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Human Physiology in Space (2)

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CHANGES IN THE PROTEIN COMPOSITION OF COSMONAUTS' BLOOD IN THE ACUTE PERIOD OF ADAPTATION TO SPACE FLIGHT FACTORS

Abstract

The adaptive states of the body, characteristic of long-term space flights, are in the field of attention of physicians and physiologists in connection with the medical risks of long-term interplanetary flights. Proteomics makes a significant contribution to the study of the reactions of the human body at the molecular level, bringing us closer to understanding the mechanisms of formation of new molecular networks and their role in the adaptation of physiological systems at different periods of space flight (SF). The aim of the work was to evaluate the changes in the protein composition of blood collected in the form of dry spots during the SF, and their correlation with the onset of changes in the physiological systems of the body in the acute period of adaptation to weightlessness, under the influence of thoracocranial redistribution of blood, microgravity, artificial composition of the gas environment and stress factors of the initial period of space flight. Samples of dried blood spots of seven Russian cosmonauts collected before the flight and on the 7th day of the flight were studied. Using proteomics methods based on chromato-mass spectrometry, 673 different proteins were detected in the samples. Using the ANDSystem program, it was found that out of 43 proteins with significantly changed levels - 24 were associated with processes related to the functions of the cardiovascular system: vasoconstriction and vasodilation, the work of the heart and blood vessels, cardiomyocytes; 29 proteins were associated with processes related to the homeostasis, such as systemic homeostasis, NO, glucose homeostasis, energy metabolism, etc.; 15 proteins - with regulation of water-salt metabolism, water transport, osmoregulation. In addition, significant changes were noted in concentrations of 17 proteins, associated with adaptation of the immune system, cellular immunity processes, and other changes in the immune system at this period of space flight. Consequently, on the 7th day of space

flight, it was possible to identify specific proteins that are participants in molecular networks and biological processes characteristic of the initial period of adaptation of the physiological systems of the human body to microgravity. Bioinformatic methods of analysis, as well as manual annotation of proteins and processes, made it possible to link the known physiological features of the cosmonauts' condition on day 7 of flight with significantly changed proteins, components of molecular networks that underlie physiological processes. The work was performed within the framework of the basic theme of the Russian Academy of Sciences 65.3.