolerance to hypoxia, while the main adaptation occurs apparently during the first 3 or 4 expeditions. Orig. art. has: 2 tables and 2 figures. [WA-22] [EF]

221.

AUTHOR: Aubakirova, Kh. Zh. (Alma-Ata)

ORG: none

TITLE: Changes in lymph circulation and lymphogenesis due to respiratory and circulatory types of oxygen starvation

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy, Dushanbe, 1966, 50-51

TOPIC TAGS: dog, hypoxia, lymphatic system, splanchnic nerve, blood circulation, blood plasma

ABSTRACT: Experimental data presented in this report were obtained with dogs under conditions of critical experiment. A respiratory type of oxygen starvation was created by forming an artificial pneumothorax on one side, lasting from two to fifteen minutes. Circulatory hypoxia was achieved by anemia of brain and liver, and by arterial and venous hemorrhage. Experiments were conducted with cutting of the vagus and splanchnic nerves for clarifying the mechanism of influence of the one-sided type of oxygen starvation on lymph circulation. The creation of a pneumothorax on one side induced in the majority of experiments a rise in arterial pressure, speeding up of respiration, and increase in lymph circulation. Cutting of the vagus and spanchnic nerves did not lead to elimination of changes on the part of blood circulation, respiration, and lymph circulation. Anemia of the brain and liver induced increase in lymph circulation in the majority of cases both before and after cutting of the vagus and splanchnic nerves. Arterial hemorrhage induced decrease in lymph circulation. In experiments with venous hemorrhage, lymph circulation remained unchanged or an increase was observed. For evaluation of lymphogenesis, the amounts of protein, albumins, and globulins in the lymph and blood plasma were determined. Calculation of the A/G coefficient and also of leukocytes in the lymph was carried out. Increase in the total protein content in the lymph and decrease in the plasma, and also change in the correlation of protein fractions in the lymph and in the blood plasma, occurred after creation of an artificial pneumothorax on one side. The number of leukocytes increased with a pneumothorax on one side. An artificial pneumothorax on one side apparently changes the permeability of blood capillaries. This was indicated by increase in the protein content in the lymph and by a decrease in the blood plasma. Consequently, shifts on the part of lymph circulation were caused by change in lymphogenesis. However, it is possible in these cases that change in the lumen of the large lymphatic vessels occurred together with lymphogenesis. Curing circulatory oxygen starvation the mechanism of change in lymph circulation was apparently connected with decrease in the process of lymphogenesis.

222.

AUTHOR: Aubakirova, Kh. Zh. (Alma-Ata)

ORG: none

TITLE: Effect of inspiration of air with an increased concentration of carbon dioxide and low partial oxygen pressure on lymph circulation and lymphogenesis

SOURCE: Konferentsiya fiziologov Srednev Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 52-53

TOPIC TAGS: dog, lymphatic system, air, carbon dioxide, splanchnic nerve, biologic respiration, blood plasma, protein

ABSTRACT: To clarify the mechanism of the effect of this type of air inspiration on lymph circulation, experiments were conducted on dogs with cutting of the vagus and splanchnic nerves, and also with perfusion of the thoracic duct. The results demonstrated that both before and after cutting of the vagus and splanchnic nerves, inspiration of air with increased concentration of carbon dioxide and low partial oxygen pressure induces an increase in lymph circulation, a rise in arterial pressure, and an increase in the respiration rate. In experiments with perfusion of the thoracic duct this type of oxygen starvation induces increase of perfusate circulation. Proteins, albumins, globulins and leukocytes were determined in the lymph and blood plasma to evaluate lymphogenesis changes. The total amount of protein in the lymph increased with inspiration of air with an increased concentration of carbon dioxide and low partial oxygen pressure. The amount of protein in the blood plasma also increased in the same period. A significant change was discovered in the correlation of protein fractions in the lymph and blood plasma. The leukocyte count in the lymph increased. Increase in lymph circulation during inspiration of air with an excessive carbon dioxide content and an insufficiency of oxygen is due to reflex change in the lumen of the lymphatic vessels, and changes in lymphogenesis are due to increase of hydrostatic pressure.

223.

AUTHOR: Azhayev, A. N. (Moscow)

ORG: none

TITLE: Adaptation to hypoxia and human tolerance to high environmental temperature

SOURCE: Fiziologicheskiy zhurnal, v. 54, no. 9, 1968, 1073-1076

TOPIC TAGS: temperature adaptation, heat biologic effect, altitude simulation, hypoxia, thermobar chamber, temperature test

ABSTRACT: Since hypoxia in the organism can be caused by high temperature, or by physical work, or by O_2 shortage, adaptation to any of these factors increases the tolerance to others. To increase high temperature tolerance by means of various combinations of these factors, 3 series of experiments were conducted in a thermal pressure chamber for 20 days with a daily exposure of 75—80 min. Six subjects participated in the first series, three in the second, and six in the third. The conditions of the first series consisted of a simulated altitude of 4000 m, a physical load of 300 kg/m, and an optimal temperature; the second series differed only in high temperature (50°C); the third series had variable altitude (2000—5000m) and physical load (315—440 kg/m), and an optimum temperature. Before and after the experiment, tolerance to high temperature (60°C), hypoxic hypoxia ("altitude" of 7000 m), and physical load (step-test: ninety 30-cm steps in 3 min) was tested. The results showed that the duration of high temperature tolerance increased only after the third series. Lesser perspiration, smaller weight loss, and smaller heat accumulation due to reduction of heat production, were also observed. Thermo-training adapts the thermoregulatory system mainly through increase of perspiration, while an increase of high temperature tolerance due to non-specific training relies apparently on shifts in the tissue metabolism which can be regarded as the adaptive reaction that controls the heat balance. During the high temperature test after the experiment, all 6 subjects of the third series showed a smaller increase of the pulse rate, maximum and pulse pressure, while the minimum arterial pressure dropped 10 mm Hg less than before the experiment. Only two subjects of the first series and one of the second showed improved temperature tolerance. Fatigue was observed in subjects of the second series toward the end of the experiment. In all series the tolerance to hypoxic hypoxia and physical load increased after the experiment. Accordingly, the pulse rate at 7000 m was 15—30 less than before the experiment, and the duration of hypoxia tolerance increased by 20—30%. The arterial pressure reached the initial values 5 min after the step-test. The fact that only the series with gradually changing factors increased the temperature tolerance correlates with the principles of sport medicine, which recommend a diversity of loads and their gradual increase, because diverse and multiple factors increase the plasticity of the nervous system and develop the higher nervous activity. The principle of diversity of loads seems to be especially important in non-specific training, because it trains the organism to meet a diversity of factors or combinations of factors of varying strength. The decrease of heat production after the third series of training indicates some adaptational trophic shifts on tissue level, while the monotonous effect of hypoxia and physical load does not increase the tissue resistance. Orig. art. has: 1 figure and 1 table. [EF]

224.

AUTHOR: Babchinskiy, F. V.; Yukhnovskiy, G. D.; Malkin, V. B. (Doctor of medical sciences)

ORG: none

TITLE: Animal tolerance to hyperoxia, hypercapnia, and high temperature after adaptation to low barometric pressure

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptability to hypoxia and resistivity of organism), 72-79

TOPIC TAGS: hypoxia, adaptation, hyperoxia, hypercapnia, temperature test, altitude chamber

ABSTRACT: Experiments with white mice were arranged to determine the changes in tolerance to hyperoxia, hypercapnia, and high temperature after adaptation to actual and simulated altitudes, and to hypoxia after extended exposure to hyperoxia. The animals were adapted to altitude for 16 days in a place situated at 2000 m, for 14 days at 3800 m, and for 13 days by means of daily exposures to gradually increasing simulated altitudes (up to 7000 m) in barochambers. In the first series, mice kept in 90—92% O_2 atmosphere for 2—4 days were exposed to a simulated altitude of 9000 m. The death rate was in direct proportion to the length of previous oxygen breathing, which was due to lung lesions caused by hyperoxia. The experiment was repeated with mice adapted for 2.5 days to 40—60% O_2 atmospheres. Experimental animals died after 8 min, while the controls died after 6 min. In the second series, animals adapted to hypoxia were exposed to pure oxygen atmosphere. Mice adapted at 3800 m died more rapidly than those adapted at 2000 m. In the third series, where the tolerance of hypoxia-adapted animals to a mixture of high concentrations of CO_2 with O_2 was tested, the death rate of experimental and control animals was practically equal. In the fourth series, the tolerance to high temperatures in mice adapted to hypoxia was tested. An exposure to 60°C revealed that mice adapted by one, and especially 3 simulated elevations survived longer than the controls. Mice adapted for 30 days in the mountains tolerated an exposure to 50° for 58 min, while controls perished after 31 min. These results indicate that adaptation to hypoxia does not increase tolerance to hyperoxia and high CO_2 content. Futhermore, even if mice adapted to hypoxia survived in these conditions as long as the controls, their agony began earlier, thus demonstrating the advantageous position of intact animals. Consequently, adaptation to hypoxia can produce a nonspecific increase of tolerance to some factors, but it does not increase the tolerance to factors which require opposite adaptive reactions. Orig. art. has: 3 figures and 2 tables.

[WA-22] [EF]

225.

AUTHOR: Barbashova, Z. I.

ORG: none

TITLE: Prolonged study of changes in erythrocyte osmotic resistance during and after acclimatization to high mountains

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 293-298

TOPIC TAGS: man, hypoxia, erythrocyte, cell membrane, osmosis, physical fitness

ABSTRACT: Tests were conducted in 26 young people divided into three groups. Thr first (5 men) had been exposed to primary acclimatization in mountains, the second consisted of 11 mountain climbers and the third of junior athletes, among these 4 girls. All had their base camp at 2000 m and underwent intensive physical training including mountain climbing to up to 5635 m. Erythrocyte osmotic resistance (EOR) was determined before, after and 4 times during the test. Results are

Table. EOR in test individuals during their stay in the mountains

Concentration	Groups			
	first	second	third-boys	third-girls
	Initial data (Moscow)			
	(5)*	(2)	(6)	(4)
0.60	9.0±4.94	0	5.3±1.93	14.2±4.11
0.56	27.8±5.36	23.0	21.6±3.22	52.0±8.31
0.52	53.6±7.43	48.5	44.5±3.52	75.0±4.31
0.48	79.2±3.18	87.5	79.3±5.01	89.2±1.01
at 50% hemolysis	0.528±0.010	0.52	0.513±0.002	0.56±0.008
	1-2 days in mountains (2000 m)			
	(5)	(10)	(6)	(4)
0.60	0.6±0.6	1.5±0.53	0.17±0.05	2.0±1.06
0.56	3.6±1.94	5.3±1.29	2.5±1.06	5.8±1.80
0.52	16.8±3.24	21.9±3.16	28.2±2.41	30.0±6.27
0.48	52.4±7.30	56.3±5.03	65.0±5.36	77.8±4.09
at 50% hemolysis	0.48±0.006	0.485±0.005	0.495±0.003	0.51±0.006
P	< 0.02	< 0.001	< 0.01	< 0.01

Table (cont.)

Concentration	Groups			
	first	second	third-boys	third-girls
	8-9 days in mountains			
	(5)		(6)	(4)
0.60	5.0±0.63		1.0±1.0	3.7±2.17
0.56	14.2±2.32		14.8±4.35	16.2±3.68
0.52	56.2±5.48		50.5±7.73	61.7±5.97
0.48	85.0+2.21		85.3±2.79	89.5±1.94
at 50% hemolysis	0.524±0.004		0.52±0.006	0.534±0.004
P	> 0.5		> 0.5	=0.02
	19-20 days in mountains			
	(5)		(6)	(4)
0.60	3.0±1.04		6.1±2.83	5.8±1.93
0.56	25.4±3.14		30.7±6.94	25.3±1.70
0.52	66.6±7.86		75.9±3.72	69.3±5.51
0.48	90.6±3.78		93.0±2.11	89.0±1.58
at 50% hemolysis	0.532±0.006		0.545±0.006	0.538±0.03
P	> 0.5		< 0.02	< 0.05
	28-30 days in mountains			
	(5)	(8)	(6)	(4)
0.60	3.4±1.42	0.0±0	2.0±1.11	1.8±0.85
0.56	16.8±4.07	6.1±1.08	8.8±3.65	8.3±1.38
0.52	48.4±4.97	42.9±2.65	41.0±6.91	43.8±6.06
0.48	81.2±2.52	79.6±2.10	80.3±3.82	77.5±3.12
at 50% hemolysis	0.516±0.004	0.51±0.008	0.515±0.008	0.515±0.003
P	> 0.25	> 0.05	> 0.5	< 0.01
	5--6 days after return from the mountains			
	(5)		(5)	(4)
0.60	0.3±0.24		3.6±1.50	3.5±1.55
0.56	0.8±0.75		26.4±8.08	22.0±3.65
0.52	23.8±5.12		51.4±11.27	65.5±5.01
0.48	70.0±5.64		80.8±6.84	8.88±4.00
at 50% hemolysis	0.495±0.003		0.522±0.01	0.53±0.006
P	< 0.02		> 0.5	< 0.05

*in parentheses the number of test individuals

shown in the table. Initial values were about the same in all men, but lower in the four girls. EOR increased in 25 out of the 26 individuals right after their arrival in the mountains. Further tests showed phasic EOR changes with a tendency to normalization. Upon return to Moscow, the EOR was increased in some, normal or decreased in others. Comparison between EOR and overall resistance of the organism to acute hypoxia and acceleration after return from the mountains showed a satisfactory coincidence between these values for most test individuals, with one exception in the first group (intolerance despite high EOR) and several irregularities in the group of mountain climbers. The adolescents were not subjected to the acceleration test but took part in sport events with generally good results. Three girls with high EOR performed well, the one with low EOR poorly. The young test individuals lost weight during the test, in contrast to adults, and suffered from colds; they were probably overexerted. In conclusion, a direct relationship between EOR and physical fitness was found in 14 out of 17 cases. However, this indicator is not fully reliable. Orig. art. has: 1 table.

226.

AUTHOR: Barbashova, Z. I. (Leningrad); Grigor'yeva, G. I. (Leningrad)

ORG: none

TITLE: Relation of changes of erythrocyte osmotic resistance and certain biochemical properties of constituent blood elements during adaptation to hypoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 63-65

TOPIC TAGS: adaptation, hypoxia, erythrocyte, rat, hemolysis, enzyme, ion exchange

ABSTRACT: Research has shown that, in blood of humans and animals adapted to hypoxia, the permeability of the erythrocyte membrane was changed only for ions and not for water. It was assumed that the cause of permeability change in erythrocytes may involve environmental shifts, especially in the ion concentration in the blood plasma or in the active reactions of the blood. It has been shown, however, that the content of sodium and potassium ions in whole blood and in the plasma was unchanged and the pH was unchanged. Instead, erythrocytes of animals adapted to hypoxia are much more buffered than cells of non-adapted animals. Adenosinetriphosphatase activity in rats successfully adapted to hypoxia was changed; its activity in the blood plasma increased considerably; it was reduced in the erythrocytes but was unchanged in the

stroma. Animals inadequately adapted to hypoxia displayed neither shifts of osmotic resistance of erythrocytes nor of adenosinetriphosphatase activity in the erythrocytes. Its activity remained high only in the plasma. The change of osmotic resistance of erythrocytes during training to hypoxia is connected, apparently, with shifts of permeability of the red cells to electrolytes, depending somewhat on the activity of the cellular adenosinetriphosphatase. This is not transport adenosinetriphosphatase, since it was not decreased in the stroma and since processing the erythrocytes with strophanthin did not change the activity of this enzyme nor of the osmotic resistance of the erythrocytes. The mechanism of change of the osmotic resistance of erythrocytes, apparently, is not connected with the properties of the erythrocyte membranes but with the ion exchange of the entire cell as a unified biological system.

227.

AUTHOR: Barkayev, V. V. (Dushanbe)

ORG: none

TITLE: Polycythemia at high altitudes and kidney function and diuresis at various heights in the Pamirs

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 65-66

TOPIC TAGS: blood chemistry, human physiology, atmospheric pressure, hematopoiesis, adaptation

ABSTRACT: These physiologic parameters were investigated at 850, 2200 and 4000-4200 m above sea level in healthy men aged 19-26 years, living and working at these heights under otherwise identical conditions for periods which varied for the first, amounted to $2\frac{1}{2}$ months for the second and 6 months to 2 years for the third group. The following results were obtained: a parallel increase of erythrocytes and hemoglobin with height; erythrocytes were 4.653 million for the 850 m height and 5,562 million for 4000 m. The corresponding hemoglobin values were 13.5 g% and 16.6 g%. Kidney function was normal at 850 m; at 2200, values for kidney function were increased (kidney plasma and blood circulation, glomerular filtration). Kidney function was depressed at 4000 m. Urinary output increased with height, from 6.96 ml/min to 8.85 ml/min. It was concluded that diuresis does not depend on the above indices, but on the ratio of glomerular filtration: reabsorption in the tubules. The value of this ratio changes with height and leads to increased water elimination through the kidneys.

228.

AUTHOR: Bernshteyn, A. D. (Alma-Ata); Zima, A. G. (Alma-Ata); Ivanov, N. A. (Alma-Ata); Khvan, M. U. (Alma-Ata)

ORG: none

TITLE: Mechanism of motor hypoxemia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 73-74

TOPIC TAGS: man, respiration, oxygen consumption, work function, hypoxemia

ABSTRACT: On the basis of various experiments, the authors conclude the following: In static work performance, a slight hypoxemic shift (4-6%) appears only when the effort takes place under some tension and is accompanied by changes in pulmonary ventilation; then alveolar O_2 tension is somewhat decreased. Under heavy work loads, O_2 saturation in the blood may decrease by 2-3% while alveolar pO_2 remains unchanged or increases. Exhausting short work loads (3-5 min) caused a sharp drop in the saturation curve (by 10-12%) accompanied again by normal alveolar tension. Long term exercise (30-60 min) resulted in a gradual drop of the oxyhemogram (decrease by 15-20%). If the same work was done under moderate oxygen deficit, blood saturation decreased by 30-35%. It was concluded that arterial hypoxemia frequently accompanies muscular exercise. In static work, hypoxic shifts may be considered the direct result of lesser lung ventilation and reduced pO_2 in the alveolar mixture. In dynamic work, hypoxemia may be caused by insufficient ventilation or a lack of coordination between ventilation and blood circulation.

229.

AUTHOR: Bobodzhanov, Yu. R. (Dushanbe)

ORG: none

TITLE: Blood morphology and some of its physicochemical properties in natives residing at various heights in the Pamirs

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy, Dushanbe, 1966, 82-83

TOPIC TAGS: hematopoiesis, man, atmospheric pressure, hypoxia, blood chemistry, adaptation

ABSTRACT: The study involved 206 native residents of seven settlements located between 846 and 4650 m above sea level and 36 men who had moved there 1-10 years ago. Natives had higher than normal values for erythrocytes and hemoglobin, and these values increased with height, e.g. at 4650 m erythrocytes were 6.7 million and hemoglobin 18 g% as against 4.71 million and 13.3 g% at 1030 m. Hematocrit values increased by 16.2% between 8600 and 3900 m, reticulocytes decreased; so did the erythrocyte diameter from 2200 m on. Total leukocyte numbers decreased substantially at great heights, starting with 3600 m. Other humoral changes involved the absolute and relative decrease in number of neutrophils and increase of lymphocytes; monocytes decreased only at great heights. The thrombocyte number increased with height (from 76,000 at 2200 to 168,000 at 3900 m), the ESR was down, blood viscosity increased; values of 3-7 were found for 846 m and 6-10 for 4650 m. Blood coagulation time shortened with increasing height. The circulatory rate doubled. No great differences were found between values from natives and from the recent residents except that reticulocytes were somewhat lower in the former.

230.

AUTHOR: Bobodzhanov, Yu. R. (Dushanbe)

ORG: none

TITLE: Changes in the peripheral blood of animals adapting to conditions of high altitude (3600 m above sea level)

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 80-81

TOPIC TAGS: hematopoiesis, rabbit, horse, atmospheric pressure, hypoxia, blood chemistry, adaptation

ABSTRACT: The study was conducted in 10 rabbits taken to this altitude and 6 native rabbits. Leukocytes and red blood elements were determined every week for 10 weeks. Similar tests were also conducted in 40 healthy horses that had been there for a year or a month. The increase in erythrocytes and hemoglobin in rabbits stopped after 8 weeks; at that time erythrocytes had increased from 5.04 to 7.31 million and hemoglobin from 14.2 to 17.8 g%. Reticulocytes stopped increasing after 4 and started to decline after 7 weeks. The number of leukocytes remained unchanged for 4 weeks, then decreased. Comparison of values found in native and newly arrived rabbits showed higher erythrocyte and hemoglobin values for the former and higher reticulocyte and leukocyte values for the latter. We earlier reported similar results for humans at 4230 above sea level. Horses showed increased erythrocyte and hemoglobin values after a month. The ESR decreased, blood viscosity increased and thrombocytes rose to 111,000/cc. Coagulation time shortened. In animals at that height for a year, these values were higher than for those with a month's stay. It was concluded that full adaptation of the hematic system to height takes more than one or two months.

231.

AUTHOR: Bobodzhanov, Yu. R. (Dushanbe)

ORG: none

TITLE: Hematopoietic properties of serum and urine from healthy individuals under conditions of the high Pamir mountains

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 78-80

TOPIC TAGS: hematopoiesis, man, atmospheric pressure, hypoxia, adaptation, rabbit

ABSTRACT: The presence of the hematopoietic factor in blood and urine was studied in the inhabitants of a settlement 3600 m above sea level, both natives and newcomers and both healthy individuals and those suffering from pulmonary anoxia (bronchial asthma or emphysema), by administering a single intramuscular injection of 1.5 ml of their serum or urine to rabbits present at this height from 7 to 31 days. The following parameters were determined: reticulocytes, hemoglobin, erythrocytes and spinal marrow punctate. The serum from the anoxic patients was found active, the urine somewhat less so, while those of the healthy newcomers had no erythropoietic activity in the rabbits. Both serum and urine from natives caused increases in the values of these parameters. Urine caused an increase in reticulocytes by 23%, serum by 54%; the corresponding values for erythrocytes were from about 5 million to 5.72 and 6.20 million, for hemoglobin from about 14.5 g% to 16.5 and 17.3 g%; erythroblasts increased by 5 and 4.3-9.4% respectively. Injection to rabbits of serum and urine from individuals at varying periods after their arrival showed that activity started after the third day. After a 2 months stay, erythroblastic elements had increased to 7.9-11.2%. It was concluded that the effect of height on hematopoietic properties of the blood starts after 3-7 days. Under hypoxic conditions, hematopoietic elements appear in the blood and pass into the urine. Their increase is directly related to length of stay at the height.

232.

AUTHOR: Bodobzhanov, Yu. R. (Dushanbe)

ORG: none

TITLE: Peripheral leukocytes of persons acclimatizing to high altitudes in the Pamir mountains

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 83-84

TOPIC TAGS: man, adaptation, barometric pressure, leukocyte

ABSTRACT: Changes in the peripheral leukocytes of 61 persons newly arrived at an altitude of 4230 meters (Kara-Dzhilga) were investigated. Out of this number, 26 persons had been preliminarily examined in Dushanbe (846 altitude) before their journey to the Pamirs, and were also examined twice after descent within one and $2\frac{1}{2}$ months. Observations in the Pamirs were carried out every 7-10 days for four months. A reduction in the leukocyte count from 6300 $\pm$ 210 to 5700 $\pm$ 240 was noted in the newly arrived persons, beginning with the eighth week of their stay and continuing until the tenth week. Subsequently the leukocyte count remained stable until the end of the fourteenth week. The average relative and absolute number of neutrophils declined as follows in comparison with the data from Dushanbe: before ascent -- 62.8 $\pm$ 1.0%, 3956.4 + 112.6; after the fourteenth week of their stay at high altitudes -- 55.0 $\pm$ 1.0%, 3025 + 166.5. The decline is statistically reliable. The percentage of bacillinuclear neutrophils did not change substantially. The average relative and absolute number of lymphocytes increased by 9.8% and 522.2 respectively, compared with the initial data from Dushanbe. The percentage of monocytes did not change in relation to the initial data by the end of the fourteenth week of stay, but the absolute number of monocytes decreased somewhat. The leukocyte count did not change substantially within one month after descent from the high altitudes, but within $2\frac{1}{2}$ months it had increased to 6200 $\pm$ 310, almost attaining the level of the initial values at Dushanbe. The percentage of neutrophils, lymphocytes, and monocytes reached the initial level within $2\frac{1}{2}$ months after descent.

233.

AUTHOR: Bondarev, E. V.; Kuznetsov, V. N.

ORG: Military Medical Academy im. S. M. Kirov, Leningrad (Voyenno-meditsinskaya akademiya)

TITLE: Evaluation of the activity stress during hypoxia and oxygen respiration under excess pressure

SOURCE: Voprosy psikhologii, no. 4, 1968, 151-156

TOPIC TAGS: human engineering, visual analyzer, psychophysiology, auditory analyzer, aircraft pilot, trainer aircraft, hypoxia, hyperoxia, adaptation

ABSTRACT: The rate of processing additional information during flight control is indicative of the amount of the pilot's psychophysiological reserves during various stages of the flight: for instance, during horizontal flight a more rapid and exact processing can be observed than during landing and take-off. The effect of hypoxia and oxygen respiration under excess pressure on the pilot's performance and on the processing of additional information was tested on 11 pilots during 15-min-long modeled flight control tests on TL-1 aircraft trainers. The additional information was conveyed by visual, acoustic, and tactile stimuli; and the response involved the rapid and correct choice of push-buttons. Hypoxia was caused by inhaling a gas mixture with a 9.5% oxygen content, equal to the p0 at a 6200-m altitude. The excess oxygen pressure equaled a 350—400-mm water column. The quality of flight control was not affected by experimental factors, although pronounced physiological shifts were observed. During hypoxia the pulse rate increased by 27 (11 during control flights) and the respiration rate decreased (increased in control flights); oxygen under excessive pressure caused similar effects. During hypoxia the rate of processing of additional visual information decreased significantly. The auditory analyzer showed greater tolerance to hypoxia. The effect of hypoxia increased with its duration. During inhalation of oxygen under excess pressure, adaptive reactions were observed: in the beginning of the first flight the processing of visual information was 62% lower than in control flights, but at the end, only 27%. During the second flight the results were close to the control, and in further flights even better than in control flights. The processing of auditory and tactile signals decreased by 45% in some subjects, while it increased by 31% in some others during the first flight. During the second flight take-off, the values corresponding to the processing of auditory signals were 33% lower, and of tactile signals 2% lower than in control. During the horizontal flight and landing, the values were 47 and 69% above the

control for auditory, and 3 and 19% above the control for tactile signals. The decline in additional information processing (mean value 27—33%) was mainly due to errors; thus, in stress situations when all the psychophysiological reserves are mobilized, the pilot can fail to control the situation. The authors suggest relatively frequent training of pilots in inhaling oxygen under excessive pressure to develop adaptation and thus to facilitate high quality performance in emergency situations. Since the visual analyzer, already overloaded with information, could process less additional information, the use of tactile and especially auditory signals is recommended for conveying additional information to the pilot. Orig. art. has: 2 tables and 1 formula. [WA-22] [EF]

234.

AUTHOR: Borshchevskiy, I. Ya.; Krylov, Yu. V.

ORG: none

TITLE: Auditory function during prolonged exposure to low barometric pressure

SOURCE: Moskovskoye fiziologicheskoye obshchestvo. Sektsiya aviatsionnoy i kosmicheskoy meditsiny. Trudy, no. 1, 1967. Aviakosmicheskaya meditsina (Aviation and space medicine), 167-169

TOPIC TAGS: audition, altitude chamber, isolation chamber, hypodynamia, adaptation

ABSTRACT: The authors studied the auditory function of subjects exposed for many days to low barometric pressure during complex experiments conducted by A. G. Kuznetsov and N. A. Agadzhanyan. The barometric pressure equaled that of an altitude of 7000 m, while the pO_2 was 150—160 mm Hg. The auditory thresholds for frequencies of 125, 250, 500, 1000, 3000, 4000, and 6000 Hz, and the time of readaptation to 1000 Hz after a 3-min-long exposure to 50-db white noise were determined. AN AU-5 audiometer was used and the results were mathematically processed by the least squares method. The auditory thresholds varied from 5 to 15 db with no specific changes in sensitivity to low or high frequencies. The highest threshold values were recorded in the first days, while a general tendency for increased sensitivity was observed during the second half of the experiment. The readaptation time varied from 43—60 sec to 150—182 sec, increasing during the second half of the experiment, but without any significant changes occurring in the threshold values. No difference was observed between these results and results of identical auditory measurements conducted on subjects exposed to the same conditions (confinement, hypokinesia) except the low barometric pressure. The high threshold values in the first days can be explained by the change from normal to experimental conditions, just as the increased sensitivity during the second half is explainable by compensatory reactions caused by adaptation. This experiment proves that the auditory function is not affected by prolonged exposure to low barometric pressure (308 mm Hg) with normal pO_2. [EF]

235.

AUTHOR: Botombekova, A.

ORG: Kirghiz State Medical Institute, Frunze (Kirgizskiy gosudarstvennyy meditsinskiy institut); Institute of Evolutionary Physiology and Biochemistry im. I. M. Sechenov, AN SSSR, Leningrad (Institut evolyutsionnoy fiziologii i biokhimii AN SSSR)

TITLE: Resistance of skeletal muscles and their myoglobin content in rats acclimated to high altitudes and trained with muscular work

SOURCE: Zhurnal evolyutsionnoy biokhimii i fiziologii, v. 4, no. 1, 1968, 42-46

TOPIC TAGS: muscle physiology, myoglobin, physiologic stress, high altitude physiologic effect

ABSTRACT: A study was made of myoglobin content and resistance in muscles of white rats subjected to hypoxia under the following conditions: Group I — 15 control rats kept in a vivarium in Frunze (760 m above sea level) for a month; Group II — 35 rats acclimated to hypoxia in the Tyan'-Shan' mountains (3200 m) for a month; Group III — 15 rats kept under the same conditions as Group II, and additionally subjected to muscular training; Group IV — 15 rats kept under the same conditions as Group I, but subjected to muscular training. Muscular resistance was determined by the time to physiological death of isolated muscles subjected to electrical stimulation; myoglobin was determined by Reynafarje's method. Muscle survival time and myoglobin content were greater in animals kept at the higher altitude; muscular training additionally increased these parameters. These values were also greater for animals kept at the lower altitude and subjected to physical training than for those kept at the same altitude without training. In all cases there was a positive correlation between increase in muscular resistance and increase in myoglobin content. It is concluded that muscular training at high altitudes facilitates changes at the cellular level which account for the increase in tissue resistance. Orig. art. has: 1 figure and 1 table. [WA-MIO-69-1] [EL]

236.

AUTHOR: Breslav, I. S.; Klestova, O. V.; Moiseyeva, O. I.; Shmeleva, A. M.

ORG: Laboratory of Respiration Physiology/ Head--Doctor of Biological Sciences A. G. Zhironkin/ and Laboratory of Experimental and Clinical Hematology/ Scientific Director--Professor A. Ya. Yaroshevskiy/, Institute of Physiology im. I. P. Pavlov/ Director--Academician V. N. Chernigovskiy/ AN SSSR, Leningrad (Laboratoriya fiziologii dykhaniya i Laboratoriya eksperimental'noy gematologii, Institut fiziologii AN SSSR)

TITLE: Effect of pure oxygen respiration on erythropoiesis

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 3, 1968, 39-42

TOPIC TAGS: rat, hyperoxia, erythropoiesis, hemoglobin, bone marrow, mitosis

ABSTRACT: Experiments were staged on 100 white rats of the Wistar line weighing 170-190 g to determine why hyperoxic respiration reduces the hemoglobin level and erythrocyte count. The experimental animals were placed in a KNZh-2 chamber supplied with pure oxygen at a normal pressure for 40 hrs, and control animals were exposed to a normal air environment. Indices included an erythrocyte count, hemoglobin level, reticulocyte count and a bone marrow culture. Acid resistance of erythrocytes was studied by the erythrogram method of Gitel'zon and Terskov. A colchicine solution was added to the bone marrow culture to study the mitotic activity of erythroblasts in a concentration of 1:500,000. Following a 40 hr exposure of animals to pure oxygen and transfer to a normal air environment, the erythrocyte count and hemoglobin level of the peripheral blood increase and the number of erythroblasts in the bone marrow decreases. The erythrocyte count starts to decrease rapidly shortly after with maximum decrease found on the fifth day, and erythropoiesis in the bone marrow still remains inhibited and returns to normal during the second week. Depression of erythropoiesis in vivo or in vitro is attributed to reduction of mitotic activity caused by the appearance of a special substance, an erythropoietic inhibitor, in the blood and not by the direct action of oxygen. The paper was presented by Academician V. V. Chernigovskiy. Orig. art. has: 1 table and 2 figures.

237.

AUTHOR: Breslav, I. S.; Salatsinskaya, Ye. N.

ORG: none

TITLE: Human reaction to hypoxia and hypercapnia breathing nitrogen - and helium-oxygen mixtures

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967 Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 212-220

TOPIC TAGS: respiratory physiology, hypoxia, hyperemia, hypercapnia, hypocapnia, helium breathing mixture

AUTHOR: The effect of helium on the reaction of the respiratory system to oxygen deficiency and excess carbon dioxide in inhaled gas mixtures was studied. Experiments were conducted with 18—25yr -old men and women. The subject, seated in a chair, breathed through a mask equipped with valves of minimum resistance. After he became accustomed to the mask, the experiment started with 5-min-long breathing of normal air. Then for 5 min the subject breathed one gas mixture from a container, and for 5 min, another. During the next 15 min the subject operated the connecting device himself and chose the gas mixture he preferred. This preference was evident from the comparison of the time periods spent breathing each of the mixtures. During the 4th and 5th min of breathing each mixture, respiratory movements, respiratory minute volume, pulse rate, and oxygenation of the arterial blood were recorded. Three series of experiments were conducted. In the first series, nitrogen mixtures with various percentages of oxygen (21—9%) were compared to helium mixtures with equivalent oxygen content; in the second series nitrogen with 21% oxygen was compared to nitrogen with 18, 15, 12, and 9% oxygen, and helium with 21% oxygen to helium with 18-9% oxygen; in the third series nitrogen with 21% oxygen was compared to the same mixture plus 1.0, 2.5 and 6% CO_2, nitrogen with 12% oxygen was compared to the same mixture plus the values mentioned of CO_2, and the same combinations were tried with helium. During the comparison of nitrogen and helium gas mixtures with the same oxygen content, the subjects invariably chose the helium mixtures, probably because alveolar ventilation requires reduced respiratory work in a less dense medium. During the use of helium mixtures breathing was more frequent while the respiratory volume decreased. The oxygenation of blood with helium mixtures did not differ significantly from that of nitrogen mixtures. The subjects did not differentiate the 18% oxygen nitrogen mixture from normal air, and the subjects who breathed an 18% oxygen-helium mixture preferred it even to the 21% oxygen, though the blood oxygenation was reduced. Because of the hypoxic stimulus, this mixture probably creates a habitual stress on the respiratory apparatus. Nitrogen mixtures containing 15% O_2, or less caused an increase of pulmonary ventilation. A helium mixture with 12% O_2 did not increase pulmonary ventilation, though the blood oxygenation was reduced as in nitrogen mixtures. The subjects did not differentiate

it from the 21% O_2 mixture, probably because of the same ventilation intensity. When the oxygen content reached 9%, the subjects avoided both types of mixture. Normal (21%) oxygen content mixtures with addition of CO_2 produced better blood oxygenation in nitrogen mixtures. The inadequate blood arterialization by the helium mixtures can be explained by disparity between the respiratory volume and the blood flow in the lesser circulation. Subjects preferred the 1% CO_2-helium mixture to the CO_2-free mixture, because hypercapnia stimulates more comfortable breathing. When 2.5% CO_2 was added, the subjects obviously avoided the helium mixture, while they accepted the nitrogen mixture. When the CO_2 content increased to 6%, both mixtures were rejected, but the avoidance of the helium mixture was more pronounced. In reduced oxygen content (12%) mixtures with CO_2, the ventilation reaction was similar for both mixtures. Blood oxygenation for 1% and especially 2.5% CO_2 concentrations was better in helium mixtures. The subjects preferred the 1% CO_2 helium mixture to the CO_2-free (because the ventilation reaction to CO_2 helped to compensate for the hyporemia), and did not differentiate between the 2.5% CO_2 and CO_2-free helium mixtures, while they avoided the 2.5% CO_2-nitrogen mixture. When the CO_2 content reached 6%, the values of ventilation, blood oxygenation, and preferences for both mixtures were identical to those for the normal O_2 concentration mixtures. The subjects always preferred CO_2 mixtures which permitted better blood oxygenation. Small CO_2 concentrations added to normal oxygen content (21%) were preferable in nitrogen mixtures, while added to reduced O_2 content (12%) they were more acceptable in helium mixtures. The pCO_2 of the blood is apparently the factor which controls man's reaction to hypercapnic and hypoxic mixtures. The ventilation reaction to the reduced pO_2 in the inhaled mixture causes hypocapnia, which provokes a negative reaction to hypoxic mixtures. The helium mixture with 12% O_2 did not cause respiration volume increase (as the nitrogen mixture did), which reduced the possibility of hypocapnia. This circumstance is probably related to the fact that the subjects did not differentiate this mixture from the normal O_2 concentration, while they avoided the nitrogen mixture with the same oxygen content. Orig. art. has: 2 figures and 2 tables. [EF]

238.

AUTHOR: Chernyakov, I. N.; Maksimov, I. V.; Azhevskiy, P. Ya.

ORG: none

TITLE: Evaporation under low atmospheric pressure conditions

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 81-86

TOPIC TAGS: perspiration, altitude simulation, partial pressure suit, man

ABSTRACT: Data were obtained on the rate of perspiration evaporation of man at high altitudes, up to 35,000 m simulated in a thermally-controlled (18-37°C) pressure chamber. One group of men, dressed in silk partial pressure suits and pressure helmets, underwent the tests with minimum exertion; another group, under measured physical stress. Ascent to simulated desired altitude was at 50-70 m/sec. The amount of evaporation was determined from weighings before and after ascent. The evaporation level was determined by changes in skin temperature and heat flow measured at 5-7 points on the body. Evaporation increased with altitude: evaporation rate (g/hr) at comfortable temperature at ground level was 44; at 20,000 m with no exertion it was 100; and under physical stress it was 183.3. The rate at elevated temperature at high altitude with no exertion was 210.8, and under physical stress it was 300. These values are still well below the detrimental limit (1500 g/hr) of evaporation. At ground level, skin temperature increased 0.3-0.9 degrees during desaturation; at 20,000 m, skin temperature dropped 1.1-2.1 degrees in 5 min. The feeling of cold was especially pronounced after prolonged time (20-30 min) at the elevated temperature before ascent: skin temperature dropped, immediately after ascent, to 33-28° C even though the chamber temperature was 35-36 C. Subjects (not subjected to initial elevated temperature) remaining at 35,000 m started to feel cold gradually after 10-15 min; their skin temperature increased slightly (0.2-0.4 degrees at comfortable temperature, and 1.5-2 degrees at elevated temperature); rectal temperature remained essentially unchanged. There was no significant change in head temperature since helmet pressure of 12,000 m was maintained. Vacuum evaporation (bubbling and evaporation of perspiration due to atmospheric pressure drop down to the saturated vapor value at skin temperature) occurred from parts of the body covered by the pressurized suit. This decreased skin temperature and increased heat flow--on reaching 35,000 m the heat flow was 2-3 times that at 12,000 m; heat loss then decreased, returning to original level in 2 hr. Physical exertion increased the heat flow values. Heat flow from body surfaces not covered with pressure suits increased more rapidly, reaching a maximum at 20,000 m; heat flow from portions of the body covered by the pressurized suit continued to increase to

the 35,000 m test limit. This is attributed to thermal insulation and vapor impermeability of the suit. Cooling of body surface by vacuum evaporation may be a factor in flight since the sealed cabin frequently becomes uncomfortably warm and water losses depend mainly on body heat exchange. Orig. art. has: 2 figures. [WA-22]

239.

AUTHOR: Chochunbayev, I. (Frunze)

ORG: none

TITLE: Effect of certain oxidizers on the hypoxemic state of animals

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 406-407

TOPIC TAGS: rabbit, hypoxia, breathing, carbon monoxide toxicity, asphyxia, potassium compound

ABSTRACT: The decarboxylizing effect of potassium permanganate during acute noxious gas poisoning was studied. In a first experimental series, rabbits were placed in a special chamber and given carbon monoxide until the onset of stupor and respiratory standstill. Then, the animals were removed from the chamber and given 5 ml/kg of a 0.05% solution of potassium permanganate intravenously. The condition of all animals was normalized within 5-10 minutes. Two comatose rabbits received up to 5 ml/kg isotonic solution of sodium chloride intravenously, after which five minutes of artificial respiration failed to restore heart operation. Two other rabbits, preliminarily dosed with the test solution in the same amounts intravenously, and placed in the chamber with carbon monoxide, suffered respiratory standstill after 18-22 minutes without preliminary stupor. Arterial pressure and respiration were measured in a second series of experiments. These experiments showed a positive effect of potassium permanganate, under lethal concentrations of carbon monoxide, with the arterial pressure level quickly returning to normal and carboxyhemoglobin disappearing at the end of the experimental period. Preliminary administration of potassium permanganate solution retards somewhat the approach of death under these same concentrations of carbon monoxide. Preheated potassium permanganate solution loses its strength and is ineffective during noxious gas poisonings. In the third stage of the effect of carbon monoxide, fresh air without potassium permanganate is not beneficial.

240.

AUTHOR: Dallakyan, I. G.; Nikitina, G. M.

ORG: none

TITLE: Effect of varying rates of growth of hypoxia on vegetative functions and bioelectric brain activity of the developing organism

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost' voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 256-268

TOPIC TAGS: rabbit, hypoxia, unconditioned reflex, electroencephalography, biologic aging

ABSTRACT: Chronic experiments were conducted in 30 rabbits aged 4-90 days. Hypoxia was created in the pressure chamber, simulating ascent rates of 2 and 15 m/sec. The animals were provided with electrodes located in neopallium, archipallium and certain nonspecific subcortical formations of the thalamus, hypothalamus and the reticular formation. Changes in the EEG were compared with values of vegetative functions (breathing and cardiac activity). Brain sections of surviving animals were also subjected to histologic study. Measurements were taken every 1000 m. In animals up to 20 days of age there was a difference in the hypoxia ceiling for the two ascent rates: 13,000 m for the slower and 11,000 m for the faster rate. The older ones had about the same ceiling, somewhat under 11,000 m. In the slow ascent, respiratory rate increases were observed in all animals at 1000-3000 m; this increase was less pronounced in the young; cardiac rate was reduced at 4000-9000 m and appeared earlier in the young, inversely paralleling the respiratory rate. Such parallelism was seen in both young and old animals at 15 m/sec. Cardiac changes related to hypoxia differed for the two ascent rates; in the slow ascent rate, hypoxic reaction started with a slow, in the second with a fast heart rate. In up to 45 day old, EEG changes appeared at 2000-3000m for both rates, in the older at 4000-5000 m (15 m/sec rate). These were serial and consisted of six phases. In the young, these phases appeared at greater heights in the faster ascent. There were also differences between young and old with respect to changes and phase duration. It was concluded that adaptive reaction to hypoxia depends both on age and the hypoxic rate and involves both vegetative functions and electric brain activity, which differ in the young and old. In the latter, the first bioelectric phase consisted in high rather than low frequency vibration and a lesser duration of the final stages of depressed bioelectric activity, accompanied by severe depression of vegetative functions; there was better differentiation between cortical and subcortical structures in the EEG. All this points toward maturation of nervous regulatory mechanisms. The rate at which hypoxia appears is an important factor in the development of compensatory reactions; the faster the ascent the later the appearance of severe changes in brain activity and vegetative functions. This feature was particularly pronounced in older animals. EEG changes at 15 m/sec point toward simultaneous inclusion of many brain structures, in contrast to the slower ascent accompanied by serial bioelectric inclusion. Synchronization (second phase) points to participation of the limbic system as a vital unit in protective reactions. Orig. art. has: 6 figures and 1 table.

241.

AUTHOR: Deynega, V. G. (Chief)

ORG: Laboratory for Experimental Therapy/ Head--V.G. Deynega/, Medical Section/ Head--R.Ya. Gershtenkern/, Central Scientific Research Laboratory for Mining Rescue Work, Donetsk (Laboratoriya eksperimental'noy terapii meditsinskogo otdela Tsentral'noy nauchno-issledovatel'skoy laboratorii po gornospasatel'nomu delu)

TITLE: Some specific reactions of white rats to hypoxia during inhalation of methan--oxygen mixtures

SOURCE: Farmakologiya i toksikologiya, v. 31, no. 4, 1968, 494-497

TOPIC TAGS: hypoxia, methane, ethane, propane, butane, central nervous system

ABSTRACT: One hundred rats were investigated with mine gas of 92.6% methane, 4.2 ethane, 0.9 propane, 0.15 butane, 1.9 N and H, and 0.25% Kr composition, and also with pure laboratory methane. In some cases the O_2 content was 6% constant and in others the amount was reduced from 21 to 3-2% (dynamic hypoxic dose). Calculations of the O_2 content/m^2 body surface were carried out according to the Meya formula $S + KW^{2/3}$, with 3.13 K (R. P. Ol'nyanskaya and L. A. Isaakyan [*Metody issledovaniya gazovogo obmena cheloveka i zhivotnykh*, L, 1959, page 175]). The results were treated statistically using I. A. Oyvin's method and mathematically using V. Yu. Urbakh's method (*Biometricheskiye metody*, M, 1964, page 323). All the laboratory rats exhibited marked reduction of O_2 consumption and also an increase in lifespan. Experiments with preliminary subcutaneous injections of barbamyl (70 mg/kg) and caffeine (30 mg/kg), or caffeine and armine (0.3 mg/kg) demonstrated the absence of direct relation between the nature of O_2 consumption and life duration and the existence of various forms of adaptation to hypoxia, including development of protective inhibition in the CNS. Orig. art. has: 2 tables. [WA-22]

242.

AUTHOR: Dolezal, Vladimir (Doctor of medicine; Candidate of sciences)

ORG: Institute of Aviation Medicine, Prague (Ustav leteckeho zdravotnictvi)

TITLE: Saturation of tissues with oxygen applied at high pressure

SOURCE: Vojenske zdravotnicke listy, no. 4, 1968, 143-148

TOPIC TAGS: physiologic oxygen effect, hypoxia, therapeutics

ABSTRACT: A review and analysis of some physiological factors decisive in the therapeutical application of hyperbaric oxygen (HO) is presented. HO is used therapeutically in cases of blood loss, CO poisoning, methemoglobinemia, and other cases of hypoxia. In many cases its use depends on the ability to compensate for the lowered blood flow. It is not yet known whether factors like insufficient glucose or a concentration of metabolites may be decisive for the tissue to function within the permissible limits of exposure to HO. It is possible that the toxic influence of oxygen itself could be a barrier to the full utilization of the beneficial characteristics of hyperbaric oxygen. The most effective use of HO so far is in cases where exposure of short duration can be effective. Orig. art. has: 6 figures. [WA-22]

[KS]

243.

AUTHOR: Doroshchuk, V. P.

ORG: Institute of Physiology im. A.A. Bogomolets, AN UkrSSR, Kiev (Institut fiziologii AN UkrSSR)

TITLE: Nature of hypocapnic (hyperventilatory) apnea

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 6, 1968, 704-711

TOPIC TAGS: cat, dog, electromyography, respirator, apnea, hypocapnia, negative feedback, autonomic nervous system

ABSTRACT: The dynamics of electrical activity in respiratory muscles during apnea and its relationship to artificial respiration were studied in 86 tests on 37 animals (35 cats, 2 dogs) under nembutal anesthesia and artificial respiration leading to hyperventilation. Artificial respiration lasted 1–20 min, the apnea 5–135 sec. Potentials were recorded by EMG, and in 11 animals the arterial blood was periodically analyzed for gas content. Hypocapnia appeared in all animals towards the end of artificial respiration. Results revealed six types of electrical activity in respiratory muscles: 1) consistent purely inspiratory (15); 2) initial inactivity followed by inspiratory muscle activity; 3) simultaneous mixed activity (19); 4) constant expiratory activity changing later to inspiratory (13); 5) constant expiratory (15); and, 6) absence of activity (15). Electrical dynamics of inspiratory muscles observed in 56 cases of apnea revealed an increase in frequency of potentials strictly paralleling changes in gas pCO_2, and pO_2 in the blood; this activity is due to chemoreceptors since it stops spontaneously with return of gas composition to initial values. Stopping of constant inspiratory activity and the start of phasic activity coincided with the time at which frequency of potentials and blood CO_2 reached initial levels. This latter activity reveals action of the respiratory center due to impulses from receptors of lung dilatation and other inspiratory mechanoreceptors (Breuer's reflex). Thus, there exists a negative feedback mechanism between inspiratory chemo- and mechanoreceptors (56 cases). The same feedback mechanism was found for expiratory activity (47 cases). If the frequency of expiratory muscle potential was below the initial level at the start of apnea this activity increased, i.e. there was parallelism between muscle activity and gas content of the blood (due to transmission of impulses from chemoreceptors to bulbar expiratory neurons); the activity decreased after reaching maximal frequency. Inverse dynamics were observed when the expiratory frequency initially exceeded normal values. It was concluded that inspiratory and expiratory negative feedbacks constitute an important element of the respiratory center, participating in the negative feedback system of respiratory regulation (respiratory volume and activity of chemoreceptors). Orig. art. has: 3 figures. [WA-22] [06]

244.

AUTHOR: Dudaryev, V. P.--Dudarev, V. P.

ORG: Department of Pathology of Hypoxic and Hyperoxic States of the Institute of Physiology im. A. A. Bogomolets, AN URSR Kiev (Viddil patolohiyi hipo- i hiperoksycheskykh staniv Instituty fixiologhiyi) im. O. O. Bohomolets, AN URSR

TITLE: Changes in blood serum proteins in intact, thyreo- and adrenalectomized animals under the influence of hypoxia

SOURCE: Fiziolohichnyy zhurnal, v. 14, no. 3, 1968, 339-347

TOPIC TAGS: hypoxia, serum protein, animal experiment

ABSTRACT: A method of electrophoresis was used to study the effect of hypoxia on blood serum proteins in intact rabbits, and in intact, thyreo- and adrenalectomized rats under normal atmospheric pressure, under conditions of "being elevated" in the pressure chamber (for seven days at heights of 2000, 4000, and 6000 m) and in actual high-altitude conditions. Under conditions of prolonged exposure to hypoxia, the albumin decrease and globulin increase are more pronounced when oxygen insufficiency is greater. Total albumin concentration during "elevation" in the pressure chamber practically remains unchanged in the intact rats, decreases in rats which are adrenalectomized, and increases in the thyreoidectomized rats. During actual high-altitude conditions, hypoproteinemia is observed in all groups of animals except rabbits. In comparison with intact animals, the albumin decrease and globulin increase in adrenal- and thyreoidectomized rats is more pronounced. Changes of blood serum protein content under the conditions which have been mentioned are not of a specific pathological nature. Orig. art. has: 4 figures and 1 table. [WA-22] [AC]

245.

AUTHOR: Dudarev, V. P.; Sokolyans'kyy, I. F. -- Sokolyanskiy, I.F.

ORG: Institute of Physiology im. O. O. Bohomol ts AN UkrRSR, Kiev (Instytut fiziologiy AN URSE)

TITLE: Significance of the thyroid gland in adaptation of rats to high mountains

SOURCE: Fiziolochichnyy zhurnal, v. 14, no. 1, 1968, 64-72

TOPIC TAGS: thyroid gland, adaptation, rat, hypoxia, biologic acceleration effect

ABSTRACT: The role of the thyroid gland in adaptation of rats to hypoxia under high mountain (Elbrus) conditions was investigated. Oxygen consumption, oxygen pressure in brain tissue (polarographic determination), and erythrocyte and hemoglobin content of peripheral blood were used as criteria for the functional state of the organism in three series of experiments in which changes after thyroidectomy were observed under normal atmospheric pressure, after 30 days at 3700 m, and after up to 45 days and gradual ascent to 4200 m altitude. The erythrocyte and hemoglobin content increase in thyroidectomized rats under Elbrus conditions is hardly different from increase in intact animals, but the reduction in oxygen requirement is less pronounced than in lowland conditions. Consequently thyroidectomized rats do not lose their ability of active adaptation to hypoxia. Resistance to acceleration is increased in thyroidectomized rats and is especially pronounced after adaptation to hypoxia. Partial oxygen pressure in brain tissue is reduced to 65-73% by the effect of acceleration, 30 units for 3 min. The resistance to hypergravitational effects is increased in acclimated rats: under these conditions the differences in the relative value of the partial oxygen pressure drop in control and in the thyroidectomized animals are not too large. Orig. art. has: 3 figures and 1 table.

246.

AUTHOR: Epshteyn, N. Z.

ORG: none

TITLE: Role of some subcortical structures in the development of adaptation to hypoxia

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 143-146

TOPIC TAGS: hypoxia, neurophysiology, adaptation

ABSTRACT: In order to gain some insight into the CNS mechanisms involved in the development of adaptation to hypoxia, experiments were conducted in which rats were adapted to hypoxia at simulated altitudes of 4000—5000 m before or after destruction of various subcortical structures; the effect of this surgery upon the adaptational process was then determined on the basis of survival at 12,500 m. It was found that, prior destruction of the reticular formation in the area of the pons and the *Nucleus reticularis tegmenti* facilitated adaptation, while destruction of these same areas, as well as the ventro-medial thalamus, increased resistance to acute hypoxia in previously adapted animals. Destruction of the anterior and dorsal thalamus however, decreased resistance in previously adapted animals. Evidently, increased resistance in these experiments was due to changes in metabolic processes affecting the general reactivity of the organism, and altitude resistance specifically. Also, the altered secretion of ACTH and, consequently, of adrenal corticoids and adrenalin is very influential in this process. Decreased resistance is explained by the fact that resistance to hypoxia is governed by the hypothalamic-hypophyseal-adrenal system and destruction of the anterior thalamus disrupts this system by decreasing secretion of ACTH. [WA-22] [EL]

247.

AUTHOR: Epshteyn, M. M.; Nikonova, V. O.--Nikonova, V. A.; Spilioti, Z. I.

ORG: Department of Biochemistry, Kiev Medical Institute im. A. A. Bolgmolets (Kafedra biokhimiy: Kyyivs'koho Medychnoho instytutu)

TITLE: The effect of ascorbic acid on oxidizing phosphorylation in cerebral mitochondria under conditions of hypoxia

SOURCE: Ukrayins'kyy biokhimichnyy zhurnal, v. 40, no. 2, 1968, 131-134

TOPIC TAGS: hypoxia, phosphorylation, animal experiment, mitochondrion, ascorbic acid

ABSTRACT: The present study shows that under conditions of hypoxia the phosphorylation intensity in the cerebral mitochondria of rats decreases 32% in comparison with the norm. Oxygen consumption decreases to a lesser degree (20%); therefore, the interdependence of oxidation and phosphorylation is disturbed. A preliminary introduction of ascorbic acid in animals which have been subjected to hypoxia results in an increase of oxygen absorption and esterification of inorganic phosphorus. However, the introduction of ascorbic acid does not equalize the ratio between respiration and phosphorylation which has been disturbed by hypoxia (P/O under conditions of hypoxia is 1.24 ± 0.5; under conditions of hypoxia with a preliminary introduction of ascorbic acid it is 1.17 ± 0.05). Orig. art. has: 2 tables.
[WA-22] [AC]

248.

AUTHOR: Gazenko, O. G. (Corresponding Member AN SSSR); Demin, N. N.; Malkin, V. B: Pevzner, L. Z.

ORG: none

TITLE: Adaptive changes in the cerebellum and in spinal motor structures under varying hypoxic conditions

SOURCE: AN SSSR. Doklady, v.179, no. 4, 1968, 997-1000

TOPIC TAGS: rat, hypoxia, central nervous system, nucleic acid, cytoplasm, RNA

ABSTRACT: Tests were conducted in rats placed in a pressure chamber simulating conditions of a rapid ascent to 8700 m, a daily gradual ascent to 3000-7000 m or prolonged (21 days) exposure to 5500 m. Nucleic acids were determined in the nerve cytoplasm, the body of satellite glial cells in various parts of the central nervous system and in spinal motor structures, by measuring optic density by UV cytospectrophotometry. In the first test series, a 2-hour stay at 8700 m was accompanied by significantly increased concentration of cytoplasmatic RNA in Purkinje's cells and even higher concentrations in motor neurons of the anterior spinal crescents. Nucleic acids also increased somewhat in the neuroglia around Purkinje's cells (increases were assumed to consist mainly of RNA). In the second, adaptive series, nucleic acid contents underwent the same changes as in the first, except that spinal motor neurons were unaffected. Results differed for the third series after a 3 weeks stay under hypoxia in that cerebellar cells were unaffected while motor neurons showed an increase somewhat below that seen in acute hypoxia. It was assumed that results of the third series point to satisfactory adaptation; those of the second series reveal a constant activation of cellular, mainly protein-synthesizing mechanisms. Increased hematopoiesis (in the 2nd and 3rd series) provides for increased oxygen transport to the tissues. It was concluded that increased RNA synthesis in the nerve cells is due to a specific protective metabolic reflex mechanism. Orig. art. has: 2 figures and 1 table.

249.

AUTHOR: Generalov, V. I.

ORG: Department of Pharmacology /Director--Prof. S. Ya. Arbuzov/ Medical Academy im. S. M. Kirov, Leningrad (Kafedra farmakologii Voenno-meditsinskoy akademii

TITLE: Influence of cystamine and some of its derivatives on animals under conditions of acute hypoxia and acceleration

TOPIC TAGS: mouse, rat, hypoxia, acceleration protection, antiradiation drug, oxygen consumption, altitude simulation

ABSTRACT: Cystamine, tetramethylcystamine and difurfurylcystamine were tested on white mice and rats for resistance to hypoxia and radial acceleration and also for their influence on oxygen consumption and oxygen pressure in the brain. The compounds were introduced by intraperitoneal injection in doses 150 mg/kg for mice and 50-100 mg/kg for rats and the animals were subjected to rarefied atmosphere in a barochamber. Use of the compounds increased resistance of the animals to oxygen starvation in a rarefied atmosphere. Larger doses of difurfurylcystamine, however, stimulated the animals and hastened their death. Radial acceleration was accomplished by revolving the animals in a centrifuge for 60 sec at 650 rpm. Use of the compounds increased the survival of the animals under these conditions. The influence of the compounds on oxygen consumption was determined by placing fasting rats in an hermetically sealed container and adding measured amounts of oxygen for 10 min. Cystamine and tetramethylcystamine 100 mg/kg or difurfurylcystamine 50 mg/kg were injected and the experiment was repeated for 15, 60 and 120 min. Under these conditions consumption of oxygen by the animals was decreased significantly. Oxygen pressure in the brain was determined by polarographic methods using platinum and silver chloride electrodes. The oxygen level was reduced by use of cystamine and tetramethylcystamine, and to a lesser degree with difurfurylcystamine. These positive reactions occurred only in the barochamber and not under the conditons of a closed container. Orig. art. has: 3 tables and 2 figures.

250.

AUTHOR: Gershenovich, Z. S.; Gabibov, M. M.

ORG: Rostov-on-the-Don State University (Rostovskiy-na-Donu gosudarstvennyy universitet)

TITLE: Some features of nitrogen metabolism in rat brain at various periods following the effect of increased oxygen pressure

SOURCE: AN SSSR. Doklady, v. 178, no. 6, 1968, 1430-1431

TOPIC TAGS: rat, brain tissue, nitrogen metabolism, amino acid, oxygen toxicity, nitrogen

ABSTRACT: The pattern of some links in nitrogen metabolism following oxygen poisoning was studied in rat brain. The criteria under study were changes in NH_3, glutamine, glutamic, aspartic and gamma-aminobutyric acid content determined in a trichloracetic extract of the brain from rats exposed to 6 atm pure oxygen until the first convulsion appeared (after 12-34 min); the rats were then removed from the pressure chamber and submerged in liquid nitrogen at once, 3 hours or 1-60 days after exposure. A single exposure to hyperoxia caused severe long lasting changes which depressed coordinative processes of NH_3 bonding and liberation. This depression, considered a protective reaction, lasted 55-60 days. Nitrogen from NH_3 (normal 0.31) was increased to 0.93 on the 2nd day after exposure; the respective values for N-from N_2 were 6.12 against 4.09, for glutamic acid 8.64 against 14.93, for aspartic acid 3.49 against 4.81, and for gamma aminobutyric acid 1.92 against 2.35. Repeated exposure may cause adaptation or cumulation of pathologic disturbances, depending on pressure (3 or 6 atm). It was concluded that repeated, particularly frequent exposure to high O_2 pressure represents a danger for man or animal since it increases metabolic disturbances and those of the central nervous system, and renders the organism more sensitive to unfavorable environmental factors. The paper was presented by Academician A. I. Oparin. Orig. art. has: 1 table.

251.

AUTHOR: Golubeva, Ye. L.; Khayutin, S. N.

ORG: Laboratory of Human Embryogenesis, All-Union Scientific Research Institute of Midwifery and Gynecology, Ministry of Health SSSR, Moscow (Laboratoriya embryogeneza cheloveka Bsesoyuznogo nauchno-issledovatel'skogo instituta akusherstva i ginekologii Ministerstva zdravookhraneniya SSSR)

TITLE: Interrelationship between cortical and subcortical structures in reaction to hypoxia

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 8, 1968, 884-892

TOPIC TAGS: rodent, hypoxia, EEG, central nervous system, autonomic nervous system

ABSTRACT: Studies were conducted to determine the composition of CNS structures participating in hypoxic reaction, the succession of their inclusion and the signs specific for the reaction under study. Twenty rabbits under urethane anesthesia, provided with electrodes for the various structures, served as the experimental material. The animals were tracheotomized and exposed to air or to a mixture of 5, 7.5 or 10% oxygen and the rest nitrogen with a normal carbon dioxide content. The experiments lasted 1--5 min with intervals of 10--20 min. In another test series, an attempt was made to differentiate the hypoxic reaction from that to pain. The mixture with 5% oxygen resulted in polymorphous, high amplitude, slow waves, particularly in the cortex (δ waves) and a lengthened latent period; these signs may be interpreted as incipient depression of cortical activity due to O_2 deficit. The mixture with 7.5% oxygen caused an active EEG reaction after a latent period of 30-120 sec, reflected in desynchronization in the sensorimotor cortical region and slow rhythms (4-7/sec) in the other structures under study, starting in the midbrain reticular formation and the hippocampus, spreading to thalamic and hypothalamic structures and then to the brain cortex. Timing varied from a few milliseconds to 3 sec. These variations were determined by the functional state of the animal and depth of the anesthesia. This would point to dominant participation of reticular and hippocampal structures in this reaction. Return to normal also proceeded in definite succession, first in the cortex, then in subcortical structures. In tests with aminasine, to distinguish this reaction from that to pain, aminasine at doses of 5--8 mg/kg fully blocked

EEG signs of pain reaction but had no effect on the hypoxic EEG reaction. It was concluded that: 1) short-term inhalation of a hypoxic mixture containing 7.5% oxygen and 92.5% nitrogen causes a sharp activation reaction consisting in a slow, regular rhythm of 4-7/sec in the reticular formation, hippocampus, hypothalamus, nonspecific thalamic nuclei and the parieto-occipital cortical regions, and desynchronization of electric activity in the sensorimotor cortical region; 2) midbrain reticular formation and hippocampus are first to react; 3) this hypoxic reaction is retained under aminasine at 5--8 mg/kg which fully blocks pain reaction, and 4) at 10--12 mg/kg aminasine also blocks the hypoxic reaction. Orig. art. has: 5 figures. [WA-22]

252.

AUTHOR: Gribanov, G. A.

ORG: Department of Biochemistry /headed by Doctor of Medical Sciences Ye. N. Morozova/, Kalinin Medical Institute (Kafedra biokhimii Kalininskogo meditsinskogo instituta)

TITLE: Change of content and of the rate of phospholipid metabolism of rat endocrine glands in experimental hypoxic hypoxia

SOURCE: Patologicheskaya fiziologiya i eksperimental'naya terapiya, v. 12, no. 2, 1968, 32-34

TOPIC TAGS: lipid metabolism, hypoxia, adrenal gland, animal experiment

ABSTRACT: The author studied the effect of acute (185±5 mm Hg for 1 h) and of chronic (250±10 mm Hg for 3--4 weeks, 8--10 h daily) hypoxic hypoxia on the content and the rate of phospholipid metabolism of rat thyroid, adreanl glands, and testicles. Acute hypoxia led to an increased content of phospholipids in the thyroid and adrenal glands. Phospholipid content proved to fall in the testicles. No significant changes in the rate of P^{32} incorporation into the phospholipids of the glands were revealed in acute hypoxia. In chronic hypoxia the phospholipid content in the adrenal glands remained unchanged, decreased in the testicles, and increased in the thyroid glands. The rate of phosphatide metabolism in the thyroids remained unchanged, increased in the testicles, and exhibited a marked fall in the adrenal glands. Orig. art. has: 1 table [Author's abstract] [NT]

253.

AUTHOR: Grinshteyn, B. Ya. (Frunze)

ORG: none

TITLE: Venous pressure and circulatory rate during adaptation to the high Pamir mountains

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 118-119

TOPIC TAGS: adaptation, cardiovascular system, hypoxia, atmospheric pressure, man, blood circulation

ABSTRACT: Tests were conducted in residents of settlements 1020, 2500 and 3600 m above sea level, a total of over 500 individuals divided into 4 groups according to length of their stay at the particular height (over 5 years to less than 6 months). The tests measured venous pressure, circulatory rate, pulse, arterial pressure, EKG and general blood chemistry. A short stay was found to cause decreased venous pressure and increased circulatory rate. Long term residents in the two lower settlements had venous pressure values near the upper normal limit, those in the higher settlement showed above normal pressures. The circulatory rate in the higher places was considerably below that at 1020 m. These findings reveal a sharp divergence in values for venous pressure and circulatory rates between short term and long term residents; e.g., venous pressure tended to rise during long stay but decreased in recent arrivals; the circulatory rate decreased in the former and increased in the latter. The authors are inclined to explain these findings by assuming hypertension of the lesser circulation in long term residents, due to alveolar hypoxia. The decreased venous pressure in newcomers is apparently caused by a decrease in venous tonus, due to the multiple effect of high mountain conditions and particularly that of hypoxia.

254.

AUTHOR: Ikramov, E. K. (Doctor of medical sciences, Professor)

ORG: Dushanbe Pedagogical Institute im. T. G. Shevchenko (Dushanbinskiy pedagogicheskiy institut)

TITLE: Tolerance to exertion hypoxia in Pamir natives

SOURCE: Vsesoyuznyy simpozium po voprosam meditsinskoy klimatologii, klimatoterapii i klimatoprofilaktiki. Sukhumi, 1967. Materíaly. Moscow, 1967, 69-70

TOPIC TAGS: atmospheric pressure, adaptation, hypoxia, endurance test

ABSTRACT: Tolerance to hypoxia during physical effort was tested on twenty 14—51-yr-old males native to a Pamir settlement 2080 m above sea level. Fifte n of them were athletes. The experiment lasted for 60—90 sec and included 5 intense physical efforts performed with closed eyes and arrested breath. The beginning of the experiment tested the functional potential of the subject depending on the external influence on the visual organs, and on the reactive condition of the cortical-subcortical mechanisms during coordinated muscular effort. Further phases of the experiment were intended to test the tolerance to hypoxia resulting from cortical respiratory retardation combined with coordinated muscular exertion in a standing position. Two of the seven adult athletes gave an excellent performance (998 and 1432 kg), while others failed in breath holding during inspiration or expiration. From eight young sportsmen, four showed good tolerance to exertion hypoxia (503—857 kg) and the others failed in breath holding. From five men not trained in sports or physical exercise, two passed the test successfully, and three failed during the final phase. These observations indicate that climatic conditions at moderate altitudes of Pamir are favorable to the vital activities of the organism, and that optimum training in sports develops tolerance to exertion hypoxia. [WA-22] [EF]

255.

AUTHORS: Jendyk, Michal (Lieutenant colonel; Doctor of medicine); Klimek, Henryk (Lieutenant colonel; Doctor of medicine)

ORG: Military Institute of Aerial Medicine (Wojskowy Instytut Medycyny Lotniczej)

TITLE: Effect of oxygen respiration upon the bacterial flora of nasal and oral cavities with special emphasis upon the alveoli

SOURCE: Lekarz wojskowy, no. 3, 1968, 175-181

TOPIC TAGS: dentistry, health, bacteriology, bacterial growth, biologic respiration, air force pilot

ABSTRACT: Results of bacterial studies of the cultures collected from nasal, oral, and dental cavities of 76 pilots (age 22 to 35) subjected to low and high oxygen pressures are described. It was established from a study of 608 cultures and 304 antibiograms that breathing oxygen for 30 minutes under normal as well as under higher pressures (up to 148 mm Hg) inhibits the growth of bacterial flora of nasal and oral mucous membranes. The strains grown in such cultures were more susceptible to the action of antibiotics and more sensitive to discoloration when using Gram's stain. It is suggested that frequent oxygen respiration by pilots may have a beneficial effect upon the condition of the mucous membranes of their nasal and oral cavities. Orig. art. has: 3 tables and 6 figures. [WA-22]

256.

AUTHOR: Kalinichenko, I. R.; Nikulina, G. A.

ORG: none

TITLE: Variation pulsograms and indices of the external respiration function during exposure of man to acute hypoxia

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 87-90

TOPIC TAGS: man, biologic respiration, health, heart, electrocardiography, hypoxia

ABSTRACT: Examination of the variation pulsogram was used as a simple method of evaluating the condition of man exposed to acute hypoxia. The method consists of constructing curves of the distribution of R-R intervals of the EKG. Variation pulsograms were constructed from recordings including 100—120 cardiac contractions of six men, ages 24—40 yr, before, during, and after enclosure for 2 hr at a 5000-m altitude without additional oxygen supply. Two series of studies were made--before and after 36-hr exposure to a changed work and rest cycle (alternating 4-hr periods of work,sleep, and rest). Indices of external respiration and of pulmonary gas exchange (respiration frequency and volume, oxygen requirement, carbon dioxide exhalation, and energy consumption), as well as leukocyte and eosinophil count, and blood sugar level, were determined. In the first series, before changed in the work-rest cycle, exposure to hypoxia was characterized by

increased respiratory volume in five of the six men, the oxygen requirement was within permissible limits in four of the men (18 and 39% excess in the other two), and carbon dioxide exhalation and energy consumption changed in the same direction as oxygen requirement; the variation pulsograms (1 hr after exposure to hypoxia) were characterized by a shift to the left and some contraction; after descent the pulsograms returned to their initial levels. The leukocyte count in peripheral blood after the test showed stressor reactions. The pulsograms showed inadequate reaction in the one subject with extremely pronounced increase in gas exchange; after exposure to hypoxia in the second series of tests this subject had a leukocytic reaction to hypoxia, and the shift to the left in his variation pulsogram was extreme, indicating reduction in the stability of his physiological regulatory mechanisms, and acting as a criterion indicating need to terminate the test. In the other five subjects the rearrangement of the work-rest cycle under hypoxic conditions caused still more pronounced changes in all the indices and shifts in the variation pulsograms. Thus variation pulsograms can be used to evaluate the health state of man exposed to acute hypoxia: sharp reduction in the pulsogram (to 0.05 sec) and its shift to the extreme left indicate inadequate organic reaction to hypoxia. Orig. art. has: 2 figures and 1 table. [06]

257.

AUTHOR: Kaplanskiy, A. S.; Durnova, G. N.; Kopylova, G. M.

ORG: Institute of Medico-Biological Problems, Ministry of Public Health SSSR, Moscow (Institut mediko-biologicheskikh problem Ministerstva zdravookhraneniya SSSR)

TITLE: Immunohistochemical study of antitoxic immunity in mice during hypoxia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 66, no.7 1968, 90-92

TOPIC TAGS: hypoxia, immunity

ABSTRACT: A study was made of the development of antitoxic immunity in mice immunized with tetanus antitoxin and kept in a barochamber (P = 378 mm Hg) for 30 days. Antitoxin level in the blood and the animals' resistance to tetanus toxin remained at normal levels, despite hypoplasia of the lymph nodes and decreased plasmacyte content in them. It is suggested that the normal antibody level in the blood is maintained despite decrease in the number of antibody-producing cells as a result of increased antibody synthesis in individual cells. Orig. art. has: 2 tables. [WA-22] [EL]

258.

AUTHOR: Kaplanskiy, A. S.; Durnova, G. N.; Roshchina, N. A.

ORG: none

TITLE: Effect of hypoxia on the status of protective mechanisms in mice

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 129-137

TOPIC TAGS: hypoxia, immunity, experiment animal, simulated space flight

ABSTRACT: The article reports results of studies on cellular and humoral immunity and features of immunomorphological reactions in the lymphoid organs and subcutaneous cellular tissue at the site of antigen injection in BAL B/C strain mice subjected to decreased atmospheric pressure. Mice in group 1 were maintained continuously for 2 weeks in the altitude chamber with atmospheric pressure equal to 596 mm Hg. Mice in group 2 were maintained for 6 hr/day for 10 days in the chamber with an initial pressure of 462 mm Hg; this was decreased every 2 days until the final pressure was 330 mm Hg. Control animals were maintained at normal atmospheric pressure. Forty animals from each group were then administered typhoid vaccine containing 400 million microbial bodies. Antibody production was determined with the passive hemagglutination reaction 3 hr, and 1, 3, 4, 5, 7, 10, and 14 days after immunization. Antibody production in group 1 animals remained normal. There were no qualitative or quantitative changes in immunomorphological reactions developing in the subcutaneous cellular tissue at the site of antigen injection and in the regional lymph nodes. An increase of short duration in the absorptive capacity of cells of the reticuloendothelial system was noted, as well as a moderate increase in neutrophils, probably due to stimulation of the physiological system of the connective tissue, resulting from moderate hypoxia. Antibody production in group 2 animals was decreased, probably due to decrease in the number of unripe elements of the lymphocytes in reactive centers of lymphoid follicles of regional lymph nodes. There was no change in plasmocyte hyperplasia in regional lymph nodes of group 2 animals. The data suggest that in the absence of O_2 sufficiency in inspired air, production of cells of the lymphocyte group is inhibited, while there is no inhibition in production and development of cells of the plasmocyte group. In contrast to group 1 animals, no increase in absorptive capacity by cells of the reticuloendothelial cells in group 2 mice was noted. No changes associated with immunization were noted in the spleens of animals of either group. Orig. art. has: 2 tables and 2 figures. [XF]

259.

AUTHOR: Kazakov, P. M.

ORG: Department of Labor Physiology, Donetsk Institute of Labor Hygiene and Professional Diseases (Viddil fiziolohiyi pratsi Donets'koho instytutu hihieny pratsi ta profesiynykh zakhvoryuvan')

TITLE: The human expiratory center

SOURCE: Fiziolochichnyy zhurnal, v. 14, no. 4, 1968, 480-486

TOPIC TAGS: man, respiratory system, epilepsy, nervous system disease

ABSTRACT: Evidence of the existence of a human expiratory center is presented, based on simultaneous multipneumographic examinations of respiratory movement characteristics in healthy children and adults suffering from schizophrenia, epilepsy, and other nervous system disturbances. Regularities of the interrelationship of the expiratory center with the cerebral cortex and an inspiratory part of the respiratory center are noted. It is deduced that there is a greater dependence of the expiratory part (in comparison with the inspiratory part) of the human respiratory center on the functional state of the cortex of the cerebral hemisphere. This conclusion is confirmed by results of studies of respiratory characteristics in schizophrenics during hallucinations and during other pathological episodes: irregular breathing with prolonged stoppage in exhalation was observed in all cases. Facts showing that in the comatose condition after spasmodic attack breathing is resumed by active exhalation indicate the existence of the expiratory part in the human respiratory center. This position is also substantiated by observations of contraction of the limb muscles during the time of the comatose condition. Contractions of the lower limb muscles synchronous with the inhalation and exhalation phases were recorded during the coma period. The human expiratory center is less resistant than the inspiratory center to the action of unusual stimuli and unfavorable factors such as strong electric current stimulation, oxygen starvation of the brain, pressure increase in the brain ventricle, or brain injury. In such cases there is therefore a disturbance in the reciprocal interaction between the expiratory and inspiratory parts of the respiratory center, and prolonged inspiration of the apneusis type occurs. The greater excitability of the inspiratory center in comparison to the expiratory center is apparently caused by the greater mass of inspiratory muscles, which determines the greater flow of nerve impulses to the inspiratory part of the respiratory center. Orig. art. has: 3 figures. [WA-22]

260.

AUTHOR: Khasanova, K. A. (Dushanbe)

ORG: none

TITLE: Morphological changes in peripheral blood at middle altitudes

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 396-397

TOPIC TAGS: barometric pressure, peripheral circulation, erythrocyte, leukocyte, hemoglobin

ABSTRACT: Five hundred native inhabitants of the city of Garm (2000 m altitude) in Tadzhikistan representing five different groups of people were investigated. Ninety six persons were from the Garm collective farm, 139 persons were from the Kalanak collective farm, 99 persons were from the state stock farm, 41 persons were from a boarding school, and 125 persons were from the center of Garm. Erythrocytes and their diameters and leukocytes were determined. The erythrocyte count in the blood of subjects of the Garm and Kalanak collective farms ranged from 3,000,000 to 6,500,000, with an average of 4,340,000 per cubic millimeter of blood; for subjects of the state stock farm and the boarding school the count was 3,000,000 to 6,000,000 with an average of 4,500,000; for subjects of the center of Garm the count was 3,000,000 to 7,000,000 with an average of 5,150,000. The hemoglobin content in the blood of subjects of the Garm and Kalanak collective farms ranged from 60 to 90 units, with an average of 75 units according to Sal'; for subjects of the state stock farm and the boarding school it was 60 to 94, with an average of 75; and, for the subjects at the center of Garm it was from 65 to 94, with an average of 80. The color index of subjects of the Garm and Kalanak collective farms ranged from 0.60 to 0.90, with an average of 0.84; for the state stock farm and the boarding school subjects from 0.70 to 0.90, with an average of 0.88; and for the center of Garm subjects from 0.60 to 0.96, with an average of 0.84. In the 125 subjects from the center of Garm, a certain tendency was noted toward a reduction of hemoglobin content, with a normal or even somewhat increased erythrocyte count. Erythrocytometric curves plotted for all subjects indicated a clear decrease in the diameter of the erythrocytes (microcythemia) with a mean diameter of 5 to 6 microns. The leukocyte count in the blood of subjects of the Garm and Kalanak collective farms and of the state stock farm was equal to 6400 on the average, for the boarding school it was 7500, and for the center of Garm 6700, i.e. the leukocyte count in all subjects fluctuated within normal limits. However, individual leukocyte counts ranged from 3000 to 9000. Less than 5000 leukocytes were observed in 105 subjects and relative lymphocytosis was observed in 100 subjects. Tendencies to relative erythrocytosis, microcythemia, leukopenia, relative neutropenia, and lymphocytosis were often noted in native inhabitants of middle altitudes.

261.

AUTHOR: Kompanets, V. S. (Major, Medical service)

ORG: none

TITLE: Effect of frequent divergent changes in barometric pressure on humans

SOURCE: Voyenno-meditsinskiy zhurnal, no. 6, 1968, 61-63

TOPIC TAGS: man, atmospheric pressure, aeromedicine, vestibular analyzer, vestibular function, aptitude testing, flight physiology, environment test chamber

ABSTRACT: Tests were conducted on flight personnel in a pressure chamber to determine their fitness under the effect of repeated barometric changes. The men were divided into two groups (25 and 20 men) about equivalent in length of service and age; the first was tested for marksmanship on a non-mobile target, and the second for auditory sensitivity to radio signals. Both groups were first acquainted with the experiment, and pre-experimental values were determined for criteria. Control tests on the ground followed after 60 min at 1000 m (5 shots and 2 radiograms of 80 scrambled signs). The real test was conducted on the 4th day with the chamber adjusted to a 1000-m height at a rate of 10-16 m/sec and a stay at this altitude for 60 min while the pressure changed 6 times. Each of 6 cycles consisted of 160 irregular pressure changes, gradually rising from 1000 ± 5 m to 1000 ± 50 m at a rate of ± 5 to ± 50 m/sec and a pressure of 674.1 ± 0.4 to 674.1 ± 4 mm Hg. Results of tests for marksmanship showed a decrease in target hits from 988 to 802. In the second group, consisting of radio operators, errors increased considerably, e.g. substitutions from 2 under ground conditions to 31, omissions from 0 to 15. Functional changes consisted in disturbed statokinetic stability, somnolence, change in pulse rate, and headaches; 13 of the first and 6 of the second group were so affected. Three of the radio operators did not make a single mistake throughout the test. These had performed this kind of work for 14 yr and flown over 4000 hr It was concluded that prolonged, repeated, opposite changes in barometric pressure may affect the fitness of flight personnel. In pre- and postflight medical examination, the physician should look for autonomic vestibular disturbances in individuals admitted for flight service with signs of vestibular instability and in those who perform unsatisfactorily. [WA-22]

262.

AUTHOR: Korobkov, A. V.; Zharov, S. G.; Korobova, A. A.; Ioffe, L. A.

ORG: none

TITLE: Maintenance of human organic stability by means of physical exercise in complex experimental conditions

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 1, 1968, 32-37

TOPIC TAGS: altitude chamber, hyperoxia, hypodynamia, human physiology, physical exercise

ABSTRACT: The effect of a long-term exposure to a pure oxygen atmosphere was studied. Four series of experiments were conducted using two test subjects in each. The first series presented a 16-day exposure to 8000 m altitude, the second and third - 30 days to 10,000 m, and the fourth - 30 days to 7000 m. In order to avoid possible effects of hypokinesia and to determine the effect of physical exercise in a pure oxygen atmosphere, three times a day the subjects of the last three series performed sets of physical exercises (15, 20, and 15 min) specially composed by F. M. Gorskiy, Yu. A. Sandalov, and V. K. Khukhlayev. In addition, every day they participated in the medicobiologic research program and followed an exact schedule of sleep and wakefulness. The experiments were conducted in a 7 m^3 pressure chamber. The atmospheric conditions were: for 10000 m altitude P = 198.1 mm, p O_2 = 174—176 mm and p CO_2 = 2—4 mm; for 8000 m altitude P = 268.8 mm, p O_2 = 240 mm and p CO_2 = 2—4 mm; for 7000 m altitude P = 307.8 mm, p O_2 = 274 mm and p CO_2 = 2—4 mm. In all experiments the air temperature was 18—22° C, the humidity 40—70%, and the rate of air flow was 0.2 m/sec. The functional condition of the cardiovascular and respiratory systems, endocrine organs, motor function, and biochemical processes were systematically studied. I. P. Ratov's method for vector-operational dynamography was used to test muscular control in the upper extremities. Control achieved by shifting the center of gravity was tested by stabilography. The electrical activity of the flexor digitorum sublimis, extensor digitorum communis, musculus biceps brachii, and musculus triceps brachii were recorded simultaneously. The results of the vector-operational dynamography improved in 7 cases out of 8 after the experiment. The test for shifting of the center of gravity proved that the number of errors made by the subjects of the first group increased considerably after the experiment. The subjects in the other groups who performed the exercises made many fewer errors. Electromyogram potentials showed amplitudes of 65—248 microvolts before the experiment and 22—125 microvolts afterwards.

The dynamics of these amplitudes apparently depends on the change in metabolic processes in the peripheral sections of the neuromuscular system, due to the altered gaseous medium. It also can be attributed to lowered motor activity. The study of the cardiovascular system showed a slight impairment in its function, but 3 or 4 days after the experiment the initial values were attained. The hemodynamic changes could be caused by hypodynamia rather than by the oxygen atmosphere; the emotional stress should also be considered. During the performance of physical exercises the pulse rate reached 100—115. Desaturation (following a special scheme) was performed before the physical exercises, in order to prevent possible complications caused by the toxic effect of O_2 reinforced by the effect of exercises. The physical exercises were intended to preserve the working capacity, the high level of the motor and sympathetic functions, and the control of the acid-base balance and CO_2 and O_2 content in the blood. During the exercises, regular, interrupted, and special "Volna-type" (A. V. Korobkov) breathing methods were used. The results of the experiments proved that a long-term exposure to a pure oxygen atmosphere (hyperoxia at 7000 and 8000 m, and normoxy at 10,000 m) lowered barometric pressure, reduced motor activity, and isolation does not produce any important changes in the respiratory system. Present experiments, as well as the flights of American astronauts, prove that the experimental conditions did not provoke any significant deviations and that working activity is possible in these conditions. Orig. art. has: 3 tables. [EF]

263.

AUTHOR: Kotovskaya, A. R.; Vasil'yev, P. V.; Vartbaronov, R. A.; Simpura, S. F.

ORG: none

TITLE: Adaptation to hypoxia as a method of increasing the resistance of man to the effect of transverse acceleration

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 288-293

TOPIC TAGS: hypoxia, acceleration stress, acceleration effect, biologic acceleration effect, adaptation

ABSTRACT: The purpose of this work was to study the effect of high altitude adaptive acclimatization on the level of resistance to transverse accelerations, while at the same time studying the characteristics of nonspecific adaptation. The investigation was conducted on 15 subjects, 7 of whom were mountaineers (for more than 10 yr). All the subjects were exposed to conditions of high altitudes ranging from 2—3 to 4—7 km in the El'brus region, and in the mountains of Tyan'Shan (2 mountaineers). The period of exposure ranged from 35 to 41 days for the mountaineers, and from 33 to 35 days for the persons not previously exposed to these conditions. The endurance threshold to transverse acceleration was determined during rotation in a centrifuge with an arm radius of 7.5 meters. The rate of increase of acceleration was 0.1 units/sec for up to 4 units and 0.2 units/sec above 4 units; the back of the chair was at an angle of 65° to the vector of acceleration. The criterion for the endurance limits was most frequently the appearance of visual disorders in the form of "black" or "gray shroud," and less frequently a disturbance of hemodynamic or respiratiory indices. The determination of acceleration resistance was conducted on each subject 1—2 weeks prior to acclimitization and 10-15 days and 1.5-3 months following exposure to high altitude. The following mehods were utilized in evaluating the physiological reactions arising during the effect of acceleration:

-- registration of tne EKG, arterial pressure in the vessels of tne shoulder and ear, registration of respiratory frequency and volume;
-- determination of the time required for a motor response to a light signal;
-- investigation of visual acuity.

Following exposure to high altitude conditions for a period of 33-40 days an increase was noted in resistance to acceleration both in the mountaineers and in the previously unadapted group (table).

DATA ON MAXIMUM ENDURABLE ACCELERATIONS PRIOR TO AND FOLLOWING ACCLIMATIZATION AT HIGH ALTITUDES

Groups studied	number of instances	Average levels of endurance of acceleration, units			P
		prior to acclimatization	after acclimatization	difference	
mountaineers,..	7	10,3±1,4	12,0±1,1	+1,7±0,6	0,001
previously unadapted persons	8	9,6±0,7	11,2±1,3	+1,6±1,4	0,05
	6	9,4±0,6*	11,6±1,0*	+2,2±1,0	0,01

More distinct tachycardia at equal acceleration rates was noted following high altitude acclimatization. The average difference in pulse-rate frequency for all subjects was +12±12 beats/min ($P<0.05$). Oxygen consumption was considerably less than during preliminary tests, which demonstrates increased reserve capabilities of the organism following adaptation to hypoxia. The respiratory coefficient, following the tests, was maintained at a higher level than in the control group. On the basis of the data presented it is possible to assume that short-term exposure to high altitude conditions is sufficiently effective and a reliable method of increasing man's resistance to acceleration. Intensification of activities of the cardiovascular and respiratory systems and the reaction to acceleration should be considered as adaptive reactions of the organism in relation to increased utilization of oxygen in the tissues. Orig. art. has: 2 figures and 1 table. [LS]

264.

AUTHOR: Krylov, Yu. V.

ORG: none

TITLE: Functional state of the human auditory analyzer during prolonged stay in an artificial atmosphere

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 327-331

TOPIC TAGS: man, helium, oxygen, artificial atmosphere, organ sensitivity, space flight simulation

ABSTRACT: The function of the auditory analyzer was studied in three series of tests on humans secluded for 25-30 days in an artificial atmosphere. Functional tests determined hearing thresholds for frequencies of 125-8000 cps and the time for reverse adaptation to a 1000 cps frequency after a 3 minute white noise of 90 decibels. In the first test series under 380 mm Hg and normal 0_2 concentration (150-160 mm Hg), auditory dynamics was rather inconstant; thresholds increased during the first half of the experiment. Reverse adaptation took 45-70 to 110-150 sec. This test was unreliable. There was no change between pre- and post-experimental hearing threshold. In the second series conducted in an atmosphere containing 1-2% CO_2, the tendency to higher thresholds in the first 1-6 days appeared highly significant. There were no aftereffects in hearing. In the third series conducted under helium-oxygen, maximal threshold increase appeared upon transition from the usual to the He-0_2 medium. Reverse adaptation took 40-180 sec. The analyzer was unaffected by the test. It was concluded that raised hearing thresholds in the beginning of these tests are a sign of adaptation, since they appeared under any of the three atmospheric conditions and were followed by return of normal hearing, and that humans have an auditory analyzer highly adaptive to prolonged stay in an artificial atmosphere. Orig. art. has: 1 figure.

265.

AUTHOR· Kuznetsov, V. S.

ORG: none

TITLE: Some features of speech function under change of the respiratory medium

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 232-237

TOPIC TAGS: man, helium, oxygen, wave propagation, vibration spectrum, speech recognition, speech transmission

ABSTRACT: Long-term tests were conducted in two individuals breathing a helium-oxygen mixture (75% helium, 2-4% nitrogen and 21% oxygen) for 10-25 days. The individuals were subjected to these tests every other day and served as controls prior to and after the test. Evaluation involved: 1) spectral analysis of Russian vowels and short words; 2) quality of speech articulation; and, 3) dynamics of amplitudinal speech characteristics. Instrumentation comprised an electromagnetic microphone (MD-55), a differential noise-resistant microphone (DEMSH-1A) and a laryngophone (LA-5). A total of 95 tables of 25 words were subjected to analysis (61 under He-0_2 and the rest under air). The vowels pronounced under the gas mixture showed increased formant frequencies (by an average 0.7 octave) and a decreased rate of high frequency components, due both to the sound propagation in this gas

Intelligibility of speech (in %) according to articulation measurements

Microphones	air medium, test days		helium-oxygen medium, test days					
	1st	2nd	3rd	5th	9th	18th	24th	29th
MD-55	100	100	100	100	95	95	100	100
DEMSH-1A	95	100	100	100	100	100	100	100
LA-5	85	85	70	70	90	80	55	80
MD-55, whisper	95	95	50	50				
DEMSH-1A, whisper	95	100	60	60				
MD-55, noise addition in the telephone	100	100	95	95	95	90		

mixture which differs from air and the functioning of the articulating apparatus, in particular its multiresonance filters (= function T). Amplitudinal levels of speech showed some initial decrease, by about 5 decibels, but this was compensated on the second day. Intelligibility of speech is shown in the table. While the values found were high, these should be lower under the less favorable conditions of space flight, due to the presence of noise, unless means are found to correct this drawback. Orig. art. has: 1 figure and 1 table.

266.

AUTHOR: Leszczynski, Bronislaw (Doctor of medicine)

ORG: Second Clinic Internal Diseases, WAM, Lodz, Poland (II Klinika Chorob Wewnetrznych)

TITLE: Acclimatization in the light of meteorological considerations

SOURCE: Lekarz wojskowy, no. 2, 1968, 104-107

TOPIC TAGS: temperature adaptation, psychologic adaptation, atmospheric humidity, atmospheric pressure, hypoxia, neurophysiology

ABSTRACT: Among the atmospheric factors generally considered to be important in determining the nature of the human environment, the most important are the temperature, relative humidity, barometric pressure and wind velocity. Each of these has a range of optimal values for living organisms. In a brief review of the literature, it is pointed out that the temperature and humidity are interdependent, so that a person is equally comfortable at 27C and 20% relative humidity or 16C and 80% relative humidity, but may require 3 months to adapt to a temperature of 30—31C at 80% humidity. This adaptation has been shown experimentally to involve the cerebral cortex as well as the pituitary-adrenal and pituitary-thyroid systems, and to affect most of the parameters of the circulation and metabolism. The question of atmospheric pressure and altitude is intimately connected with that of hypoxia, and both are reviewed briefly in their interaction with the neuroendocrine systems of the body. Low pressure has been found to affect the thyroid, for example, as well as the adrenal cortex and parathyroids. Hypoxia resulting from low partial pressures of oxygen results in changes in urinary pH, 17-ketosteroid excretion, electrolyte balance, and eventually in the blood picture and iron metabolism. The problem of acclimatization to high-altitude conditions thus involves a broad range of disturbances in the circulatory and endocrine systems, related via the nervous system to psychic reactions to changes in meteorological conditions.

267.

AUTHOR: Lukiyenko, P. I.

ORG: Department of Pharmacology /Director--Docent M. V. Korablyev/ Grodnenskiy Medical Institute (Kafedra farmakologii Grodnenskogo meditsinskogo instituta)

TITLE: Effects of certain neuroplegic, gangliolytic and adrenolytic agents on the resistance of animals to acute hypoxia

SOURCE: Farmakologiya i toksikologiya, v. 31, no. 1, 1968, 100-103

TOPIC TAGS: mouse, hypoxia, adrenolygic drug, tranquilizer, chlorpromazine, cholinergic blocking agent

ABSTRACT: Fifteen chemical compounds were tested on white mice to determine their effect on resistance to hypoxia. The substances were injected subcutaneously in one dose of varying strengths. The animals were placed either in a barochamber which simulates a rarefied atmosphere or in a hermetically sealed container (without removal of CO_2 gas). The effectiveness of the compound was judged by the length of life of the experimental animals compared with controls. Most of the compounds significantly raised the resistance of the mice to acute oxygen insufficiency caused by the rarefied atmosphere. Chlorpromazine was effective only in doses of 1-5 mg/kg. With higher doses up to 10-30 mg/kg its protective activity was sharply reduced. In a closed container hydralizine and chlorpromazine prolonged life up to twice as long with a dose of 3 mg/kg and three times as long with a 15 mg/kg dose. Of the neuroplegic agents the most active were the tranquilizers (reserpine and chlorpromazine), less active, the central M-cholinolytics (metamizyl, diaphen and benactyzine) and the weakest, the central N-cholinolytics (adiphenine, gangleron and aprophen). The protective activity of chlorpromazine is lower in the closed container because of a difference in hypoxia developed under conditions of the closed container and the barochamber. Gangliolytic agents, benzhexamethonium and pachycarpine had little or no effect on hypoxia. The adrenolytic agent, hydralizine, was effective both in the barochamber and in the closed container. This was probably due to its ability to depress coenzyme containing metal and mercapto groups which decrease the velocity of the enzymatic reaction thereby requiring a lower consumption

of oxygen. The stronger adrenolytics, dihydroergotoxin and dihydroergotamine, do not possess this activity. The compounds arranged in order of descending activity of resistance to hypoxia in rarefied atmosphere are reserpine, hydralizine, chlorpromazine, ethyzine, metamizyl, diaphen, benactyzine, benzhexamethonium, diparcol, adiphenine, ganglieron, and aprophen. In a closed container the length of life increased with hydralizine and chlorpromazine and did not change with reserpine and metamizyl. Orig. art. has: 2 tables.

268.

AUTHOR: Lyszczarz, J.--Lyshchazh, Ye.; Glogowska, M.--Glogovska, M.

ORG: Institute of Experimental Pathology [Director: prof. dr. Z. Ruszczewski], PAN (Zaklad patologii Doswiadczalnej PAN)

TITLE: Influence of the composition of atmospheric air on respiratory function. Effect of deep anoxemic hypoxia on the mechanics of breathing

SOURCE: Acta physiologica Polonica, v. 18, no. 4, 1967, 573-581

TOPIC TAGS: respiratory physiology, biologic respiration, hypoxia

ABSTRACT: Changes in the mechanics of breathing were estimated in anesthetized rabbits during and after breathing a gas mixture containing 7% oxygen. These changes were compared with the disturbances in gas exchange. During breathing of 7% oxygen, nonelastic resistance rose, while compliance was unaltered. Immediately after inhalation was discontinued, nonelastic resistance fell below the control level, while compliance increased. Later, a fall in compliance and an increase in nonelastic resistance were observed. An interpretation of the results obtained is attempted. Orig. art. has: 4 figures. [WA-N-68-2] [EL]

269.

AUTHOR: Malkin, V. B. (Doctor of medical sciences)

ORG: none

TITLE: On the importance of some regulating systems in the development of adaptation to hypoxia

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 137-143

TOPIC TAGS: hypoxia, experiment animal, cerebellum, cerebrum, pituitary gland, adrenal gland, simulated space flight

ABSTRACT: The article reports on the role of the cerebral cortex, cerebellum, adrenal cortex, and pituitary gland in the adaptation of rats to hypoxia. Animals were adapted in natural conditions (Caucasus Mountains) at 2000 m for 16 days and at 3800 m for 14 days, and in the altitude chamber at 2000 m and 4000 m, and 3000—5000 m continuously for 20 to 30 days, or for 6 hr per day at altitudes beginning at 3500 m and increasing to 7000 m. Hemoglobin, erythrocyte and reticulocyte counts were done during and at the conclusion of the adaptation process. After excision of one, and especially of both cerebral hemispheres, there was a significant increase in resistance of the animals to acute hypoxia. Adaptation of decorticated animals to decreased barometric pressure led a further increase in the resistance of the respiratory center to hypoxia. After excision of the cerebellum and exposure to decreased barometric pressure, resistance of these animals to acute hypoxia was lower than in intact animals. The difference in the development of the adaptation effect after excision of the cerebellum and of the cerebral cortex is explained by the different effect of these structures on subcortical formations, especially on the respiratory center. Adaptation to hypoxia in adrenalectomized rats depended on the training regimen while in the altitude chamber. Adrenalectomized animals adapted in mountain altitudes showed increased resistance to acute hypoxia. Thus, adrenalectomy does not exclude the possibility of animals adapting to a moderate degree of hypoxia. Hypophysectomized animals showed increased resistance to acute hypoxia after acclimatization in mountains, although hemoglobin, erythrocyte, and reticulocyte counts were decreased. The study suggests that surgical ablation of the most important control systems of the body does not eliminate the possibility of adapting to decreased barometric pressure, although the adaptation process is altered. Orig. art. has: 3 tables. [XF]

270.

AUTHOR: Malkin, V. B. (Doctor of medical sciences); Loginova, Ye. V.

ORG: none

TITLE: Effect of aminazin on resistance of animals to acute oxygen deficiency

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 147-151

TOPIC TAGS: hypoxia, brain, spinal cord, chlorpromazine

ABSTRACT: An attempt is made to explain the role of the reticular formation in adaptation to acute O_2 deficiency in animals adapted to acute hypoxia and in non-adapted animals. In the first group of experiments, intact mice and rats not adapted to hypoxia were administered aminazin (chlorpromazine) 10 mg/kg body wt intraperitoneally. Animals were then placed in an altitude chamber and elevated at the rate of 80—100m/sec. Mice were elevated to 9000 m and allowed to remain for 60 sec. Rats were gradually elevated to 11,000—14,000 m and allowed to remain 5 minutes at each increase in elevation. In the second group of experiments, animals not adapted to hypoxia and animals trained in the altitude chamber beginning with 3000 m/day and ascending to 7000 m on day 13 were studied. Thus, resistance to hypoxia was studied simultaneously in four groups of animals. O_2 consumption in aminazin-treated animals was reduced, and survival rates of aminazin-treated mice at 9000 m for 60 sec were lowered. Aminazin-treated mice adapted to altitude showed greater resistance to acute hypoxia than nonadapted animals. The adaptation effect in training of the animal to decreased barometric pressure is probably a result of certain functional shifts occurring on different levels. The reticular formation plays an important role in adaptation to hypoxia. Although aminazin, which causes a sharp decrease in the functional level of cellular elements of the reticular formation, would be expected to decrease the adaptation effect, data from this study indicate that it does not cause significant changes in adaptation acquired during training. Aminazin-treated mice trained in the altitude chamber showed decreased altitude resistance of 1.5%, compared with 40% in untrained animals. Similar data were obtained in studies on rats. It is concluded that blocking of certain cellular structures of the reticular formation is of no significance in the preservation of acquired adaptation, or that resistance of these structures to the effect of aminazin is sharply increased during the process of adaptation. [WA-22] [XF]

271.

AUTHOR: Malkin, V. B.; Yukhnovskiy, G. D.

ORG: none

TITLE: Effect of adaptation to high mountains on human resistance to acute hypoxia and high temperatures

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 280-288

TOPIC TAGS: man, hypoxia, physical fitness, oxygen consumption, training program, temperature adaptation, psychologic adaptation

ABSTRACT: Tests were conducted in 26 healthy young men: 11 sportsmen (mountain climbers), 10 who had never been in the mountains and 5 scientists collaborating in this study. Stepwise adaptation of a group of 5 in 1964 called for 12 days at 2000 m, 12 days at 3800 and 4200 m and 6 again at 2000 m. The alpinists stayed at 2000 m for 6 days, then went higher. In the next year, the first group stayed at 3800-4200 m for 20 days. The scientists stayed at 2000 m for 25-28 days, but went periodically to the higher camps for 4-6 days. Tests in the pressure chamber before and after adaptation determined the limit of tolerable hypoxia (criteria: writing, simple arithmetic tasks, writer's cramp, disturbance of consciousness). EEG and EKG were also determined during and after the tests. The thermal experiment consisted of 24 tests at 70 C and 40% humidity without ventilation under normal atmospheric pressure while the men wore shorts and sat in a chair. Hypoxic tolerance tests in the 5 individuals adapted to mountain heights showed a considerable increased resistance to hypoxia; four remained at a simulated 7000 m for 20-30 min without significant change in their general condition or working capacity; the fifth who had shown ventricular extrasystole under overload prior to his stay in the mountains tolerated a 30 min stay in the pressure chamber at 3000 m without untoward effects. There were no great changes in the group of alpinists. The scientists' resistance to hypoxia was also increased except for one who had blacked out at 5000 m in the pressure chamber prior to his departure for the mountains. He tolerated mountain heights of 3800-4200 m again perfectly but almost collapsed at 5000 m. Results of resistance to height in the three groups are shown in the table. Comparison between the training program and high resistance in alpinists showed that carrying of heavy or light packs was unrelated to resistance.

Table. Changes of resistance to height before and after a stay in the mountains

Family name	before mountain stay		after mountain 4-6th day		after mountain 28-32nd day		Change in resistance
	height km	time sec	height km	time sec	height km	time sec	
			Test individuals				
A-yev	9	120	8	300	8	300	decrease
V-ko	9	190	9	60	8	300	increase
K-as	7	300	8	2700	8	220	same
Sh-k	8	90	9	70	-	-	same
K-us	9	50	9	140	9	100	same
			Alpinists				
Ts-n	8	240	8	240			unchanged
K-ov	9	110	8	300			decrease
B-in	9	70	9	200			increase
K-yev	9	110	9	130			unchanged

Table. (cont.) Changes of resistance to height before and after a stay in the mountains

Family name	before mountain stay		after mountain 4-6th day		after mountain 28-32nd day		Change in resistance
	height km	time sec	height km	time sec	height km	time sec	
			Alpinists (cont.)				
T-m	8	120	9	165			increase
S-t	9	160	9	140			unchanged
B-ov	9	40	9	120			increase
N-ov	8	90	8	250			same
G-r	8	300	9	100			same
B-d	9	40	9	130			same
M-n	9	70	9	60			unchanged
			Scientific collaborators				
U-a	8	80	8	270			increase
R-a	7	70	8	150			same
L-a	7	90	8	120			same
M-ko	6	300	7	110			same
M-ns	5	270	5	300			unchanged

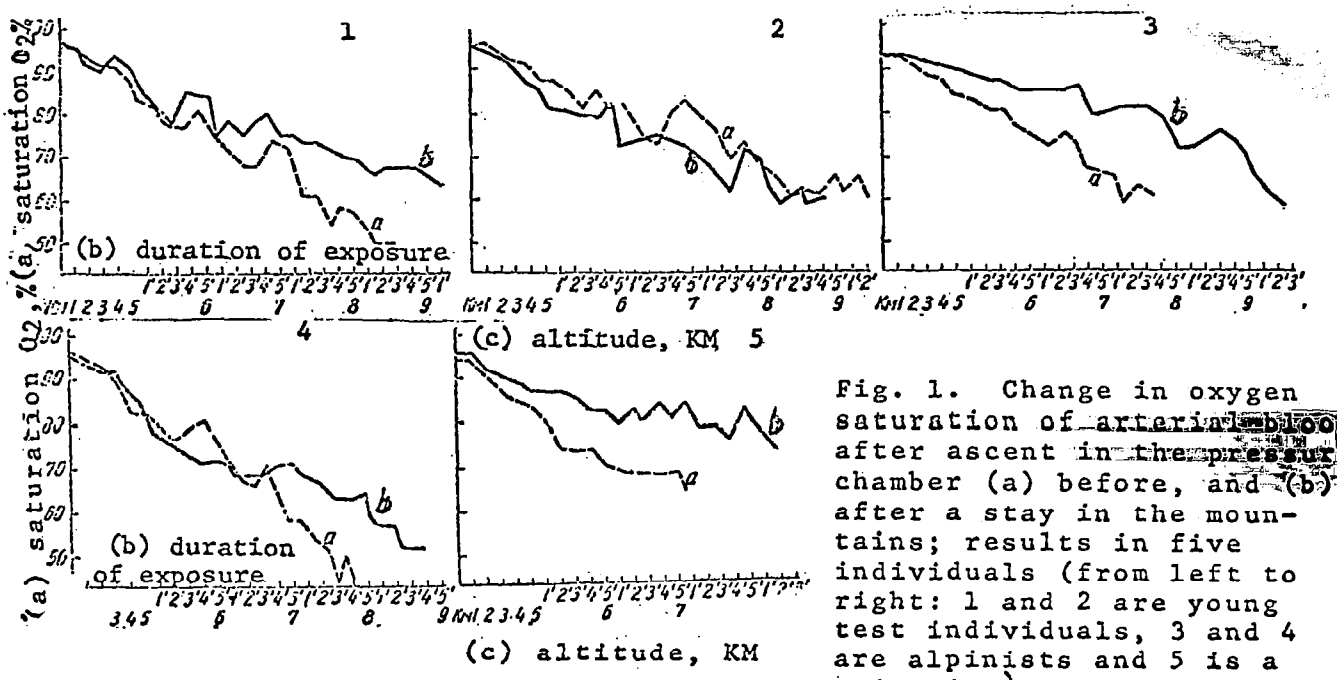


Fig. 1. Change in oxygen saturation of arterial blood after ascent in the pressure chamber (a) before, and (b) after a stay in the mountains; results in five individuals (from left to right: 1 and 2 are young test individuals, 3 and 4 are alpinists and 5 is a scientist)

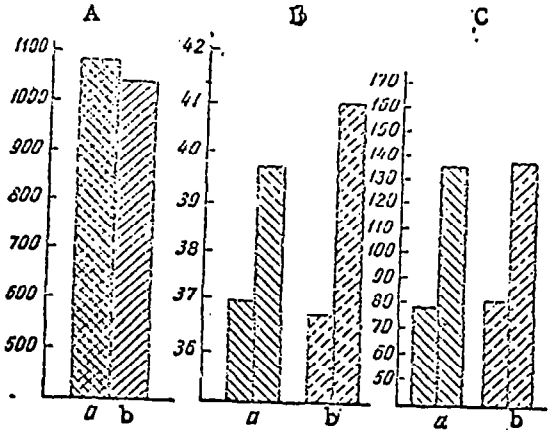


Fig. 2. Time of stay in the thermal chamber at a temperature of 70°, change in weight, body temperature and pulse rate (a) before and (b) after a stay in the mountains (average values from 11 individuals). A) weight loss; B) body temperature; C) pulse rate/min.

Hematologic studies revealed increases in hemoglobin and erythrocytes in the young men arriving in the mountains for the first time; the same applied in a lesser degree to the adult scientists while differences were insignificant for the alpinists. In searching for the occasional sharp increase in resistance after adaptation to high mountains, the authors found that the most resistant individuals breathed deepest, and their blood showed the highest 0_2 saturation (Fig. 1). At the end of the test, these people had the same 0_2 saturation as their less resistant collegues. It was concluded that the capacity for work under low oxygen pressure is determined mainly by adaptive processes directed toward transporting the available oxygen to those body structures that are most sensitive to hypoxia. Orig. art. has: 2 figures and 1 table.

[WA-22] [06]

272.

AUTHOR: Malkin, V. B. (Doctor of medical sciences); Yukhnovskiy, G. D.; Markaryan, S. S.

ORG: none

TITLE: Effect of adaptation to high mountain altitude on resistance to acute hypoxia, high temperature and vestibular stimulation in man

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 8, 1968. Adaptatsiya k gipoksii i ustoychivost' organizma (Adaptibility to hypoxia and resistivity of organism), 57-65

TOPIC TAGS: altitude chamber, hypoxia, heat effect, vestibular effect

ABSTRACT: The article describes the influence of adaptation to high mountain altitudes on the resistance of healthy subjects to the effects of acute hypoxic hypoxia, high environmental temperature, and vestibular stimulations. The experiments were conducted on 11 highly qualified alpinists, 10 young physically fit males, and 3 scientists assigned to the project. Altitude resistance in all participants was determined in an altitude chamber before and after sojourn in the mountains. Subjects were gradually elevated to a height where symptoms of hypoxia appeared. Ascent in the chamber did not exceed 7000 m in

5 subjects. In all other experiments, ascent was 25 m/sec with a rest period of 15—20 sec for every km for the first 5000 m; the rest period after 5000 m was 5 min for each subsequent 25 m ascent. The following physiological parameters were monitored: EEG in frontal-occipital leads, EKG in 3 standard leads, external respiration, arterial blood pressure, oximetry with the Krasnogvardeyets oximeter, and physical and mental capacity. There was a distinct increase in altitude resistance in the 5 subjects who ascended to 7000 m. Four subjects without O_2 masks for 20—30 min maintained a satisfactory general condition and a high level of physical and mental achievement. Before altitude acclimatization, this was possible for only 1—8 min. Increase in altitude resistance was most pronounced in active subjects acclimatized to 3800—4200 m for sufficiently long periods after adaptation to altitude conditions at 2000—4000 m. Resistance to the effect of high temperature was studied in 24 altitude-acclimatized subjects. They were placed in a thermoaltitude chamber with normal barometric pressure, temperature +70°C, humidity 40—65%, and without ventilation. EKG and respiration were monitored with the Al'var electroencephalograph. Body water loss was determined by comparing body weight before and after the experiment. A marked decrease in resistance to high environmental temperature was noted within 10—14 days in the majority of the subjects. The functional state of the vestibular analyzer before and after sojourn in the mountains was studied in 10 altitude-

Table 1. Determination of vestibular resistance by continuous cumulations of Coriolis accelerations

Subject	Time of tolerance min sec before acclimatization	Time of tolerance min sec after acclimatization	Difference	Subject	Time of tolerance min sec before acclimatization	Time of tolerance min sec after acclimatization	Difference
K . .	3.45	9.05	+5.20	U . .	0.18	0.45	+0.27
V . .	4.30	12.00	+7.30	S . .	1.10	1.35	+0.25
K . .	2.30	3.30	+1.00	G . .	1.40	2.20	+0.40
K . .	6.00	6.00	0.00	N . .	1.05	1.30	+0.25
A . .	4.00	1.00	—3.00	K . .	1.25	1.00	—0.25

adapted subjects by the method of continuous cumulations of Coriolis accelerations. Results are shown in Table 1. Analysis of the data suggests that acclimatization in mountains results in increased resistance of the vestibular analyzer. This phenomenon is due to the fact that in conditions of hypoxia, the sensitivity of the vestibular analyzer is initially increased, and then is steadily decreased. Orig. art. has: 2 tables and 1 figure. [XF]

273.

AUTHOR: Malomsoki, J.; Szmodis, I.; Herendi, Ildiko

ORG: Research Department of the National Institute for Medicine of Physical Education and Sports of the Hungarian Ministry of Public Health, Budapest

TITLE: Some factors in the control mechanism optimalizing work metabolism

SOURCE: Academia scientiarum hungarica. Acta physiologica. Supplement to v. 32, 1967, Abstracts of the lectures held on the First Joint Congress of the Hungarian Societies of Biochemistry, Biophysics and Physiology, Pecs, October 12 to 14, 1967, 92

TOPIC TAGS: oxygen consumption, respiratory physiology, neurophysiology

ABSTRACT: Due to neuro-endocrine regulation, several organic functions show an identical tendency in activation and deactivation, during muscular exertion. Therefore, the excitation and attenuation processes of the respective cardiovascular, respiratory, and motor functions also run an apparently similar course. However, during a complex test series applying four gradually increasing work-loads, the authors have found certain divergence in the functional dynamics of these systems which might be due to discrepancies of the enzymatic and energetizing processes, though no changes have occurred in the transport mechanism of oxygen. In the initial phase of work, graded motor activity elicited first the activation of pulse frequency. The rise in respiratory minute volume was also fast, while O_2 consumption increased relatively slower. After 60 sec of the first load level, the percentage of oxygen consumption rose sharply, exceeding the speed of the increase of other values. From the second load level, ventilation and O_2 consumption proceeded in a similar manner. The cardio-respiratory functions investigated reached the peak of their activity at the same time, i.e. in the second minute of the highest load. In the following period of attenuation, the curves of pulse beat, ventilation, and oxygen consumption decreased sharply and were almost parallel, however, from the second minute of the recovery period, the restoration of the initial pulse frequency leveled off, while ventilation kept decreasing further; meanwhile, O_2 consumption showed the most marked fall. The decrease of the percentage of oxygen consumption occurred last of all, but then it fell quite steeply; from the fourth minute of recovery its curve ran below the baseline. This undershoot, or counter-regulation, failed to cease even in the seventh minute of recovery, so this value did not return to the initial one. Thus, within the scope of integrated control trend, the dynamics of activation and deactivation of certain organs may behave differently depending on their own functional states. [Full text given] [WA-22] [KS]

274.

AUTHOR: Mansurov, A. R.; Babchinskiy, F. V.; Krasnykh, I. G.; Tyutin, L. A.

ORG: none

TITLE: The effect of hyperoxia on the thoracic organs of white rats

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 3, 1968, 12-15

TOPIC TAGS: hyperoxia, cabin atmospheric control, atmospheric condition, atmospheric chemistry, physiologic oxygen effect

ABSTRACT: The purpose of the present work was to study pathological changes developing in the thoracic organs of white rats as a result of exposure to hyperoxia of different levels and duration. The rats were placed in a special chamber (whose interior gaseous medium could be controlled and maintained at any given level) where they could be tended and observed. Periodically, roentgenograms were made of the thoracic organs, and roentgenokymograms of respiration. The heart surface area was determined in separate tests by a planimeter. Animals exposed to pure oxygen showed pathological changes in the respiratory and cardiovascular systems on the second day (in some) and on the third day (in all animals). The changes involved folcal and infiltration lesions in the lungs, exudation in the pleural cavity, segmental and lobar atelectasis, restricted diaphragm, mobility and increased size of the heart. An exposure of animals to pure oxygen for 48 hr with an interval of 5 days repeated four times led to the development of pulmonary emphysema and functional changes of the myocardium. An exposure of animals 70% O_2 and 30% N_2 atmosphere at an altitude of 2400m produced pathological changes in the heart and lungs; however, they appeared after a longer period of time than in the case of 100% oxygen environments. A 20-day exposure to the 50% oxygen atmosphere did not result in any functional or morphological changes of the thoracic organs. Orig. art. has: 2 tables. [WA-22] [LS]

275.

AUTHOR: Markelov, I. M.; Simanovskiy, L. N.

ORG: Military-Medical Academy im. S. M. Kirov (Voyenno-meditsinskaya akademiya); Institute of Evolutionary Physiology and Biochemistry im. I. M. Sechenov Academy of Sciences SSSR (Institut evoliutsionnoy fiziologii i biokhimii Akademii nauk SSSR)

TITLE: Change in the activity of lactate dehydrogenase and its isoenzymes in the blood and tissues of rats following adaptation to hypoxia

SOURCE: AN SSSR. Doklady, v. 182, no. 4, 1968, 982-984

TOPIC TAGS: dehydrogenase, hypoxia, adaptation, altitude simulation

ABSTRACT: The activity and relationships of isoenzymes of lactate dehydrogenase (LDH) were studied in 34 white rats during prolonged adaptation to hypoxia in the altitude chamber with simulated heights of 2500—7600 m. Animals were studied on the 10th, 20th, and 30th days of adaptation. Isoenzymes of LDH were studied in the blood plasma, erythrocytes, brain, liver, and spleen. Tissue homogenates were separated for determining the total activity of LDH 1:160, and for enzyme electrophoresis 1:40. The relation of the individual isoenzymes was determined by densitometry. Total LDN activity was determined by spectrophotometry. It was determined that the total activity of LDH varies in different tissues, increases at various periods of adaptation to hypoxia, and is related to the functional peculiarities of the tissues (see Table 1). In control rats, the

Table 1. Change in the total activity of LDH as a result of training to hypoxia ($M \pm t$)

Groups of rats	Plasma	Erythrocytes	Kidney	Brain	Liver	Spleen
Control	274±5,0	8390±280,0	88,3±8,2	57±6,6	296,8±17,9	86,4±1,8
10 day	630±22,0*	11000±100,0*	91,0±10,0	—	300,0±21,0	104,0±7,0*
20 day	423±52,0*	9400±60,0*	123,0±9,1*	99,2±12,8*	258,6±31,4	80,0±9,3
30 day	282±16,0	10800±80,8*	108,8±9,7	82,2±7,2	386,3±24,6*	108,8±17,0

isoenzyme LDH_5 predominated in the blood plasma, liver, and spleen, while LDH_1 and LDH_2 predominated in the brain and kidney. During the process of adaptation, LDH_1 and LDH_5 were increased during days 10—20. On day 20, LDH_2 and LDH_3, and especially LDH_{4-5} were increased in the brain; LDH_4 and LDH_5 were sharply increased in the kidney on day 20, and in the liver and spleen on day 10. There was an increase in the percentage of M-subunits in the brain on days 20 and 30, in the kidneys on day 20, and in the spleen on day 10. During this tine, the total LDH activity was increased. Changes in LDH activity and relationships may be considered compensatory mechanisms, connected with a decrease in O_2 tension. Orig. art. has: 2 tables and 1 figure. [WA-22] [XF]

276.

AUTHOR: Musin, B. S.

ORG: Institute of Normal and Pathologic Physiology, AMN SSSR, Moscow (Institut normal'noy i patologicheskoy fiziologii AMN SSSR)

TITLE: The significance of cholinergic factors of regulation in modifying heart action during hypoxic and muscle training in postnatal ontogeny in rats

SOURCE: Konferentsiya biokhimikov Respublik Sredney Azii i Kazakhstana, 1st. Alma-Ata, 1966. Trudy (Transactions of the conference of biochemists of the Republics of Central Asia and Kazakhstan). Tashkent, Izd-vo "Fan", 1967, 211-213

TOPIC TAGS: cholinesterase, hypoxia, oxygen consumption, heart rate, metabolic regulation, homeostasis

ABSTRACT: The role of hypoxic and muscle training in reducing homeostasis in ontogeny was studied in 1--7-month-old rats. After every 1.5 months, EKG, respiration, and basal metabolism were studied in the quiescent animals. Hypoxic training consisted of 2-hour daily exposure in a pressure chamber equal to an altitude of 5000 meters, while muscle training consisted of daily swims, beginning at 10-minute periods and increasing to one hour. To determine the mechanism of metabolism, respiration, and cardiovascular activity reduction, blood cholinesterase activity was studied by the Pikrovskiy method and Mgb content of the heart and muscles was measured. After six months of training the indicators of homeostasis were reduced, with the greatest reduction in the oxygen requirement and lesser reduction in respiration, heart rate, and basal metabolism. The heart weight of trained animals was 15% greater than that of untrained animals. The reductions noted were found to be controlled by the activity of cholinesterase in the blood. After three months of training test animals showed a much greater reduction in cholinesterase activity than control animals, while after six months the level was half that of control animals. The authors conclude that increased regulatory cholinergic factors are responsible for the reductions noted. Untrained animals given small doses of eserine for six months showed reductions in heart rhythm, respiration, and oxygen requirement similar to that of hypoxic- and muscle-trained animals. The myoglobin content of trained animal hearts and muscles was greater than in control animals. The author concludes that the increase in cholinergic patterns of homeostasis is the basic mechanism causing reduction of energetic processes and the level of cardiovascular and respiratory system activity. [WA-22] [04]

277.

AUTHOR: Navakatikyan, O. O.; Lebedeva, V. V.; Blagoveshchens'ka, I. M.; Pevnyy, S. O.; Pevnyy, S. A.

ORG: Donets Institute of Labor Hygiene and Professional Diseases (Donets'kyy instytut gigiyeny pratsi i profzakhvoryuvan')

TITLE: Complex action of different surrounding temperature, physical load, and oxygen concentration in inhaled air on human thermoregulatory functions

SOURCE: Fiziolohicknyy zhurnal, v. 14, no. 1, 1968, 73-80

TOPIC TAGS: human, perspiration rate, physiologic oxygen effect, physiologic stress, working condition, body temperature

ABSTRACT: The complex action on the human organism of high temperature surroundings (50-60 C, 20-30% humidity), physical load (10,000 and 20,000 kgm/hr), and different oxygen concentrations in the inhaled air (21, 40, 100% oxygen) was studied using mine rescue teams and students previously acclimated to high temperature surroundings. Body temperature, chest and forehead skin temperature, and perspiration rate were determined before, during, and after the action of the investigated factors. The obtained material was treated by the method of standard deviations, which required that the series of tests be organized and alternated in such a manner as to negate possible effects of the previous experiment on the one following. The obtained results indicate an interdependence of the effects of the action of oxygen, surrounding temperature, and physical load. Under room temperature conditions oxygen increases skin temperature, and at high temperatures, reduces it. Work in comparison to quiet conditions at room temperature, causes less increase in skin temperature; under high temperature surroundings, the increase in skin temperature during work is higher than under quiet conditions. 50-100% oxygen, in comparison to air, causes less lowering of perspiration during work under low temperatures compared to work under high temperature. Based on the obtained data, the use of 50-100% oxygen is recommended for heavy physical labor under high temperature conditions. Provision should be made for people working in oxygen respirators to regulate the oxygen content of the inhaled medium so that the oxygen content is reduced at time of quiet and light work, and increased during periods of heavy work. Orig. art. has: 3 tables.

278.

AUTHOR: Osipova, S. V.; Uskova, N. V.; Khaunina, R. A.

ORG: Department of Pharmacology, Leningrad Pediatric Medical Institute /headed by Professor I. V. Markov/ (Kafedra farmakologii Leningradskogo pediatricheskogo meditsinskogo instituta); Laboratory of Psychopharmacology, Leningrad Scientific Research Psyconeurological Institute im. V. M. Bekhterev /Head of Research, Candidate of medical sciences I. P. Lapin/ (Laboratoriya psikhofarmakologii Leningradskogo nauchno-issledovatel'skogo psikhonevrologicheskogo instituta)

TITLE: Effect of gamma aminobutyric acid and its derivatives on the resistance of animals to hypoxia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 65, no. 1, 1968, 72-76

TOPIC TAGS: psychopharmacologic drug effect, hypoxia, hypothermia, mouse, drug resistance, animal experiment

ABSTRACT: Of different derivatives of gamma-aminobutyric acid (GABA), only two— gamma-hydroxybutyric acid (γ-hydroxybutyrate) and beta-phenyl-gamma-aminobutyric acid (BPGABA)- had the ability, upon intraperitoneal administration, to increase the resistance of animals (mice and rats) to hypoxia caused by reduction of atmospheric pressure. In experiments on mice, the duration of the protective effect of BPGABA surpassed γ-hydroxybutyrate; however, the most effective doses of gamma-hydroxybutyric acid (in respect to LD_{50}) were five times less than BPGABA. There was found a coincidence of increased resistance of mice to hypoxia with other effects of γ-hydroxybutyrate and BPGABA, such as restricted movement and hypothermia. The paper was presented by Member AMN SSSR V. V. Zakusov, 17 July 1966. Orig. art. has: 1 figure and 2 tables. [Authors' abstract] [NT]

279.

AUTHOR: Popov'yan, M. D.

ORG: Department of Neural Diseases (Head -- Prof. A. V. Ul'yanova), Saratov Medical Institute (Kafedra nervnykh zabolevaniy Saratovskogo medinstituta)

TITLE: Compensatory mechanisms of the organism during acute cerebral hypoxia

SOURCE: Ob"yedinennaya konferentsiya nevropatologov i psikhiatrov Sredney Azii. Materialy s uchastiyem chlenov pravleniya Vsesoyuznogo obshchestva nevropatologov i psikhiatrov (Materials with the participation of members of the board of the All-Union Society of Neuropathologists and Psychiatrists). Dushanbe, Izd-vo "Irfon", 1966, 54—55

TOPIC TAGS: hypoxia, hemorrhage, adaptation, compensatory reaction

ABSTRACT: Compensatory mechanisms were studied in 125 cases of acute cerebral hypoxia resulting from atherosclerosis and hypertension. Reactions to hypoxia resulting from cerebral circulatory disruptions were found to include the following compensatory mechanisms: difference increase in arterio-venous O_2 content, percentage increase in utilization of O_2 by tissues, increase in respiratory minute volume and pulmonary O_2 absorbtion, increase in the erythrocyte number and hemoglobin content of peripheral blood, and (to a lesser degree) increase in O_2 carrying capacity of the blood. [WA-22] [EF]

280.

AUTHOR: Portugalov, V. V. (Moscow); Kaplanskiy, A. S. (Moscow); Durnova, G. N. (Moscow)

ORG: Institute of Medical-Biological Problems, Ministry of Public Health SSSR

TITLE: Changes in the internal organs of mice during hypoxic hypoxia

SOURCE: Arkhiv patologii, v. 30, no. 9, 1968, 39-45

TOPIC TAGS: hypoxia, adaptation, altitude simulation, altitude chamber, histopathology

ABSTRACT: To determine the maximum permissible degrees of atmosphere rarefaction and the optimum conditions for adaptation to hypoxia, changes produced by it in the organism were studied in white mice exposed to acute and chronic hypoxia. Seventeen mice were place in a ventilated barochamber with 286 mm Hg pressure (7500 m) for 24 hr, and 30 mice in a 378 mm Hg atmosphere (5500 m) for 14 days. After the experiment, the animals were sacrificed and tissues of their internal organs were studied. Acute hypoxia caused emphysematous spots in the lungs, changes in the fibers (especially in the vicinity of vessels) in the heart, vacuolization of the cytoplasm in liver cells, granular dystrophy in the epithelium of renal tubules, a reduction of glycogen content in spermatocytes and spermatids, and increased lysis of lymphocytes and increased number of macrophages in the spleen and lymph nodes. Chronic hypoxia caused more pronounced lesions which included: pronounced emphysema and multiple (sometimes serious) hemorrhages in the lungs, changes in valves and decomposition of fibers in the heart, plethora and necrosis in the liver, pronounced dystrophy and partial necrosis of the epithelium of renal tubules, pronounced cell lysis in the testicles, and a drastic decrease in lymphocytes and increase in macrophages in the spleen and lymph nodes. The obtained data prove that hypoxia causes pathological changes in internal organs, that the time factor is decisive in the development of these changes, and that increased tolerance to hypoxia resulting from acclimatization cannot serve as a criterion of the absence of serious pathological changes in internal organs. Orig. art. has: 4 figures. [WA-22] [EF]

281.

AUTHOR: Potapchuk, A. N. (Tashkent)

ORG: none

TITLE: Changes in certain physiological indices in temporary inhabitants of high altitudes

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 290-291

TOPIC TAGS: adaptation, hypoxia, physiologic parameter, physiologic stress, human memory

ABSTRACT: Subjects were divided into three groups according to length of stay at high altitudes. Persons living at high altitudes for 10 to 14 days comprised the first group; persons living at high altitudes for 220 to 270 days comprised the second group; and, persons living at high altitudes for 600 days and more comprised the third group. Observations were conducted at altitudes of 3200 to 4100 m above sea level. The following changes in a number of physiological functions were noted. The body weight of persons in the second and third groups increased by two to three kilograms, but did not change in the first group. The size of the thorax decreased by two to four cm in the first group, while in the second and third groups it increased by 0.5 to three cm. The respiration rate at high altitudes increased up to 25 to 28 per minute and then remained almost unchanged for all groups until the end of the stay at high altitudes. In the first group the pulse increased from 72 to 104 per minute, and in the second and third groups it fell within the limits of the average for low altitudes. Blood pressure increased insignificantly (130/75) at the start of the stay at high altitudes, but returned to normal level within eight to ten days. It became even lower (105/70 to 95/55) in persons of the second and third groups. Muscular strength measured by holding objects with an extended arm for a period of time and chinning on a crossbar a number of times decreased on the average by 20 to 25%; it remained at the same level for the entire duration of the stay at high altitudes. On the other hand, the results for running 100 meters and distance in grenade throwing improved depending on the degree of acclimatization. The degree of endurance was considerably lower compared to the average of 75, as shown by a step test. Average figures for various altitudes are given below.

	3200 m	3800 m	4100 m
First group	39	37	40
Second group	40	39	42
Third group	39	40	42

Investigations showed that starting at a 4000 m altitude in the Pamirs and before acclimatization, memory capacity began to decline somewhat and the accuracy of memory increased insignificantly. Starting at 3200 altitude, mental functions deteriorate.

282.

AUTHOR: Putilina, F. Ye.

ORG: Laboratory of the Biochemistry of the Nervous System and Metabolism, Physiological Institute imeni Academician A. A. Ukhtomskiy (Laboratoriya biokhimii nervnoy sistemy i obmena veshchestv Viziologicheskiy institut)

TITLE: Conversion of glucose and pyruvate into lactic acid in the brain in norm and in hypoxia

SOURCE: Leningrad. Universitet. Fiziologicheskiy institut. Nervnaya sistema, no. 8, 1967, 68-72

TOPIC TAGS: rat, brain, hypoxia, biochemistry, glucose, carbohydrate metabolism, radioactiver tracer

ABSTRACT: The intensity of the conversion of glucose and pyruvates into lactic acid in the brain was studied in norm, with hypoxia and with the use of radioactive substances. Hypoxia was caused in white rats by subcutaneous introduction of sodium nitrite during 15, 30 and 45 min. Oxygen insufficiency was determined by quantitative methemoglobin in the blood. Determination of quantity and specific activity (SA) of lactic and pyruvic acids in the brain was carried out with marked compounds, Glucose-1 C^{14} and pyruvate-2 C^{14}, which were introduced into the animal subcutaneously in quantity 20 mk curie/100 g body weight. Duration of radioactive exposure was 15 min (serious form of hypoxia) and 30 min (hypoxia of average severity). Known methods were used for determination of quantity and SA of pyruvic and lactic acids. The percentage of lactate and pyruvate in the brain did not change 15 min after introduction of $NaNO_2$. In the last 30 min the level of lactic acid increased 3.1 times and pyruvate 1.7 times with hypoxia of average severity. With severe form of hypoxia, lactate increased 4.5 times and pyruvate 1.9 times. Increase of the proportion lactate/pyruvate serves as an indication of the intensity of the anaerobic process because the least variation from the norm causes a change of this value. With a weak form of hypoxia the value does not differ from the norm and equals 14; with average form of hypoxia, it increases to 25; and with serious form, to 33. SA of lactate in the brain decreases after introduction of glucose-1 C^{14} with both forms of hypoxia. With pyruvate-2 C^{14} the decrease is observed only in the serious form of hypoxia. SA of glucose in serious hypoxia is decreased 4.8 times and SA of pyruvate, 40%. To determine the change of intensity of the formation of lactic acid from glucose and pyruvate, the comparative specific activity (CSA) of lactate was calculated. This showed an increase of 10-16%. Orig. art. has: 2 tables and 2 figures.

283.

AUTHOR: Romanchuk, L. A.; Rubina, Kh. M.

ORG: Department of Biochemistry First Leningrad Medical Institute im. I. P. Pavlov (Kafedra biokhimii I Leningradskogo meditsinskogo instituta)

TITLE: Effect of phenazine metasulfate on the conversion of methemoglobin to hemoglobin in the blood of rats with hemic hypoxia

SOURCE: Voprosy meditsinskoy khimii, v. 14, no. 4, 1968, 358-360

TOPIC TAGS: rat, blood chemistry, hypoxia, hemoglobin, sulfur compound, organic azo compound

ABSTRACT: Levels of methemoglobin (MetHb) and reduced glutathione (GSH), and activities of glucose-6-phosphate (G-6-P-dehydrogenase) and glutathione (GSSG)-reductase in the erythrocytes of rats were measured after treatment with sodium nitrite followed by phenazine metasulfate to study the effect of the latter (as a catalyst in electron transfer from NADP-H_2 to MetHb), and its mechanism, in reversing metabolic changes accompanying hypoxemia. Rats (200-250 g) receiving sodium nitrite subcutaneously (10 mg / 100 g body weight) were sacrificed upon the onset of severe hypoxia (45 min) and erythrocyte hemolysates were prepared. Another group received freshly prepared solutions of phenazine metasulfate (2 mg/ 100 g body weight) 30 min after the sodium nitrite. Blood was analyzed 1, 2 and 3 hr after giving phenazine metasulfate. MetHb and GSH were determined spectrophotometrically. G-6-P-dehydrogenase was measured by increase in absorption of NADP-H_2 (reduced nicotinamide-adenine-dinucleotide-phosphate) at 340 millimicrons. GSSG-reductase activity was determined by the amount of GSH formed as a result of the following reaction:

G-6-P+NADF $\rightleftharpoons$ G-6-P dehydrogenase gluconolactone-6-P+NADP-H_2;

GSSG+NADP-H_2 $\rightleftharpoons$ GSSG-reductase NADP+2GSH.

The limiting factor in this change is GSSG-reductase. SH groups were determined spectrophotometrically. Rats given sodium nitrite died in 45-50 min. After giving phenazine metasulfate all the animals (60) survived, and began to recover from hypoxia in 10-15 min. MetHb had decreased sharply one hour after giving phenazine metasulfate, and was practically completely converted into hemoglobin after 3 hr. Sodium nitrite did not affect G-6-P dehydrogenase activity, indicating normal production of reduced NADP in these animals; however, GSSG reductase activity decreased markedly, which could cause decreased utilization of reduced NADP

in maintaining reduced glutathione. Although GSH did not decrease when hypoxia was developing, it could decrease during more prolonged hypoxia, as observed previously. Phenazine metasulfate produced a significant increase in GSSG-reductase activity in one hour, restoring normal levels in 3 hr. Stimulation of MetHb reduction by phenazine metasulfate is apparently connected with the glutathione reductase system of erythrocytes. Orig. art. has: 2 tables. [WA-22]

284.

AUTHOR: Sadritdinov, B. (Tashkent)

ORG: none

TITLE: Experimental data on coronary circulation with removal of a lung under conditions of hypoxia and hyperoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 311-312

TOPIC TAGS: dog, hypoxia, hyperoxia, blood circulation, thoracic surgery

ABSTRACT: Fifteen experiments were conducted on dogs to study coronary circulation under conditions of hypoxia and with removal of a lung under conditions of hypoxia (10% oxygen and 90% nitrogen) and of hyperoxia (inspiration of pure oxygen). During hypoxia (breathing a constant volume of an artificially hypoxic mixture) coronary circulation increased by 15 to 22%. Arterial blood pressure rose both for systemic and pulmonary circulation. Definite tachycardia was observed. A distinct reduction in the oxygen saturation of arterial blood began. The changes indicated increased markedly during the first three minutes of the action of hypoxia, and then became stabilized. Removal of the left lung under conditions of hypoxia (5 to 10 minutes after providing the hypoxic mixture) further increased the changes in coronary circulation and in the activity of the cardiovascular system. The coronary circulation rate increased on the average by 30 to 35 percent. This increase in coronary circulation is ensured by the compensatory possibilities of the coronary vessels. In this way, removal of a lung under conditions of hypoxia facilitated the development of oxygen starvation, because half of the respiratory surface of the lungs was decreased. Hyperoxia (the artificial breathing of pure oxygen) with an extensively open pneumothorax moderately increased coronary circulation (by 4 to 5%

on the average), and the percent of oxygen saturation of arterial blood rose significantly, with an unchanged initial level of blood pressure both for systemic and pulmonary circulation. With removal of a lung under conditions of hyperoxia, in contrast to the preceding series of experiments, no clearly expressed hemodynamic and nerve-reflex changes were observed but the general nature of reactions remained the same. A reduction was noted in oxygen saturation of arterial blood to 92 percent. Coronary circulation increased and remained noticeably higher until the end of the observations. During various manipulation of the radix pulmonis in the course of the lung operation a pure oxygen supply is advisable, judging from the results of the experiments.

285.

AUTHOR: Savel'yev, N. K.; Smirnov, Yu. M.

ORG: Department of Normal Physiology /Head - Prof. G. A. Vaksleyger/, Orenburg Medical Institute (Kafedra normal'noy fiziologii Orenburgskogo meditsinskogo instituta)

TITLE: Circulatory changes in dogs during hyperoxia with and without anesthesia

SOURCE: Byulleten' eksperimental'noy biologii i meditsiny, v. 66, no. 7, 1968, 27-28

TOPIC TAGS: hyperoxia, anesthesia, circulatory system

ABSTRACT: In a chronic experiment, inhalation of 90—90% oxygen did not produce changes in arterial blood pressure and blood flow rate in the carotid sinus in nonanesthetized dogs. In Nembutal - anesthetized dogs hyperoxia caused a drop in arterial pressure and a marked decrease in blood flow rate in all cases. [WA-22] [EL]

286.

AUTHOR: Serova, L. (Candidate of Biological Sciences)

ORG: none

TITLE: Very high altitude [studies at Mt. Elbrus]

SOURCE: Znaniye - sila, no. 1, 1968, 9-12

TOPIC TAGS: hypoxia, man, adaptation, space biologic experiment, astronaut training

ABSTRACT: An expedition manned by aspirants in physics from the Kiev Institute endeavored to live and work at the summit of Mt. Elbrus in the summer of 1967. The study was conducted to help determine if it is practical to establish a laboratory at such altitudes (5595 m). Differences in hypoxic conditions under simulated pressure chamber conditions at sea level and at high altitudes are pointed out, such as the effects of ultraviolet radiation and ionized air. An indication was sought as to whether training at 2240 m or at some higher altitudes would be effective in preparing for the Olympics in Mexico. The possibility of training astronauts and spacemen at the Elbrus laboratory was considered. The author gives his own impressions and those of other members of the expedition--Professor Nikolay Nikolayevich Sirotinin (biologist), Vladimir Ivanovich Danileiko and Valya Matsynin (who assembled the building mentioned below), and an anonymous alpinist who considered living and working at the summit impractical. The expedition ascended in stages, acclimating at camps at the ice base of the mountain at 3700 m, and at 4200, and 4800 m before reaching the 5595 m summit where the pressure is one-half atmosphere. Blood analyses were made and physiological tests were conducted at each level to determine ability to work. A metal and fiberglass building was brought by helicopter and assembled at the summit. The construction specialist Pavel Beloshitskiy was brought up, unacclimated, by helicopter; he developed mountain sickness, and had to be taken down to a camp at a lower altitude. Manifestations of hypoxia--difficulty in breathing, confusion, loss of memory, and inability to judge distance, are vividly described. The work of Galina Aleksandrovna Leont'yeva in conducting the medical tests is cited. Operation "Elbrus-67" was successful, the building remains erected, and a new group of laboratory collaborators were already assembling in August to continue the studies, weather permitting. Orig. art. has: 5 figures. [06]

287.

AUTHOR: Shmeleva, A. M.; Breslav, I. S.

ORG: none

TITLE: Effect of hyperoxia on the dynamics of erythropoiesis in animals

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 298-302

TOPIC TAGS: mouse, rat, hyperoxia, erythropoiesis, artificial atmosphere

ABSTRACT: Tests were conducted in 100 white mice and 100 Wistar rats exposed to hyeroxia for various periods of time. In the first test series, the mice were kept for 15 days in an atmosphere of 60% oxygen and 40% nitrogen; blood was examined repeatedly and showed an initial erythrocyte increase which then declined to below normal. Hemoglobin first showed a slight decline, then increased towards the end of the test and upon return to normal atmospheric conditions. Reticulocytes also increased. Hyperoxia thus tended to stimulate erythropoiesis in this case. In the second series, a 90 min exposure to oxygen at 2.5 atmospheres caused no significant erythrocyte or hemoglobin changes during the test but increased reticulocytes immediately after its end, followed by variations and return to normal around the 15th day. In the third series, the rats were kept for 40 hours in 97% oxygen at normal pressure. There was no toxic effect. Following the test, an increase of erythrocytes was observed which underwent considerable variations for the next two weeks, resulting in a somewhat higher concentration of young red blood cells. In the fourth series where the rats were exposed to the same artificial atmosphere for 72 hours, results were similar to those of the third series although somewhat more pronounced. The stability index to oxygen hemolysis decreased sharply after exposure and increased to above normal on the 3-6th day. It was concluded that hyperoxia had a multiple effect on red blood. Dynamics of erythropoiesis involved alternating periods of growth and reduction in the content of young erythrocyte forms. There is no simple relationship between oxygen effect and changes in the blood system. Depending on O_2 partial tension in the medium, length of stay and the body's adaptation to the hyperoxic effect, erythropoiesis will be either depressed or stimulated. Orig. art. has: 6 figures.

288.

AUTHOR: Shumyts'ka, N. M.

ORG: Department of Comparative Physiology, Institute of Physiology im. O. O. Bohomolets AN URSR, Kiev (Viddil porivnyal'noyi fiziologiyi Instytutu fiziologiyi AN URSR)

TITLE: Some data on the comparative characteristics of the process of adaptation to hypoxia and of the method of gradual acclimation to high mountain climate

SOURCE: Fiziolohichnyy zhurnal, v. 13, no. 6, 1967, 824-827

TOPIC TAGS: hypoxia, adaptation, dog, blood, erythrocyte, hemoglobin

ABSTRACT: The effects of hypoxia on animals with no previous acclimation and on animals exposed to progressively higher altitudes were compared. Unacclimated dogs were exposed to acute hypoxia conditions (3500 m altitude) for ten days, and were examined before the test, on the second and tenth days, and for five months after return to normal atmospheric pressure. In the other test the animals were taken to progressively higher alttitudes up to 3700 m over a period of 24 days. In the animals suddenly exposed to acute hypoxia the hemoglobin content increased by the 10th day, dropped suddenly, and recovered to initial levels after 4 months. The number of erythrocytes dropped initially, increased by the 10th day, and then dropped sharply, recovering gradually by the 5th month. Increase in body weight continued for a short period after return to normal pressure, dropped sharply by the end of the first month, and returned to initial test weight after 5 months. The number of reticulocytes increased to a maximum by the 10th day, dropped gradually to a minimum 4 months later, and started to recover by the 5th month. The color index was somewhat lower by the 10th day, reached a maximum in 1 month, and returned to initial levels in 5 months. In the animals exposed to progressively higher altitudes, the hemoglobin content did not fluctuate very much; erythrocyte count dropped initially but increased substantially by the end of acclimation, then dropped again, but to a level higher than the initial level. Body weight fluctuated, but to progressively higher levels. The number of reticulocytes increased to a maximum toward the end of acclimation, dropped some during the next two months, and then leveled out at a much higher level than the original. Color index dropped during acclimation, then recovered partially. Thus gradual acclimation not only stimulates reactions to higher altitudes, but these reactions are retained for 2-3 months after return to normal atmospheric pressure. These favorable effects of gradual acclimation compared to sudden exposure to hypoxia conditions are of value in conditioning athletes, and in medical treatment of illnesses due to oxygen insufficiency. Orig. art. has: 2 figures.

289.

AUTHOR: Simanovskiy, L. N.

ORG: Institute of Evolutionary Physiology and Biochemistry im. I. M. Sechenov AN SSSR, Leningrad (Institut evolyutsionnoy fiziologii i biokhimii)

TITLE: Change in activity of the reactions of the pentose-phosphate cycle and glycolysis in rat erythrocytes under adaptation to hypoxia

SOURCE: Biokhimiya, v. 33, no. 1, 1968, 15-19

TOPIC TAGS: rat, erythrocyte, hypoxia, glycol, glycolysis, pentose, phosphate

ABSTRACT: A brief activation of the pentose-phosphate cycle in acute anoxia and myocardial infarct has been recorded. Here the effect of adaptation to hypoxia is studied. 100 male rats were separated into four groups: Gr. I (42) served as controls; Gr. II (18) were tested on the 10th day of adaptation; Gr. III (17), on the 20th; Gr. IV (24), on the 30th day. The animals were put in a pressure chamber for 5.5 hr daily. Initial pressure corresponding to 2500 m height was increased by 500 m daily to 7600 m. Activity of glucose-6-phosphate dehydrogenase (G-6-F-DG), determined by a known spectrophotometric method, was expressed in μmole $NADF \cdot H_2/10^9$ hemolyzed erythrocytes/5 min. Activity of transketolase (TK) was determined by loss of ribose-5-phosphate (R-5-F) (Meybaum-Albaum and Umbreit method) and accumulation of sedoheptulose-7-phosphate (S-7-F) (Dishe-Brownstone and Denstedt method). Loss of R-5-F, in μg/ 10^9 erythrocytes/ 3 hr was: Gr. I, $\sim$ 18; Gr. II, $\sim$ 30, Gr. III, $\sim$ 45; Gr. IV, $\sim$ 40. Accumulation of S-7-F, in μg/ 10^9 erythrocytes/ 3 hr: Gr. I, $\sim$ 5; Gr. II, $\sim$ 10; Gr. III, $\sim$ 12; Gr. IV, $\sim$ 11. Changes in G-6-F-DG activity do not follow the same pattern: Gr. I and II have the same activity, $\sim$0.9 mole $NADF \cdot H_2$/ 10^9 erthrocytes/ 5 min; Gr. III, an increase to $\sim$ 1.3 mole; but Gr. IV, a decrease to $\sim$ 0.6 mole. Glycolysis rate in erythrocytes of rats adapted to hypoxia is higher than in controls, but its height is affected by type of substrate used and by technique of hemolysate production. Greatest accumulation of lactate is noted when G-6-F and FDF are used as substrates; least, when glucose is the substrate. It was found that hexokinase activity was extremely low in the hemolysate after centrifuging at 15000 g, but sufficiently high in the residue; after centrifuging at 1000 g, practically all hexokinase activity occurred in the liquid above the residue. Since hexokinase is in some degree connected with cell

structure, it is possible that a significant part is carried away with the residue at higher rates of centrifugation. Since it is known that there are disturbances in erythrocyte permeability under lowered activity of glycolysis and the G-6-F-DG reaction, and there is an increased destruction of erythrocytes in the initial stages of hypoxia, one may assume that the observed changes in the pentose phosphate cycle and in glycolysis are important in preserving the structural entity and functional activity of erythrocytes in hypoxia. Orig. art. has: 3 figures.

290.

AUTHOR: Smirnov, Yu. M.; Savel'yev, N. K.

ORG: Department of Normal Physiology Medical Institute, Orenburg (Kafedra normal'noy fiziologii Meditsinskogo instituta)

TITLE: Regulation of blood circulation in the limbs of dogs breathing air with increased or decreased oxygen content

SOURCE: Fiziologicheskiy zhurnal SSSR, v. 54, no. 6, 1968, 712-719

TOPIC TAGS: dog, hypoxia, hyperoxia, blood circulation, peripheral circulation, peripheral nervous system, sympathetic nervous system

ABSTRACT: The origin of efferent mechanisms determining posthypoxic vasodilation or hyperoxic vasoconstriction was studied in tests on 98 dogs under nembutal anesthesia; blood pressure, vascular tonus and rate of blood circulation were determined in various arteries. Hypoxia and hyperoxia were obtained with 8—10% or 92—26% oxygen in nitrogen administered for 5 min. In several test series, animals with intact peripheral chemoreceptors or following exclusion of carotid and aortal zones were subjected to tests. In 11 cases, desympathization of limb vessels was obtained by removing the lumbar sympathic nodes. Atropine was occasionally administered for excluding cholinergic effects on the limbs. Most animals with intact carotid and

aortal zones reacted to the hypoxic mixture with increased (average 6.4%) arterial pressure reaching maximum in the 3rd min. In only 15% did this decrease below prehypoxic levels during the experiment. Vascular tone in the limb showed a transitory increase in the majority; a sharp (by 28%) decrease in tonus was observed in the posthypoxic period in all animals, and a decrease of blood pressure in 92% (12.7% below prehypoxic levels). Blood circulation in the femur artery increased in 84% (by 11%) during hypoxia and was related mainly to vascular dilatation. A hyperoxic mixture caused a drop in blood pressure in the majority. Blood circulation decreased in 60%, increased in 22% and remained unchanged in the rest. In 37%, blood circulation first increased, then decreased. The vascular tone of the femur artery also underwent biphasic changes in 53%: a decrease was followed by an increase. After exclusion of the carotid and vagus nerves, hypoxia caused both decrease in vascular tone and blood pressure, and the stage of secondary dilatation was either depressed or absent. Hyperoxia caused both increase in vascular tone and blood pressure. Desympathization of the limb led to full disappearance of the phase of constriction and secondary dilatation under hypoxia and vascular dilatation in hyperoxia. Hypoxia caused a decrease in vascular tonus (by 5%) and hyperoxia and increase (10%). It was concluded that: 1) inhalation of a hypoxic mixture by intact dogs causes increase in blood pressure, increased blood circulation in the femur artery and a biphasic reaction of limb vessels: constriction followed by dilation; 2) inhalation of a hyperoxic mixture by these animals leads to a consistent decrease in blood pressure and an initially decreased vascular tonus in limbs followed by increase above the initial level; a biphasic change is observed in the femoral circulation: initial acceleration followed by reduction; 3) exclusion of carotid and aortal zones stops the pressor reaction in hypoxia and depressor in hyperoxia; the phase of posthypoxic delation in limb vessels is considerably reduced or absent; dilatory vascular reaction in hypoxia and constriction in hyperoxia is more pronounced; 4) exclusion of cholinergic nervous effects on limb vessels in hypoxia has no effect on vascular reactions; and, 5) exclusion of sympathetic nerves in limbs leads to full exclusion of pressor reaction in hypoxia and depressor in hyperoxia. Phasic dilation of limb vessels in the posthypoxic reoxygenation period is absent. Orig. art. has: 5 figures. [WA-22] [06]

291.

AUTHOR: Soltysiak, Jerzy -- Soltysyak, Ye. (Warsaw)

ORG: Center of Experimental and Clinical Medicine/directed by Professor Dr. Z. Ruszczewski/, PAN, Warsaw (Centrum Medycyny Doswiadczalnej i Klinicznej PAN); Team of Industrial Physiology/headed by Docent Dr. St. Kozlowski/(Zespol Fizjologii Pracy)

TITLE: Influence of training on the performance capacity of rats and their resistance to altitude hypoxia and acceleration stress

SOURCE: Acta physiologica polonica, v. 19, no. 5, 1968, 703-711

TOPIC TAGS: clinical medicine, grey rat, hypoxia, biologic acceleration effect, animal experiment

ABSTRACT: The influence of physical training on the performance capacity of rats and their resistance to altitude hypoxia and acceleration stress was studied in 58 rats. The rats were trained for 6 weeks on treadmill at a 6° grade, moving at a rate of 30 m/min. The training period during the first four days consisted of 5 min and gradually increased by 5 min every fourth day up to 30 min on the 25th day; all further training periods were 30 min. The total running time of each rat during the training program was 16 hrs (covered distance of 28,800 m), corresponding to 1133 kgm of work at a rate of 0.877 kgm/min. Measurements of performance capacity at altitude hypoxia (307 mm Hg = 7000 m above sea level) and after 15-min exposure to acceleration + 10 G_z revealed about threefold increase of running capacity of the trained rats as compared with untrained controls. Resistance to low atmospheric pressure (145 mm Hg - 12000 m above sea level) and acceleration + 15 G_z was not significantly different in trained and untrained rats. Blood lactate, pyruvate, and glucose levels in both groups of rats were tested under conditions of altitude hypoxia and after an exposure to acceleration. The results showed that a running training (endurance training) in rats ensures greater performance capacity in rats also under conditions of altitude hypoxia and after an exposure to + G_z. Training did not affect survival time of the rats under conditions of simulated altitude of 12000 m above sea level or acceleration + 15 G_z, indicating lack of so-called nonspecific resistance to environmental factors, if survival time is taken as an index of resistance. An experimental part of the study was supervised by Professor Dr. W. Missiuro. The author thanks Docent Dr. Z. Jethonow for consultation and assistance in the research; J. Zaborowska, Z. Wozniak, and W. Radziszewska for technical assistance. Orig. art. has: 2 figures, 1 table, and a bibliography of 19 title. [Author's abstract] [WA-22] [NT]

292.

AUTHOR: Swiecicki, W.--Sventsitski, V.; Jethon, Z.--Yemon, Z.; Kurzepa, S.--Kuzhena, S.

ORG: Military Institute of Aviation medicine [Scientific Director prof. dr. T. Walawski], Warsaw (Wojskowy Instytut Medycyny Lotniczej); Institute of Mother and Child [Director prof. dr. B. Gornicki] (Instytut Matki i Dziecka)

TITLE: The effect of oxygen breathing under increased pressure on acetylcholinesterase and monoaminooxidase activity in the brain and liver

SOURCE: Acta physiologica Polonica, v. 18, no. 4, 1967, 607-612

TOPIC TAGS: respiratory physiology, acetylcholinesterase, monaminooxidase

ABSTRACT: Constant respiratory hypertension, i.e., breathing with oxygen under increased pressure (20 mm Hg) was applied for 4 min to 10 rabbits under urethane anesthesia (1.0 g per kg body weight, in 10% aqueous solution). Ten rabbits under urethane anesthesia served as controls. Acetylcholinesterase activity was assayed by the method of *Helstrin* as modified by *Fleisher* and *Pope*, and monoaminooxidase activity by the method of *Zeller* et al. in the mitochondria of the brain and liver obtained from the animals by the method of *Brody* et al. Oxygen breathing under increased pressure in rabbits under urethane anesthesia had no effect on acetylcholinesterase activity in the mitochondria of the liver and brain. Monoaminooxidase activity was increased in the brain mitochondria, and decreased in liver mitochondria. Orig. art. has: 2 tables. [WA-N-68-2] [EL]

293.

AUTHOR: Szelenyi, I.; Sos, J.; Li, Bok Nam; Selmeci, L.; Rigo, J.

ORG: Institute of Pathophysiology, University Medical School, Budapest

TITLE: Effect of pure low pressure oxygen-environment on the metabolism of rats

SOURCE: Academia scientiarum hungarica. Acta physiologica. Supplement to v. 32, 1967. Abstracts of the lectures held on the First Joint Congress of the Hungarian Societies of Biochemistry, Biophysics and Physiology, Pecs, October 12 to 14, 1967, 106

TOPIC TAGS: physiologic oxygen effect, animal physiology, physiologic parameter

ABSTRACT: In their first experimental series, authors placed albino rats in low-pressure-chamber containing pure low pressure (260 mmHg) oxygen for 8 hrs. The control animals were kept under normal atmospheric conditions. Beginning with the experimental 8 hrs, the urine was collected during 24 hrs and the Na, K, and Ca content, as well as the total-N and amino acid-excretion was determined. The LDH activity of the blood serum and of the myocard,as well as the glycogen-content of the hearts were also examined. It could be established, that: (1) Ca-excretion significantly increases, Na-voidance slightly rises, K-excretion remains unchanged, and the value of the Na K ratio increases; (2) the quantity of total-N increases in the urine; (3) excretion of some amino acids remains unchanged (aspartic acid, glutamic acid, arginine) voidance of certain amino acids (leucines, phenylalanine proline, alanine) is increased; (4) LDH activity of the serum and the myocard was identical in both groups; (5) in the course of acute charge glycogen content of the hearts did not change. [Full text given] [WA-22] [KS]

294

AUTHOR: Szelenyi, Zoltan; Donhoffer, Szilard

ORG: Institute of Pathophysiology, University Medical School, Pecs (Orvostudomanyi Egyetem Korellttani Intezete)

TITLE: The thermogenetic function of brown adipose tissue and the response of body temperature to hypoxia and hypercapnia in the cold- and the warm-adapted rat

SOURCE: Academia scientiarum hungarica. Acta physiologica, v. 33, no. 1, 1968, 31-39

TOPIC TAGS: hypoxia, hypercapnia, tissue physiology, body temperature

ABSTRACT: The effect of breathing 5 to 7 per cent CO_2 in air and of 12 per cent O_2 in N_2 on deep colonic temperature, temperature of the interscapular brown adipose tissue, and that of the underlying longitudinal dorsal muscle were measured at ambient temperatures of 20°C and 10°C in adult rats adapted to environmental temperatures of 5°C and 30°C, respectively, oxygen consumption being recorded simultaneously. In response to exposure to hypercapnia or hypoxia the greatest and most rapid fall in temperature occurred in the brown adipose tissue in both the warm- and the cold-adapted animals. Similarly, after reverting to air breathing, brown adipose tissue temperature rose more rapidly and to a higher level than either colonic or muscle temperature. Brown adipose tissue temperature exceeded colonic temperature to a greater extent in the warm adapted group, before, during and after exposure to hypercapnia or hypoxia. The observations have revealed the almost immediate cessation or reduction of thermoregulatory heat production in brown adipose tissue in response to hypercapnia or hypoxia, and the immediate onset of increased heat production in that tissue after reverting to air breathing. Orig. art. has: 9 figures. [Authors' abstract] [Original article in English]
[WA-22] [KS]

295.

AUTHOR: Turusbekov, B. T. (Frunze)

ORG: none

TITLE: Autonomic functions in children during temporary and prolonged stays at high altitudes

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 370

TOPIC TAGS: pediatrics, adaptation, atmospheric pressure, erythrocyte, leukocyte, physiologic parameter, biologic respiration

ABSTRACT: A series of observations was conducted in 1962 and 1965 with groups of children who stayed from 4 to 20 days and for three years in the mountains (1800 m) on the shore of Lake Issyk-Kul'. Children of the native inhabitants were simultaneously examined for comparison of their indices with those of the newly arrived children. For children staying in the mountains three to four years, the erythrocyte count, amount of hemoglobin, leukocyte count and leukocyte formula, thrombocyte count, erythrocyte sedimentation rate, blood coagulation time, and duration of bleeding were close to the figures for local children. Compared to children living in low altitudes, an increase in all hemodynamic functions was clearly observed in children staying in the mountains; this was reflected by the pulse rate, levels of systolic, diastolic, pulse, and average dynamic pressures, and by reactions to dynamic and static stresses. Autonomic and vascular reflexes were characterized by a sympatheticotonic tendency. The rate, depth, and minute volume of respiration, the vital capacity of the lungs, maximum ventilation, and the respiratory reserve in arriving and local children were identical. However, these figures were somewhat higher than in children from low altitudes. It appears that a short stay (20 to 25 days) at middle altitudes does not substantially influence the body's autonomic functions. However, with a careful and methodical procedure, specific and adaptive changes were detected in alveolar ventilation, in the systolic and minute blood volume, in the erythrocyte count, in the amount of hemoglobin, and in cardiac rhythm. These positive adaptive changes characterize the beneficial influence of the middle altitudes on a growing child.

continuous adaptation, the results were similar to those of rats, while in mice exposed to interrupted adaptation, erythrocytes and hemoglobin increased gradually and significantly, decreasing rapidly after the experiment. Apparently the fluctuations of atmospheric pressure during each day in the interrupted adaptation series had a significant effect on adaptation. This method is recommended for primary adaptation, as well as for maintenance of already existing adaptation. Orig. art. has: 3 tables. [WA-22] [EF]

298

AUTHOR: Vasil'yev, P. V. (Moscow); Uglova, N. N. (Moscow)

ORG: none

TITLE: Effect of long-term stay on animal tolerance to over-exertion under conditions of low barometric pressure or change in the gaseous medium

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 95-96

TOPIC TAGS: hypoxia, atmospheric pressure, carbon dioxide, mouse, rat, guinea pig, rabbit

ABSTRACT: On the assumption that adaptation to oxygen deficit also implies that to the effect of physical overload, white mice, rats, guinea pigs and rabbits were subjected for 14 days to a daily 6 hour stay in a low pressure chamber to pressures down to 281 mm Hg, or to acclimatization under mountain conditions (4000 m above sea level) for a month with or without physical exercise. Survival under stress was found to increase 2-3 fold for the experimental animals compared to controls. Active forms of adaptation (hypoxia combined with physical exercise) were more effective than passive. Change of the gaseous medium consisting in a decrease of partial oxygen tension to 65 mm with increase of CO_2 to 38 mm Hg increased rather than reduced the survival rate, while CO_2 addition under normal conditions had no effect. Adaptation of the animals to the pressure chamber, mountain conditions and changes in the gaseous medium was accompanied by increased hemoglobin and erythrocyte values. Addition of CO_2 to air with a low oxygen content slowed hematopoietic stimulation but the CO_2 effect on resistance was retained. A comparative evaluation of these factors permits the assumption that hematopoietic values exert no decisive effect on the mechanisms which increase the stability of hypoxia-adapted animals to the effect of over-exertion.

299.

AUTHOR: Vasil'yev, P. V.; Uglova, N. N.

ORG: none

TITLE: Effect of physical training of white mice under normal and low partial oxygen pressure on their resistance to transverse acceleration and hypoxia

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 248-255

TOPIC TAGS: mouse, training program, hypoxia, transverse acceleration, physical fitness, biologic acceleration effect

ABSTRACT: Tests were conducted in 380 mice subjected to static and dynamic training (on poles and in water) of varying intensity under mountain conditions or those in the plain and then exposed to accelerations of 45 units (twice for 10 min with a 10 min interval) or tested for resistance to gradually increasing hypoxia. In the first test series, two groups of animals underwent gradually increasing physical training on the poles for 30 days with a 10 g weight attached to the tail every day or every other day. Weight gains in both groups were satisfactory. The group subjected to daily training performed better on the centrifuge, i.e. survival exceeded controls by 27% compared to 15% survival for the first group. In the second test series, the mice underwent training on the poles and swimming at the same rates as the first series. These mice gained less weight than controls.

Table 6. Survival of trained mice and controls under gradually increasing hypoxia

Test series	Experimental conditions	M±m, min	t
I	control group	99±14.0	-
	trained by swimming for 30 days	162±10.4	3.15
	training on poles with a 10 g weight	140±17.4	1.69
II	control	107±0.65	-
	training on poles in Moscow	144±8.2	4.5
	acclimatization to 2100 m	114±3.5	1.96
	acclimatization and training on poles at 2100 m	151±7.5	5.84

302.

AUTHOR: Vinogradov, V. M.; Pastushenkov, L. V.; Frolov, S. F.

ORG: Department of Pharmocology/ Chief - Professor S. Y. Arbuzov/ Military Medical Academy im. S. M. Kirov, Leningrad (Kafedra farmakologii voenno-meditsinskoy akademii)

TITLE: Prophylactic and therapeutic application of electron-acceptor properties of hydroquinone for oxygen insufficiency

SOURCE: Farmakologiya i toksikologiya, v. 31, no. 2, 1968, 218-221

TOPIC TAGS: hydroquinone, hypoxemia, mouse, EEG, EKG, cat

ABSTRACT: The authors have studied the effect of hydroquinone on hypoxemia. In one series of experiments mice were placed in a pressure chamber and observed for length of survival. In another series asphyxia was achieved by submersion of mice in water for 55 seconds. The test group was given a subcutaneous injection of hydroquinone thirty minutes before the experiment. Survival rate of the test and control groups was compared. Effectiveness of hydroquinone was tested in rats where hypoxemia was accomplished by ligation of both carotid arteries. The response of cats to hydroquinone following hypoxemia of the brain was also studied. After introduction of electrodes into the frontal and occipital lobes of the brain the animals were given intravenous injections of dithilin, and artificial respiration was administered. After baseline EEGs and EKGs were taken, artificial respiration was discontinued for five minutes and then resumed. Repeated EEGs and EKGs indicated the gradual onset of asphyxia followed by normalization of respiration or death of the animal. Hydroquinone was injected intravenously within a half hour of resumption of respiration. In other experiments on cats a study was made of the reaction of the cardiovascular system to hydroquinone with artificially induced oxygen deprivation of the tissues. The results of all the experiments showed that hydroquinone had a prophylactic and therapeutic effect on hypoxemia of different origins, but due to its toxic qualities it should be considered a prototype of other equally active but more desirable substances of the same nature. Orig. art. has: 2 figures.

303.

AUTHOR: Voinova, I. I.

ORG: none

TITLE: Effect of hypoxia on vestibular analyzer function of rats

SOURCE: Kosmicheskaya biologiya i meditsina, v. 1, no. 6, 1967, 37-40

TOPIC TAGS: rat, hypoxia, vestibular function, altitude simulation, visual physiology, cerebral cortex, body temperature, breathing

ABSTRACT: Adaptation processes of animals to vestibular stimulation produced by rotation were studied in 23 experimental white rats immediately following a simulated ascent; seven white rats served as a control. The first group of 13 experimental animals ascended to a simulated altitude of 11,000-12,000 m in an altitude chamber (20-22°C) at a rate of 2 m/sec for 2 hrs; the second group of 10 experimental animals under the same conditions ascended at a rate of 25 m/sec for 8 min. Both groups remained at the 11,000-12,000 altitude for 5 min and then descended in 3 min. Immediately following the descent, the animals were fastened to a rotating platform and were rotated 25-30 times at 360 r/sec with intervals of 1-2 min. Duration and number of nystagmic movements were recorded on an electrocardiograph, with electrodes placed at the outer corners of the eyes. The eyes were shielded with a lightproof cover. Respiration rate was recorded to evaluate the sympathetic functions, and rectal temperature was measured every 5 min. The study data were statistically processed on a Setyn' electronic computer. Findings show that for the first group, nystagmus duration increased by 40% and the number of nystagmic movements by 30%; for the second group the figures were 70% and 45%, respectively. In the first group the vestibular somatic reaction was completely restored in 30-40 min, and duration of the nystagmus after the 9-13th rotation essentially did not differ from that of the control group. In the second group, restoration of nystagmus was slower and reaction of the pupils to vestibular analyzer stimulation remained high even after 70 min. The respiration rate of the first group tended to decrease compared to the control group, and the respiration rate of the second group increased by 30%. The respiration rate of both groups was restored to normal in 30-40 min. The rectal temperature of the first group dropped by 4-5° following descent, but changed very little in the second group. Considering that hypoxia first of all affects the activity of the central nervous system, it appears that the inhibiting effect of the cerebral cortex on the vestibular analyzer was weakened. Vestibular functional disorders are more markedly expressed with rapidly developed hypoxia (25 m/sec) than with more gradual hypoxia (2 m/sec). Orig. art. has: 3 figures. [06]

305.

AUTHOR: Yanvareva, I. N. (Leningrad); Kuz'mina, T. R. (Leningrad)

ORG: none

TITLE: Change of the electrical activity of the visual cortex and thalamus during hypoxia of the organism

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 427-429

TOPIC TAGS: hypoxia, experiment animal, thalamus, cerebral cortex, blood volume, anabiosis

ABSTRACT: Background electrical activity and the evoked potential of the visual cortex and thalamus in response to sensory stimulations during hypoxia caused by mortal blood loss were studied. Animals were bled from the femoral artery until clinically dead (5 minutes in all experiments) and reanimated by the V. A. Negovskiy method. Changes of evoked potentials before bleeding, during the approach of clinical death and in various periods of reanimation were compared. Electrical phenomena were correlated with autonomic reactions: respiration blood pressure and electrocardiogram. A light flash locally in the lateral convolution of the cortex and the external geniculate body usually resulted in positive-negative, but sometimes only positive or negative evoked potentials with brief latent periods, with definite limit of assimilation of rhythm, amplitude and length of phase. Activation of the electrical activity of the cortex and the external geniculum occurred in most experiments at the beginning of bleeding. Increasing hypoxia led to progressive slowing of inhibition of the background electrical activity, and the evoked potentials and the background electrical activity disappeared before the evoked potentials, which decreased in amplitude at that time. Evoked potentials from the external geniculate body are maintained longer during dying than in the visual cortex, showing the thalamus to be more resistant to hypoxia than the cortex. During reanimation, evoked potentials appear first in the external geniculate body. Evoked potentials are reestablished with the positive phase in most experiments, but sometimes have a positive-negative phase with the amplitude of the positive four times that of the negative phase. Evoked potentials are reestablished later in the arterial cortex and the amplitude is less than in external geniculate body. Evoked potentials of the visual cortex and external geniculate body return to the initial level within 60-120 minutes, depending on the length of dying. An inversion of sign of the evoked potential of the visual cortex compared with the sign of the evoked potential registered before bleeding was seen in some experiments in both the dying process and the process of reanimation. This procedure was inhibited by 1% solution of GAMK and was increased somewhat by aminazine injection (4 mg/kg). This indicates the negative evoked potentials are a reaction to specific impulsation entering the cortex.

306.

AUTHOR: Yusupova, N. Ya. (Frunze)

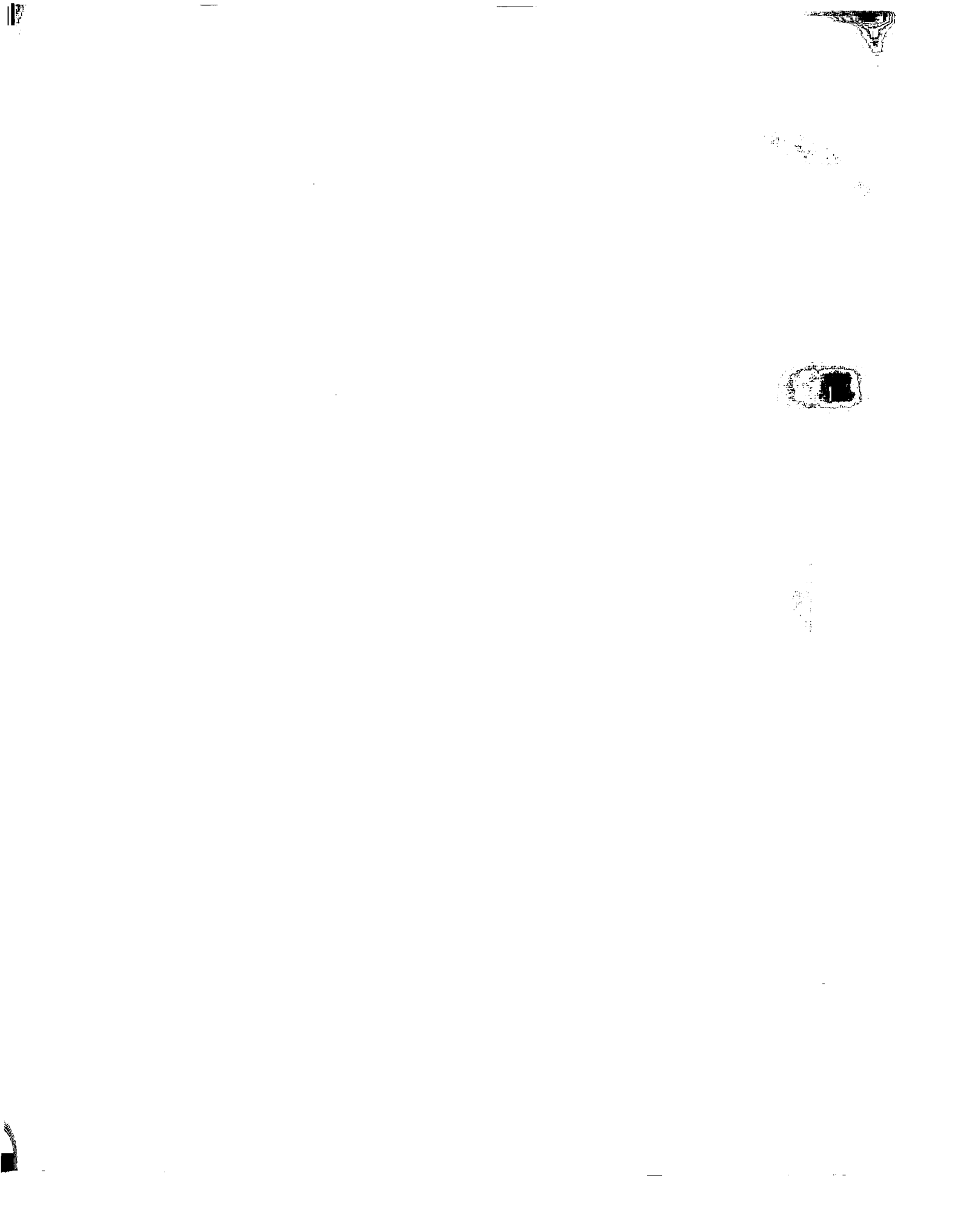
ORG: none

TITLE: Hemopoietic activity of the blood during ventilational and circulatory forms of hypoxia

SOURCE: Konferentsiya fiziologov Sredney Azii i Kazakhstana, 3d, Dushanbe, 1966. Materialy. Dushanbe, 1966, 423-424

TOPIC TAGS: hypoxia, man, blood, pulmonary disease, blood circulation

ABSTRACT: The hemopoietic activity of the blood serum of 11 healthy persons, 25 persons with lung diseases (chronic pneumonia with diffuse pneumosclerosis, severe bronchial asthmas) and 22 persons with rheumatic mitral cardiac defects was studied. An increase of hemopoietic activity of the serum was observed in one-third of the patients with varying degrees of circulatory and ventilational hypoxia. Activity of the serum during ventilational hypoxia increased by plus 196% with variations from plus 9 to plus 561%; during circulational hypoxia it increased to plus 150% with variations from plus 11 to plus 344%. There appeared to be a connection between the serum activity and the percent of oxygen saturation of arterial blood: patients with oxygenation of blood from 90% and lower most often showed high serum activity. In these patients the serum activity was reduced, with its decrease being registered equally after both ventilational and circulatory hypoxia. No correlation was established between oxygenation of the blood and serum activity on one hand and the quantity of erythrocytes, hemoglobin, and reticulocytes, and the maturity index of erythrocytes on the other. Patients with ventilational deficiency sometimes revealed erythrocytosis and an increase of quantity of hemoglobin. The absence of hyperglobulia in most patients may be connected with the effect of the pathological process on hematosis. An improvement of the general condition of patients led to a decrease of indications of decompensation of increased serum activity. These data indicate polyglobulia and an increase of serum activity are universal reactions observed during hypoxia due to altitude and also during ventilational and circulatory hypoxias. This reaction may be inhibited or extinguished by the pathological process, causing ventilational or circulatory hypoxia.



309.

AUTHOR: Zhironkin, A. G.; Troshikhin, G. V.

ORG: none

TITLE: Central nervous system function and gas exchange during prolonged exposure of animals to a hyperoxic helium environment

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 208-212

TOPIC TAGS: hyperoxia, environment test facility, helium, helium oxygen atmosphere, artificial atmosphere, central nervous system, conditioned reflex, gas exchange

ABSTRACT: A study was made of CNS functions (development of conditioned reflexes) and of gas exchange in 60 male white mice exposed to helium-oxygen (60% O_2), nitrogen-oxygen (60% O_2), and standard atmospheres for 20 days. The three groups (two experimental and one control) were confined in hermetic chambers automatically supplied with the appropriate gas mixture at a temperature of 19–21°. The conditioned reflex stimulus was a light, followed by an electric shock delivered through half of the floor of the cage; the conditioned response was running to the opposite side of the cage when the light appeared. The reflex was considered to be established when an animal made ten consecutive correct responses. It was found that the reflex was established most rapidly in the control groups (7 days). An average of 11 days was required by the oxygen-nitrogen group, and 12 days by the helium-oxygen group. This difference between the two experimental groups was, however, statistically unreliable. In the case of the helium-oxygen atmosphere, the delay in development of conditioned reflexes may be related to the high thermal conductivity of helium, which causes cooling of the animal. For the nitrogen-oxygen atmosphere, the explanation is based on previous observations of decreased conditioned-reflex activity observed in dogs exposed to oxygen-rich (60% O_2) atmospheres. Gas exchange was also found to be increased in the experimental groups, though it was less expressed in the nitrogen-oxygen group. Again, the effect in the helium-oxygen group is attributed mainly to the thermal conductivity of helium. The thermal conductivity of oxygen may also be a factor, as the thermal conductivity of oxygen is somewhat greater than that of air. It is concluded that both helium and oxygen tend to stimulate gas exchange rate, and that further research is necessary to determine the exact mechanisms of these phenomena. Orig. art. has: 2 figures. [EL]

310.

AUTHOR: Zolotukhin, A. N. (Lieutenant Colonel, Medical Service)

ORG: none

TITLE: Combined effect of low carbon monoxide concentrations and hypoxia on the visual analyzer

SOURCE: Voyenno-meditsinskiy zhurnal, no. 4, 1968, 60-64

TOPIC TAGS: man, spatial perception, carbon monoxide toxicity, hypoxia, flight physiology, aircraft cabin environment, visual perception

ABSTRACT: Two series of tests were conducted in 10 healthy young men at rest in a pressure chamber simulating ground conditions or 3500 m height, who were exposed for three hours to the effect of 0.03 or 0.01 mg/liter CO, then underwent performance tests. The window of the taxistoscope and other testing instruments were lighted with 150 lux. Carboxyhemoglobin (COHb) was measured in the blood at the beginning and end of each test. After the effect of the first concentration under ground conditions, perception accuracy of spatial distribution and the visual perception rate were reduced; such impairment was more pronounced at heights. Performance tests gave poor results, revealing reduced concentration during prolonged uniform activity, impaired spread of attention over several objects and doubling of errors at the end of the test compared to the beginning, while overall productivity remained unchanged. Night vision decreased for both air pressures. COHb content increased under 0.03 CO from 0.72 to 2.5% both on the ground and at heights, but its adverse effect on the visual analyzer was more pronounced at heights. In the second series with a lesser CO concentration, taxistoscopic changes were insignificant on the ground, significant at heights. Performance tests revealed little deviation from normal, nor was night vision significantly affected. COHb levels in the blood increased after 3 hours CO but caused no changes in visual analyzer function on the ground and insignificant changes at heights. It was concluded that flight personnel should not be exposed for 3 hours to a CO concentration of 0.01 mg/liter and that CO content should be monitored constantly, particularly in parts of the cabin which are not hermetically closed. Orig. art. has: 4 tables.

SECTION 11. MEDICAL MONITORING AND BIOTELEMETRY

311.

AUTHOR: Barnatskiy, V.N.; Kuznetsov, A.G.

ORG: none

TITLE: Sympathetic phenomena during motion sickness

SOURCE: Kosmicheskaya biologiya i meditsina, v.2, no. 1, 1968, 49-53

TOPIC TAGS: vestibular apparatus, motion sickness, sympathetic nervous system, dog

ABSTRACT: The authors' objectives in this investigation were: 1) to study the motor activity of the stomach during the development of motion sickness; 2) to study the motor activity of the dog's stomach during adequate stimulation of the vestibular apparatus accompanying altered functional conditions of the proprioceptive, visual, and interoceptive analyzers; 3) to explain the physiological role of the upper cervical sympathetic ganglia in the development of motion sickness; 4) to determine the effectiveness of administration of sodium bicarbonate to prevent motion sickness. The experimentation involved 12 dogs, three of which were desympatectomized. Adequate vestibular stimulation was achieved by rotation of the animals (20 min; angular acceleration 2.5 ± 0.25 sec $^{-2}$; tangential 0—0.1G radial 0—0.3G) and by rocking (±0.3 G in 2 sec). Electrical activity of the stomach muscle and nerves, and the passage of liquid from the stomach to the duodenum were studied before, during, and after exposure to acceleration. It was found that animals were more susceptible to motion sickness in the dark than under illumination, when suspended than when standing normally on the feet, and when the chemoreceptors of the stomach are exposed to acid substances than to basic. It was also found that desympathectomized animals were more susceptible to motion sickness than intact animals. Administration of sodium bicarbonate was found to increase resistance to motion sickness, probably as a result of some as-yet-unexplained effect on electrolyte metabolism. Orig. art. has: 3 figures. [EL]

312.

AUTHOR: Chervyakova, T. S.; Tyazhelov, V. V.

ORG: none

TITLE: Miniature telemetric device for electromyographic transmission

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 2, 1968, 55-58

TOPIC TAGS: biotelemetry, telemetry transmitter, electromyography, rat, miniature radio equipment

ABSTRACT: To obtain a small transmitter for a one-channel biotelemetric system, a 3-point induction generator with 2 semiconductor triodes (TM-4) was chosen. Frequency was modulated by voltage changes in the emitter. The scheme is shown in Fig. 1. It measured 15 x 10 x 3 mm without generator, volume was 0.5-0.6 cc, and weight 1.2 g. The transmitter was used with a standard receiver, placing the antenna at a 1-3 m distance from the transmitter. The latter's frequency is somewhat affected by nearby articles, but if an automatic frequency control (1-2 sec contant time) is included,

Figure 1. Basic electric scheme of the transmitter.
T_1, T_2 - triodes; C_1 = 2 microfarads; C_2 = 3,000 picofarads; C_3 = 40 picofarads; C_4 = 20 picofarads; R_1 = 90 kilo ohms; R_2 = 1.6 kilo ohms; R_3 = 80 kilo ohms.

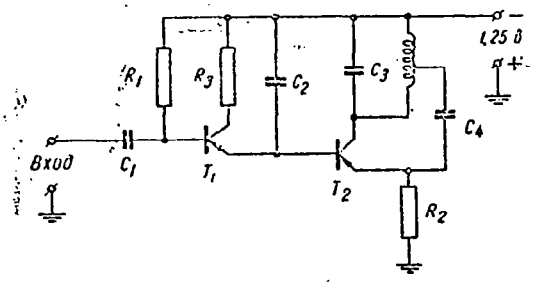
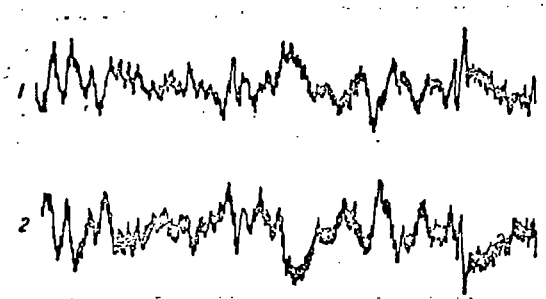


Figure 3. Comparative EMG of muscle in the rat hind leg.
1) direct; 2) telemetric



recording is reliable. Figure 3 shows comparative electromyograms of a rat leg. The apparatus has the following parameters; for EMG biopotential: carrier frequency 22 mHz, initial resistance 350 ohm; frequency band 1-300 Hz; range 0.015-4 mvolt; weight with energy source 2 g; energy requirement 0.4 mwatt; range of action 3.5 m; duration of uninterrupted working capacity 5 days. Orig. art. has: 3 figures and 1 table.

313.

AUTHOR: Gazenko, O. G.; Maksimov, D. G.; Yeliseyenkov, Yu. B.

ORG: none

TITLE: Some results of medical biological investigations made in accordance with the "Mercury" and "Gemini" programs

SOURCE: AN SSSR. Izvestiya. Seriya biologicheskaya, no. 2, 1968, 204-217

TOPIC TAGS: space flight biologic effect, aerospace medicine, astrobiology, astronaut training

ABSTRACT: Medico-biological investigations on the effect of space flight factors on man and animals had been started in the United States long before the implementation of the Mercury program. The life support systems and the boundaries of physiological shifts under conditions of suborbital and orbital flights in the Mercury spacecrafts have been tested on apes. In the following six experiments conducted in the very same craft (1961--1963), the possibility of man's staying in space for 1--5 days in the capacity of a pilot, engineer, or

experimenter has been shown. In 10 experiments conducted in accordance with the Gemini program (1965--1966) the possibility of a two-man team staying in space for 8 and 14 days, i.e. throughout a period adequate for a flight to the Moon and re-entry onto the Earth has been demonstrated. Changes in the astronauts bodies have not proved to be of a dangerous nature, and have been even less than those observed during the 4 and 8th day of flight. However, some medico-biological problems connected with the prolonged staying of man in space remained unsolved. The main problems include inadequate sleep, deficit of water consumption, disorder of routine defecation regimen, hypostatic hypotony, and some hematologic and biochemical changes observed in the human organism. The Gemini program provided for a further development of the experience accummulated by the Soviet cosmonaut A. Leonov on leaving the space ship and conducting operations in open space. It has been shown that physiological changes in astronaut's bodies are quite permissible, but further careful study of man's limitations for conducting labor operations and resting in open space has been deemed necessary. Orig. art. has: 4 figures and 3 tables. [Author's abstract] [NT]

314.

AUTHOR: Gazenko, O. G.; Gurfinkel', V. S.; Malkin, V. B.

ORG: none

TITLE: Electroencephalographic investigations in cosmic medicine

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy kosmicheskoy biologii, v. 6, 1967, 83-92

TOPIC TAGS: man, EEG, electroencephalography, cosmic medicine, cosmonaut selection, cosmonaut training, biologic acceleration effect/(U)Vostok 3 manned spacecraft, (U)Vostok 4 manned spacecraft

ABSTRACT: Practical aspects of applying electroencephalography in evaluating the functional state of the central nervous system of cosmonauts are discussed. Extensive studies and use have been made of EEG data in the selection of individuals. For example, the dynamics of an individual's orienting reaction, recorded by depression and recovery of the alpha-rhythm, are indicative of the subject's emotional reactivity: delayed extinction of the orienting reaction is an objective indication of emotional instability. After extinction of the orienting reaction, the EEG is relatively stable (10-15% fluctuation) and is

therefore a valuable element of the physiological characteristics of an individual. The EEG can be used in conjunction with functional tests on hyperventilation, hypoxia, vibration, and radial and angular accelerations to help detect high sensitivity to hypocapnia or to determine endurance to other factors of different flight conditions. Detailed studies of changes in brain bioelectric activity under acute hypoxia have established phasic changes in the EEG revealing depth of the hypoxic condition. Two different changes in EEG portraits have indicated different mechanisms of the effect of oxygen insufficiency to the central nervous system. The EEG can be used during cosmonaut training for increased gravity, vibration, and acceleration: 1) as an index of an individual's resistance to the given functional stresses and his ability to adapt; and, 2) to determine the significance of changes associated with isolated effects of individual dynamic flight factors. Mechanisms of the EEG phasic changes are under investigation in studies directed to determining the bioelectric activity of different brain structures and comparing activities of different central nervous system formations and activities of the individual cellular elements of these formations. Although basic physiological mechanisms have not been determined yet, the EEG is one of the most informative parameters for constructing systems for observations and medical control under cosmic flight or other extreme conditions. Electroencephalographic investigations during the Vostok flights showed telemetric EEG registration during flight is possible, but further work is needed, especially on a system of electrode fixation. EEG recordings during the Vostok-3 and Vostok-4 flights showed no changes beyond normal limits. Three aspects of EEG application in cosmic medicine are stressed: 1) for selection and training; 2) for determining development of pathological conditions in the cosmonaut and automatically signaling such information in the ship and to ground stations; and, 3) to evaluate the level of the cosmonaut's wakefulness and sleep during flight.

315.

INVENTOR: Golovko, Yu. P.; Rulik, I. I.

ORG: none

TITLE: Electronic device for studying the reaction of a human organism. Class 30, No. 215405

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 13, 1968, 61

TOPIC TAGS: medical equipment, human physiology

ABSTRACT: This Author Certificate introduces electronic equipment designed for the study of reactions of a human organism. To eliminate the mechanical connections between the components of the device with the organism, use is made of a high-frequency contactless movement-pickup unit for converting the organisms reactions to an electric signal. [Translation of patent abstract] [WA-MIO-69-3] [LD]

316.

AUTHOR: Kalinovskiy, A. P.

ORG: none

TITLE: Systems for processing physiological information in space research

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 76-82

TOPIC TAGS: biologic computer, space physiology, space flight biologic effect, digital computer system, electronic data processing

ABSTRACT: Distortions and errors tend to show up in biotelemetered information from space due to technical difficulties or transmission interference. Thus, it is necessary to devise optimum methods for consolidating transmitted physiological data for immediate automatic processing and analysis on board the space ship. Results of detailed medical examinations in space and on the ground may be best analyzed with electronic computers, and especially by electronic digital computers. When direct storage of information into the computer is impossible or impractical, data may be recorded on an intermediate storage device such as automatic paper tape recorders, film, photopaper of loop oscillographs, punched tape and punched cards. This information is then converted into electrical signals and stored in the memory unit of the computer. An outline of a general scheme for automatic processing of physiological information

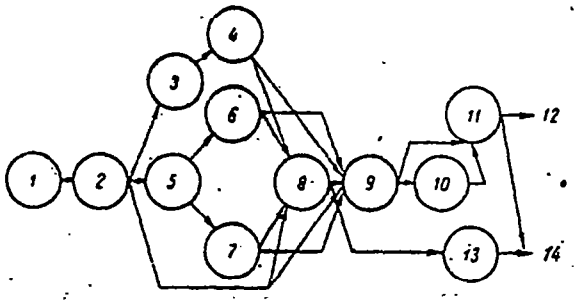


Fig. 1. Scheme for automatic processing of physiological information

1 - Biological object; 2 - pick-up and amplification; 3 - magnetic registration; 4 - read-out from the magnetic storage unit; 5 - graphic registration; 6 - automatic computation; 7 - semiautomatic computation; 8 - preliminary processing; 9 - conversion into numerical data; 10 - recording on intermediate storage device; 11 - machine processing; 12 - results of processing; 13 - logical analysis during monitoring; 14 - results of monitoring

appears in the accompanying figure. Physiological parameters obtained from the biological object (man, animal) are converted into electrical signals and amplified by the pick-up and amplification equipment (2). The data may then be registered and processed by different methods, depending on design of existing processing systems. Nine possible courses for designing automatic systems for processing information are illustrated and briefly described. Orig. art. has: 1 table and 9 illustrations.

[XF]

317.

AUTHOR: Komendantov, G. L.; Kopanev, V. I.

ORG: none

TITLE: Motion sickness as a problem of space medicine

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 331-338

TOPIC TAGS: motion sickness, space medicine

ABSTRACT: Motion sickness during spaceflight has been observed in several Soviet cosmonauts, and has received considerable scholarly attention from space-oriented medical scientists for some time. The physiological bases for the development of motion sickness in spaceflight have been found to differ from those involved in terrestrial motion sickness, as is shown in the table.

Table. Basic physiological mechanisms of motion sickness under terrestrial conditions and during weightlessness. (In order of importance)

Terrestrial conditions	Weightlessness
Reflex mechanisms	Disturbance in functional interaction of analyzers
Conditioned-reflex mechanisms	Weakened reciprocal influence of otolith organ on function of semicircular canals
Disturbance in functional interaction of analyzers	Coriolis accelerations
	Conditioned-reflex mechanisms

Adaptation to weightlessness (and hence disappearance of motion sickness) occurs as a result of development of new functional interrelationships among the analyzer systems. A number of methods of prophylaxis of motion sickness in cosmonauts are mentioned: 1) selection of subjects on the basis of suitability for spaceflight as shown by tests of statokinetic stability; 2) training methods to improve statokinetic stability and nervous system "plasticity"; 3) development of optimal physiological and hygienic conditions in spacecraft cabins; 4) use of pharmacological agents to increase work capacity and vibration resistance, as well as NS stimulants to increase nonspecific resistance; 5) further improvement of cabin design to facilitate orientation during weightlessness and to increase stability during flight; and 6) organization of optimal work-rest regimes. Orig. art. has: 1 table. [WA-22] [EL]

318.

AUTHOR: Parin, V. V. (Academician)

ORG: none

TITLE: The cosmos and mankind

SOURCE: Priroda, no. 11, 1967, 29-32

TOPIC TAGS: cosmology, social structure, astronautics

ABSTRACT: The extensive publicity given to accomplishments in astronautics does not accurately reflect the real dangers to which cosmonauts are exposed during all stages of flight, nor does it reflect the difficulties overcome daily by specialists in the field. The losses encountered, as in the heroic death of Vladimir Komarov and the tragedy at Cape Kennedy, cannot stop the progress of mankind; on the contrary, they call for unison of forces and still greater persistence. Territorial rights for any one side do not exist on the moon or in space. Mastery of space is of significance to mankind, serving to bring nations together so mankind can act as a unit. The International Committee for the Study of Cosmic Space now serves as an international tribunal for exchange of scientific information in all disciplines associated with the mastery of space. The development of astronautics has resulted in a whole series of new disciplines, new equipment, and technological processes. Some recent advances in biology and medicine resulting from astronautics may save the lives of many people. This aspect of cosmic investigations was brought out by President Kennedy shortly before his death. Although his objective was to increase financing for the U. S. space program, the general humanitarian nature of space investigations was still emphasized. Man needs to adapt biologically to the atmospheric, gravitational, and ecological conditions of space, but the effect of the cosmos on his psychological and social organization is even more important. Mastery of space provides new impetus for development of mankind as a biological system, and new stimulus for development of human civilization. We are nowhere near the stage of inhabiting all the solar system as envisioned by cosmonautics founder K. E. Tsiolkovskiy, but present space achievements indicate man's foresight and readiness for such effective activity. The cybernetic man is not considered an antihuman project, but rather an auxiliary--mastering space is not a case of man or automaton, but man and automaton. French Professor Louis Armand's proposal to send man and provisions on a nonreturn trip to the moon is a new exotic type of suicide, contrary to the basic principles of humanism. Advances since 1959 indicate a round trip to the moon may be soon possible. [06]

319.

AUTHOR: Parin, V. V.; Bayevskiy, R. M.; Nefedov, Yu. G.

ORG: none

TITLE: Principles of medical monitoring during prolonged spaceflight

SOURCE: Kosmicheskaya biologiya i meditsina, v. 2, no. 4, 1968, 57-58

TOPIC TAGS: manned space flight, diagnostic medicine, computer medical diagnosis, biotelemetry, biomedical monitoring

ABSTRACT: Extended spaceflights require the development of a new methodology for medical monitoring; conditions require that the monitoring system be autonomous, and that it have the capacity of not only diagnosing but also of prognosing medical events. An on-board computer will be an obvious necessity, as will be algorithms by which the condition of the crew and the life-support system may be evaluated; self-teaching algorithms appear particularly promising for this application. During extended flights, it would be desirable to carry out a detailed medical examination once a month, and an evaluation of the condition of major systems every 7--10 days, while basic indices such as pulse, respiration, and body temperature would be monitored every 3--6 hr. Codes will have to be developed to facilitate communication by the on-board physician with doctors on Earth. Existing methods of medical monitoring will have to be modified for maximum simplicity and dependability. More concretely, a chair with built-in ballistocardiograph pick-ups has been designed to allow monitoring of cardiovascular functions, respiration, and motor activity. Dielectric devices have been included in the clothing to record circulatory and respiratory activity, and experiments are being made with telemetrically recorded seismocardiographs for on-board monitoring. Methods are also being developed for evaluating coordination and psychological condition based on handwriting. Biochemical methods involving analysis of urine and saliva are being studied; saliva is especially useful in studying not only humoral factors related to metabolism, electrolyte balance, and hormone and enzyme activity, but also neuroendocrine regulation and immunobiological reactivity. With regard to the cabin environment, fast methods of determining the level of bacterial contamination must be developed. Finally, before extended flights can take place, ways must be found of predicting and identifying all types of pre-critical medical situations. [EL]

320.

AUTHOR: Parin, V. V.; Zakrzhevskiy, Ye. B.; Bayevskiy, R. M.

ORG: none

TITLE: Clinical aspects of interplanetary flights

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 25-28

TOPIC TAGS: space medicine, interplanetary flight, computer medical diagnosis

ABSTRACT: Illnesses occurring during interplanetary space flights may be divided into three categories: 1) those attributable to living conditions (hygiene, diet, way of life, psychological factors); 2) those caused by space flight factors (cosmic radiation, magnetic fields, weightlessness); and 3) those related to endogenous factors (auto-infection, disturbance of nervous or endocrine function). A great deal of medical planning and research will be necessary in preparation for manned interplanetary flight, and a doctor will have to be included in the crew. In view of the many medical problems which could occur during such flights, complex mathematical analysis will have to be made to determine the probabilities for the appearance of all the possible medical situations. To simplify matters, a diagnostic approach based on syndromes rather than specific diseases is suggested, as is the development and perfection of diagnostic algorithms. The interplanetary ship will have to carry a complete arsenal of automated medical equipment, including that required for reanimation. The position of the doctor on board will be a demanding one; while he could not be expected to have specialized knowledge of every relevant medical field, he will have to be thoroughly competent in diagnosis and treatment of the illnesses which may develop, and in the use of the instrumentation available to him. [WA-22] [EL]

321.

AUTHOR: Presman, A. S.

ORG: none

TITLE: Electromagnetic fields and space biology

SOURCE: Electromagnetic fields and living nature (Elektromagnitnyye polya i zhivaya priroda). Moscow, Izd-vo "Nauka", 1968, 250

TOPIC TAGS: electromagnetic biologic effect, space medicine

ABSTRACT: Until now, spaceflights were conducted at relatively small distances from the earth where natural electromagnetic fields are only somewhat weaker than the terrestrial, but future flights might transport living organisms out of range of terrestrial electromagnetic fields. The question of how this condition will affect the vital processes of living organisms still remains open, although an experimental 10-day stay under condition of a compensated terrestrial electromagnetic field caused no significant physiological changes except for reducing the threshold frequency of resolving flicker fusion. Another problem arises from the possible influence of strong magnetic fields used for protection from cosmic rays. The influence of weak magnetic fields of cosmic origin, whose periodicity of changes differs from the terrestrial, is also unknown. Terrestrial electric fields and electromagnetic fields of the atmosphere will also be absent in such flights. Experimental data on the effects of natural electromagnetic fields on living organisms indicate that all these problems cannot be discarded as unimportant. [WA-MIO-69-1] [EF]

322...

AUTHOR: Volynkin, Yu. M.; Parin, V. V.; Yazdovskiy, V. I.

ORG: none

TITLE: Initial data on physiological research during manned spaceflight

SOURCE: Mediko-biologicheskiye issledovaniya v nevesomosti (Medico-biological studies of weightlessness). Moscow, Izd-vo "Meditsina", 1968, 23-24

TOPIC TAGS: man, cosmic medicine, biologic weightlessness effect

ABSTRACT: This is an introduction to a series of articles on physiological investigations during spaceflight. Three stages of preparation for spaceflight are mentioned: selection of cosmonauts, their testing under various stresses, and finally their preparation and training. Since objective indices for determining the state of man under various factors had been established, the Gagarin and Titov flights were under medical telemetric monitoring. Data showed normal respiratory and cardiovascular reactions during acceleration and weightlessness, good tolerance of acceleration and deceleration, retention of ability to perform complex coordinated movements. There were possible vestibulo-autonomic shifts, without physiological discomfort, and ability to work was retained. These flights are the start of a new experimental era of space medicine in which the effects of prolonged stays in space can be evaluated. [WA-22]

323.

AUTHOR: Yaroshenko, G. L.; Terent'yev, V. G.; Chichkin, V. A.

ORG: none

TITLE: Medical provisions in prolonged cosmic flights

SOURCE: AN SSSR. Problemy kosmicheskoy biologii, v. 7, 1967. Rabochaya deyatel'nost', voprosy obitayemosti i biotekhnologiya (Operational activity, problems of habitability and biotechnology), 439-442

TOPIC TAGS: space medicine, space medicine equipment, probability distribution, Poisson distribution

ABSTRACT: Based on morbidity data collected during a polar expedition in the antarctic and using Poisson's distribution, the probability (R_1) of 14 diseases was calculated for a space crew of up to 15 people and a flight of up to 12 months.

$$R_1 = 1 - e^{(n \cdot \lambda_i \cdot \tau)},$$

is the main formula, where n is the number of crew members, λ_i the statistical probability of occurrence of the given disease, and τ the time. For a crew of e.g. three and a 3 months flight, the probability of cardiac disease would be a low 0.12. Such an approach should favor: a) anticipation of the most probable dysfunctions and the probable time of their appearance; b) provisions for suitable medication; c) evaluation of cosmonauts' training for medical aid in flights of varying duration and for a numerically differing crew; d) determination of conditions under which the presence of a physician on board would be required. This approach may also prove useful for creating optimal medical conditions for expeditions of any kind. Orig. art. has: 1 table.

SECTION 12. EXOBIOLOGY AND SPACECRAFT STERILIZATION

324.

AUTHOR: Imshenetskiy, A. (Academician)

ORG: none

TITLE: Exobiology: methods and problems

SOURCE: Nauka i zhizn', no. 4, 1967, 54-63

TOPIC TAGS: exobiology, extraterrestrial life, cosmos, contamination

ABSTRACT: Present studies in the new discipline of cosmic biology are discussed: 1) study of the effect of cosmic factors on living things, 2) examination of planets and meteorites from the biological standpoint, 3) working out methods for trying to observe life on planets and in space, and 4) prevention of transfer of forms of life from the earth to other planets. Effects of cosmic conditions--vacuum, ionizing radiation, low temperature, UV irradiation--on living things, and microorganism ability to withstand all these factors (except UV, but even this can be masked) are discussed. Studies on an artificial Mars show some cultures not only can exist, but can multiply slowly under such conditions. The upper limit of the biosphere, especially with respect to microorganisms, has not been established. Interplanetary transfer of life, by air currents from the earth or by cosmic dust to the earth, is examined. Methods for microbiological analyses of meteorites are under development at the Institute of Microbiology AN SSR. Findings thus far indicate no life brought in by meteorites--the microorganisms found are believed to have entered into meteorite pores from the surrounding soil. Methods for sterilizing space craft to prevent contamination of space are under examination--prolonged heating at 105°, ionizing irradiation of equipment that cannot be subjected to heat treatment, and gas sterilization. The presence of the same chemical elements and radicals in space and of some organic materials in carbonaceous chondrites is pointed out not as definite proof of extraterrestrial life, but as the result of chemical evolution preceeding life on earth and possibly in space. Methods for observing extraterrestrial life are under development. The prime method is the observation of growth and multiplication of living materials, as by the Gulliver apparatus. Other methods of observation may be based on measurements of optical activity, luminescence, and mass spectrometry or microscopy. The possibility of existence of life in a form more simple than microorganisms is mentioned, as is the hypothesis that life on other planets may be on another basis than it is on earth (not based on carbon, but maybe on silicon or germanium, with sulfur instead of phosphorus as the source of energy, and ammonia or glycol as solvent). The need for a biological laboratory on a planet surface to obtain information on extraterrestrial life is indicated. Orig. art. has: 9 figures.

325.

AUTHOR: Lozina-Lozinskiy, L. (Doctor of biological sciences)

ORG: none

TITLE: Mars on Earth [Exobiological experiments]

SOURCE: Pravda, no. 306, 1 Nov 68, p. 3, cols. 4-7

TOPIC TAGS: exobiology, test chamber, environment simulation, biologic ecology, space biologic experiment

ABSTRACT: The possibility of life on Mars or other planets led scientists to investigate the survival possibilities of simple organisms in conditions similar to Martian atmosphere. Experiments with atmospheres consisting mainly of nitrogen proved that although most microorganisms died, some lived and even reproduced in these conditions. No significant changes in the survival rate of microorganisms were observed when nitrogen was replaced by CO_2. Later, a special exobiologic low pressure chamber (of 18 ℓ volume) called "Fotostat" was constructed in which conditions of space can be simulated more exactly and automatically. It was observed that bacteria, and even protozoa which require oxygen, survive in an atmosphere which contains 0.0005—0.0002% oxygen and has 0.01 atmospheric pressure. This means that an oxygen content 4—5 million times smaller than that of a terrestrial atmosphere is sufficient for their survival. Experiments performed in the "Fotostat" showed that the main obstacle for reproduction is the shortage of humidity rather than gas composition, temperature, or radiation. These observations suggest that, considering the adaptability of unicellular organisms, the unfavorable conditions on Mars do not exclude the possibility of the existence of life similar to terrestrial. Future experiments will include the modeling of conditions on other planets in the "Fotostat." [WA-22] [EF]

326.

AUTHOR: Troitskiy, V. (Professor; Doctor of physico-mathematical sciences)

ORG: none

TITLE: The search for signals of extraterrestrial civilizations

SOURCE: Aviatsiya i kosmonavtika, no. 9, 1968, 56-61

TOPIC TAGS: radio astronomy, radio signal, long range signal, extraterrestrial life

ABSTRACT: This is the last of a series of articles on this subject in the present periodical. The main objective of the author appears to be to stimulate interest in radiation from outer space as a possible form of communication from extraterrestrial civilizations. He outlines some of the possible and essential characteristics of such signals. There should be no doubt of its artificial origin, of course, to distinguish it from all natural phenomena. Monochromatic signals would appear most likely, with modulation differing from natural forms. If the distribution of field strength is not Gaussian, special attention should be given it. Dimensions of the source should be considered. Large bodies occupy but a small angle of arc at great distances, but the size of the emitter may be effectively enlarged by use of entire orbit, reflections, and the like, and observers should keep this in mind. It is stated that we can now transmit signals to distances of 1000 light years. Others may do as well, or better. Within a sphere of this diameter, with our system at the center, some 10^7 celestial objects may be present. Receivers with appropriate filters should be set up in large numbers to examine the possibilities. Radio frequencies appear most likely, but others, such as IR, should be investigated. Orig. art. has: 1 table.

327.

AUTHOR: Troitskiy, V. (Professor; Doctor of physico-mathematical sciences; Director)

ORG: Gorkiy Scientific Research Institute of Radio Physics (Gor'kovskiy nauchno-issledovatel'skiy radiofizicheskiy institut)

TITLE: The search for signals of extraterrestrial life

SOURCE: Aviatsiya i kosmonavtika, no. 8, 1968, 77-80

TOPIC TAGS: extraterrestrial life, long range signal, radio signal, galaxy, star

ABSTRACT: Investigations of Venus indicate that it not only supports no civilization but it supports no simple life forms either. However, the author believes it foolish to think life should be confined to our planet. At least 10^{10} galaxies offer possibilities of life. If we consider life to evolve in systematic relation to evolution of the physical universe, then we should look for celestial bodies approximately the same age as our earth (3—4 billion years). Stars that offer greatest promise belong to spectral classes F, G, or K. Periodic displacements of many stars in these classes (perhaps half) indicate the presence of planets. On the basis of the lowest estimation of civilized life on earth (10,000 years), perhaps 100,000 star systems may fall within the age group to possess civilizations. On the basis of the maximum estimation of civilized life on earth (1,000,000 years), the number of star systems with possible civilizations is 10,000,000. Possible methods of establishing contact are considered: 1) interstellar manned flights; 2) sending automatic stations to other star systems; 3) detecting and transmitting electromagnetic signals. Only the last seems practical at the present time. Background noise is considered to be the chief obstacle to transmission of intelligent signals across interstellar space. Wavelengths of 50—70 cm offer most promise. Laser transmission at present appears less feasible than radio transmission. Available power is considered in view of an extrapolated rate of development. Civilizations no older than ours are thought to have similar power restrictions ($3 \cdot 10^{12}$ watts), but with development may reach 10^{36} watts.

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