ENABLING BIOLOGICAL DISCOVERY THROUGH BIOSPECIMEN SHARING: THE NASA BIOLOGICAL INSTITUTIONAL SCIENTIFIC COLLECTION

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Understanding biological impacts from spaceflight hazards and the subsequent development of countermeasures are a high priority to enable humanity to venture back to the Moon, and then to Mars and beyond. Experiments have been conducted with model organisms flown to space and analogous investigations terrestrially, to identify biological mechanistic impacts from spaceflight hazards and to develop mitigation countermeasures, thus contributing towards basic and applied science goals. However, sending organisms into space is a costly endeavor. To maximize scientific return, all biospecimens not required by spaceflight-relevant Principal Investigators are harvested, preserved, and archived in the NASA Biological Institutional Scientific Collection (NBISC). Biospecimens are collected and preserved according to well-established standard operating procedures to maintain scientific quality and are available on-request by the international scientific community. NBISC currently stores over 32,000 biospecimens from Shuttle, International Space Station, and ground-based space analog investigations. Tissue sharing has resulted in at least 33 publications since 2011 and 51 requests since 2016. Many requests for NBISC biospecimens come from first-time investigators who subsequently submit grants as their point-of-entry into the field of spaceflight biology and health. The NBISC biorepository is part of the NASA 'Open Science for Life in Space' collaborative group of projects, which includes NASA Genelab, the Space Biology Program's Biospecimen Sharing Program, Physical Sciences Informatics, and the Ames Life Sciences Data Archive. NBISC biospecimens have been awarded to NASA Genelab, who then generated various open access science 'omics datasets through the GeneLab Sample Processing laboratory, with resulting data widely used for biological study. Other NBISC biospecimen awards have led to studies on fecal microbiome analysis, DNA damage analysis using single-cell DNA sequencing, enzymatic-pathway identification involved in spaceflight muscle atrophy, and characterization of ocular morphological changes. Of note, NBISC is expanded to include a new Space Microbial Culture Collection (SMCC) for the collection, identification, documentation, long-term preservation, and distribution of space-related microbial isolates.