Advancing Translational Space Research Through Biospecimen Sharing: Amplified Impact of Studies Utilizing Analogue Space Platforms

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Biospecimen Sharing Programs (BSPs) have been organized by NASA Ames Research Center since the 1960's with the goal of maximizing utilization and scientific return from rare, complex and costly spaceflight experiments. BSPs involve acquiring otherwise unused biological specimens from primary space research experiments for distribution to secondary experiments. Here we describe a collaboration leveraging Ames' expertise in biospecimen sharing to magnify the scientific impact of research informing astronaut health funded by the NASA Human Research Program (HRP) Human Health Countermeasures (HHC) Element. The concept expands biospecimen sharing to one-off ground-based studies utilizing analogue space platforms (e.g., Hindlimb Unloading (HLU), Artificial Gravity) for rodent experiments, thereby significantly broadening the range of research opportunities with translational relevance for protecting human health in space and on Earth. In this presentation, we will report on biospecimens currently being acquired from HHC Award *Head-Down Tilt as a Model for Intracranial and Intraocular Pressures, and Retinal Changes during Spaceflight,* and their availability. The BSP add-on to the project described herein has already yielded for HHC-funded investigators more than 4,700 additional tissues that would otherwise have been discarded as waste, with additional tissues available for analysis. Young (3-mo old) male and female rats and Older (9-mo old) male rats are being exposed to HLU for either 7, 14, 28, or 90 days. Additional groups are exposed to 90 days of unloading followed by either 7, 14, 28 days or 90 days of recovery (normal loading). Comparisons are made with non-suspended controls. Unused tissues are: Skin, Lungs, Thymus, Adrenals, Kidneys, Spleen, Hindlimb Muscles (Soleus, Extensor Digitorum Longus, Tibialis Anterior, Plantaris & Gastrocnemius), Fat Pads, Reproductive Organs, and Intestines. Tissues are harvested, weighed, preserved then archived (with metadata) using a sample tracking system (CryoTrack). Preservation techniques include snap-freezing and RNALater/snap-freezing. Specimens were weighed at the time of dissection, and organ mass:body mass ratios analyzed to determine unloading effects across conditions and durations. The results corroborate previously reported effects of short-term exposure to microgravity or unloading exposure on various organs, and provide new insights into adaptation to long-duration unloading relevant to sustained spaceflight exposures on ISS.

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