66th International Astronautical Congress 2015

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

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BION-M1 PROJECT: GENERAL CHARACTERISTICS AND PRELIMINARY RESULTS

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Abstract

After a 16-year hiatus, the biological satellite Bion-M1 made a successful spaceflight in 2013. That was the first ever 30-day long flight of an unmanned space vehicle that carried a number of various biological specimens. In the course of flight, over 30 biological experiments as well as many biotechnological, exobiological and astrobiological, radiation biology and radiation physics, and technological experiments were performed. Comprehensive studies of the flown samples were conducted by Russian researchers from over 70 science centers, as well as scientists from the Ukraine, Kazakhstan, Germany, France, Bulgaria and the USA. Among the biological specimens were male C57Bl/6 mice, never before used in Russian long-duration space experiments. The key objective of the Bion-M1 research program was to examine spaceflight effects upon biological specimens at the cellular and molecular levels. Many biological investigations produced novel data that they were of great importance for both theoretical knowledge and practical application. Among other observations, animal experiments demonstrated noticeable shifts in arterial contractility, changes in the expression of genes regulating the brain-derived neurotrophic factor (BDNF), serotonin and dopamine systems as well as enhanced bone marrow production of interleukin-1 (IL-1), a potential regulator of bone resorption and a factor involved in osteoporosis development. Bion-M space missions will be continued. It is planned to launch Bion-M2 in 2019. The major goals of the Bion-M2 science program will be similar to those of Bion-M1. The basic difference will be the Bion-M2 orbit altitude. It is expected that Bion-M2 will fly at an altitude of 1000 km, i.e., at an altitude almost twice as high as that of Bion-M1. It is also planned to launch in 2022 Bion-M3 whose research program will be focused on gravitational biology studies.