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Life and Microgravity Sciences on board ISS and beyond (Part II) (7)

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RODENT RESEARCH REFERENCE MISSIONS ON THE ISS NATIONAL LAB

Abstract

The International Space Station U.S. National Laboratory in partnership with Taconic Biosciences has developed a Rodent Research Reference Mission Microgravity Model to enable space-based research to benefit Earth using well-characterized strains of Mus musculus to provide for Principal Investigators biological tissues, biospecimens, and data from mice exposed to spaceflight on the ISS and in ground-control environments using a standardized experimental design concept in a standard, group-housed rodent habitat configuration. The hypothesis-driven science objectives of the first two rodent research reference missions were defined to investigate the effects of chronological age on cellular senescence and concomitant systemic effects on inbred female BALB/C and C57BL/6 mouse strains, respectively, exposed to the spaceflight environment and either euthanized in orbit or returned to Earth via Live Animal Return after several weeks of exposure to microgravity on the ISS. It has been well documented that prolonged exposure to the spaceflight environment results in significant and rapid changes in gene expression and cellular pathways that affect multiple organ systems of human crew and in model organisms in association with the length of exposure to the space environment. These changes in cellular and organ function in model organisms are hypothesized to be similar in pathology to the onset and progression of some human diseases and the pre-symptomatic manifestation of cellular and metabolic dysfunction associated with aging and senescence on Earth. Rodent spaceflight experiments have provided a broad range of translational data pertinent to biomedical advancements in neurology, muscle physiology, bone physiology, immunology, cardiovascular and developmental biology. It is hypothesized that older mice will experience systemic effects on major organ systems reflected in differential patterns of gene expression and musculoskeletal markers that, after identical terms of exposure to the spaceflight environment, are increased in magnitude of effect by increased age relative to a younger cohort of mice. The identity of metabolic or regulatory pathways involved and the magnitude of these spaceflight effects in the older and younger mice from two different genetic strains of mice may inform translational biomedical research on Earth related to musculoskeletal, metabolic, and neurodegenerative diseases associated with aging.