

## GRAVITATIONAL STRESS INNOVATIVE TREATMENT METHODS

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**Annotation:** *In connection with the deepening of understanding of the cellular mechanisms of hypoxia under chronic extreme exposure, as well as due to the success of pharmacology in the creation of new effective antihypoxants, it seems interesting and practically significant to study in an experiment the possibility of their use to optimize the adaptation syndrome caused by chronic hypergravity. Nutrition and living conditions of animals of all groups did not differ. At the end of the experiment, 14 days after the last extreme exposure, the animals were taken out of the experiment with ether vapors, and then the material was taken for conventional laboratory, biochemical and immunological studies.*

**Key words:** *gravitational stress, chronic hypergravity, hypoxia, adaptation syndrome, antihypoxant, pharmacooptimization of adaptation syndrome.*

The performed study fully complied with ethical standards and was carried out in accordance with the current rules for conducting work using experimental animals and was approved by the ethical committee of the International Academy of Sciences of Ecology, Human Safety and Nature (protocol No. 2 dated May 12, 2021).

The significance of differences in the mean values of independent samples was assessed using the parametric Student's test with a normal distribution law and the nonparametric Mann-Whitney test with a difference from the normal distribution of indicators. The test for normal distribution was evaluated using the Shapiro-Wilks test.

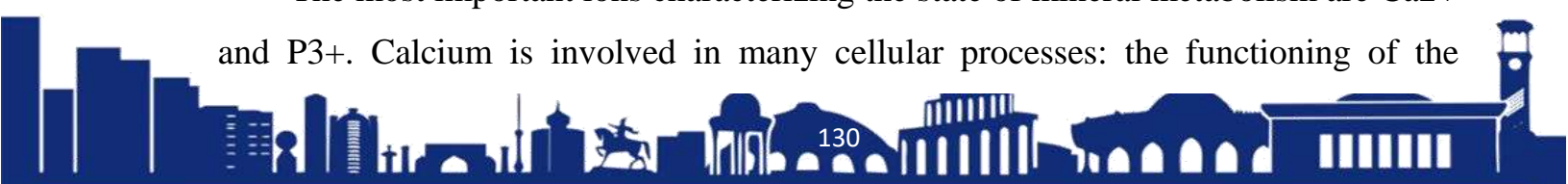
It was established that under chronic gravitational influences in the leukocyte formula of experimental animals (series 2 and 3) there were no significant differences compared to laboratory animals of series 1, that is, a group of intact animals.

The polysystemic blood reaction is known as the hematological stress syndrome, which is defined as a hematological response to tissue failure of various nature. Ideas about the general adaptation syndrome are largely associated with the assessment of quantitative and qualitative changes in the peripheral blood leukocyte formula [6].

It is known that the protection of the purity of the internal environment of the body is carried out by a complex of functionally interacting barrier systems. The immune system carries out detoxification reactions in close unity with the liver. So, in the process of protecting the body from foreign chemical compounds, coupled responses of two types arise: induction of the synthesis of microsomal monooxygenases in the liver and induction of the synthesis of specific antibodies. Reciprocal relationships between the immune system and enzymatic mechanisms of liver biotransformation activity have been established. Against the background of structural damage to the liver parenchyma and its functional insufficiency, the activity of microsomal enzymes of hepatocytes decreases, which leads to a decrease in the clearance of foreign substances entering the body, incomplete neutralization of endogenous metabolic products. Nonspecific liver function disorders lead to the appearance of distinct relationships with the parameters of the immune system (correlations of ALT and CEC, 1dC, bilirubin - CEC) [7, 8].

It has been shown that bilirubin increases the activity of phagocytosis by stimulating the microtubule system of macro- and microphages. Incomplete metabolism of protein structures and other chemical compounds can lead to the development of intoxication, immune and allergic reactions. The presence of a pathogenetic relationship between disorders of the functional state of the immune system and the liver made it possible to form an idea of the functional unity of the main mechanisms of immunological and metabolic homeostasis [9].

The most important ions characterizing the state of mineral metabolism are  $\text{Ca}^{2+}$  and  $\text{P}^{3+}$ . Calcium is involved in many cellular processes: the functioning of the



membranes of all cell organelles, the processes of oxidative phosphorylation, and regulates cell division [10]. In recent years, it has been shown that calcium ions play an important role in the antioxidant protection of cells by regulating the activity of apoptosis reactions [3]. It is known that the concentration of calcium and phosphorus ions in the blood serum determines its concentration in saliva. A long-term decrease in the level of ionized calcium and the Ca / P ratio in the secretion of the salivary glands leads to electrolyte imbalance, which results in caries and non-cariou lesions of hard dental tissues. Carrying out pathogenetic therapy, leading to the normalization of calcium levels in blood plasma, simultaneously increases the calcium content in saliva [10].

It is known that the main methods for studying the activity of phagocytic cells are: the test for the reduction of nitroblue tetrazolium - NBT-test, which allows to evaluate the oxygen-dependent antimicrobial system of phagocytes. Under the influence of microorganisms (or products of the bacterial membrane, in particular zymosan) on phagocytic cells, biochemical reactions of the so-called "respiratory explosion" are initiated, in which oxygen consumption by the cell increases by 7–15 times. As a result of these reactions, hydrogen peroxide and singlet oxygen ( $O_2^-$ ) are synthesized, which have a pronounced bactericidal activity. The intact leukocyte membrane is impermeable to H<sub>2</sub>O<sub>2</sub>. During phagocytosis, the absorption of HBT–heparin–fibrinogen complexes occurs, its transfer to the phagosome and cytoplasm of phagocytes, where H<sub>2</sub>O<sub>2</sub> is reduced to formazan. H<sub>2</sub>O<sub>2</sub> reduction involves membrane oxidases that catalyze the transfer of electrons from the reduced form of NADP to molecular oxygen [12]. The dehydrogenases of glycolysis and hexose monophosphate shunt also take part in the reduction of H<sub>2</sub>O<sub>2</sub>, which provide a diffuse blue color and small blue granules in the cytoplasm of cells, while formazan is detected as large dark blue in phagosomes. granules. Defects in the formation system of superoxide hydroxyl radicals and hydrogen peroxide underlie incomplete phagocytosis [7, 8]. Consequently, the formation of

formazan in phagosomes characterizes the intensity of absorption of particles and the production of active radicals. Thus, the NBT-test is an integral one, allowing to evaluate both phagocytic and metabolic activity of cells.

**Conclusion.** Summarizing the above presented, it can be noted that under chronic hypergravity exposure, stress adaptive reactions develop, which pathogenetically justifies the need for preventive protective measures. At the same time, given the trend in world pharmacotherapy towards the creation of multicomponent drugs, it is advisable to continue experimental studies on the use of actoprotectors, as well as their combinations with antihypoxants for the purpose of their therapeutic and prophylactic use in chronic gravitational stress.

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