

SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Medical Care for Humans in Space (3)

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APPROACHES TO THE DEVELOPMENT OF BIOMEDICAL SYSTEMS FOR PILOTED  
EXPLORATION MISSIONS**Abstract**

The sine qua non condition for piloted missions to Mars or other objects of the solar system including asteroids is availability of suitable biomedical systems. The design concept should be built with reference to the known factors of such missions, their duration, environment on terrestrial bodies, and time crew will stay there. Many aspects of the biomedical systems developed and realized aboard orbital stations, the International space station in the first place, deserve to be regarded as predecessors of the systems for health monitoring and maintenance of future exploration crews. At the same time, there are issues and tasks which have not been yet fully resolved. Specifically, these are prevention of the adverse changes in body systems and organs due to microgravity, reliable protection from the spectrum of space radiation, and elucidation of possible effects of hypomagnetic environment. We should not walk away from search and development of key biomedical technologies such as a system of automated fitness evaluation and a psychodiagnostic complex for testing and optimization of operator's efficiency, and others. We have to address a large number of issues related to designing composite life support systems with high autonomy, closure and ecological safety of human environment that will provide transformation of all kinds of waste. Another crucial task is to define a concept of the onboard medical center and dataware including the telemedicine technology. All the above developments should assimilate the most recent achievements in physiology, molecular biology, genetics and advanced medical technologies. Biomedical researches on biosatellites do not lose topicality. An important step toward designing and enhancement of biomedical systems for exploration missions was made in the Mars-500 project carried out at the Institute of Biomedical Problems in Moscow. The experiment furnished valuable observations of the relationship within the human-environment system and a wealth of data about health and performance of people living in the conditions of artificial environment and isolation. The experiment reproduced several features of exploration mission including very long duration, autonomy, and work on the Martian surface. It provided an opportunity to test some countermeasures to negative health developments, and to verify and upgrade telemedicine technologies, to validate stand-alone systems of psychological support, and numerous technologies and equipment for life support. Also, new data on mechanisms of body adaptation in the course of long-term simulation experiment were acquired.