NASA SBIR 2011 Phase I Solicitation

X17 Inflight Biological Sample Preservation and Analysis

The Human Research Program (HRP) is an applied research and technology program aimed at providing human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration. HRP's specific objectives include development of technologies that serve to reduce human systems resource requirements, such as mass, volume, and power to maximize utilization of spaceflight platforms to perform the essential research and technology development tasks that can only be accomplished during a space mission. Addressing multiple HRP human health and performance risks and knowledge gaps across various disciplines requires collection, preservation and analysis of biological samples from human subjects during a space mission, a common practice in clinical diagnostic medicine. However, the spaceflight environment affords unique challenges for the processing, storage and transport of biological specimens, due to highly constrained resources, such as limited conditioned stowage (mass and volume requiring storage in refrigerators or freezers) available. This topic aims to mitigate those space mission constraints by means of innovative approaches for the collection, long duration ambient temperature preservation, and low-resource small-footprint in situ analysis of human biospecimens, such as blood and urine, for a wide array of biomedically significant analytes.

Subtopics

X17.01 Alternative Methods for Ambient Preservation of Human Biological Samples During Extended Spaceflight and Planetary Operations

Lead Center: JSC

Participating Center(s): ARC

Addressing multiple Human Research Program (HRP) human health and performance risks and knowledge gaps across various disciplines requires collection, preservation and analysis of biological samples from human subjects during a space mission, a common practice in clinical diagnostic medicine. However, the spaceflight environment affords unique challenges for the processing, storage and transport of biological specimens, due to highly constrained resources, such as very limited conditioned stowage (mass and volume requiring storage in refrigerators or freezers) to keep and return the biospecimens. This subtopic aims to mitigate those space mission constraints by means of innovative approaches for the long duration ambient temperature preservation of human biological samples, particularly blood and urine, while maintaining the integrity of a wide array of biomedically significant molecular markers for subsequent post-mission processing and analysis.

This subtopic seeks proposals for novel approaches to preserve analytes of clinical and research interest in human blood and urine samples for a minimum of one year at ambient temperature. Target blood analytes to be preserved include those in the Comprehensive Metabolic Panel: glucose, calcium, albumin, total protein, electrolytes (sodium, potassium, bicarbonate, chloride), kidney tests (blood urea nitrogen, creatinine), and liver tests (bilirubin, alkaline phosphatase, alanine amino transferase, aspartate amino transferase). Additional blood markers to be preserved include N-telopeptide, sulfate, highly specific C-reactive protein, tumor necrosis factor, interleukin-1, interleukin-6, 8-hydroxy-2-deoxy-guanosine, vitamin D, homocysteine, and selenium. For urine samples, the following analytes should be preserved: creatinine, cortisol, N- and C-telopeptides, hydroxyproline, 4-pyridoxic acid, 3-methylhistidine, G-carboxyglutamic acid, 8-hydroxy-2-deoxy-guanosine, uric acid, phosphorus, citrate, sulfate, oxalate, calcium, sodium, potassium, magnesium, and chloride. The proposed technology should be low-resource, low-footprint, and should involve a low volume of supplies/consumables, which do not require refrigeration or freezing for storage.

NASA Deliverable: Prototype functional system for long duration room temperature preservation of human blood and/or urine biospecimens, demonstrating integrity for a subset of the target analytes (in Phase I).