H8.01-2768 - In Space Manufacturing of Microfluidic Chips for Biological Research

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

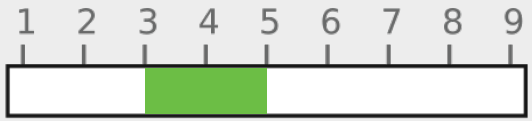
Translational research aboard the ISS provides unprecedented opportunities for studying the microgravity impact on physiology. For example, symptoms of accelerated aging occur after prolonged exposure to microgravity — such as muscle and bone loss, reduced cardiopulmonary function and immune deficiency. The exact cause is unknown, and it has been observed that these conditions are reversible when astronauts return to Earth. Organ-on-a-Chip (OOC) applications aboard the ISS will enable studies of organs at the cell and tissue levels under reduced gravity, will contribute to our understanding of the process of aging and could reveal molecular targets that can slow that process. These delicate fluidic devices are not designed to withstand the harsh launch conditions and few systems can be flown in stasis or within the limited active thermal carriers. Despite these hardships, the possibilities have pushed OOCs into low earth orbit. The Techshot in-space manufacturing platform will open additional possibilities by removing these limitations.

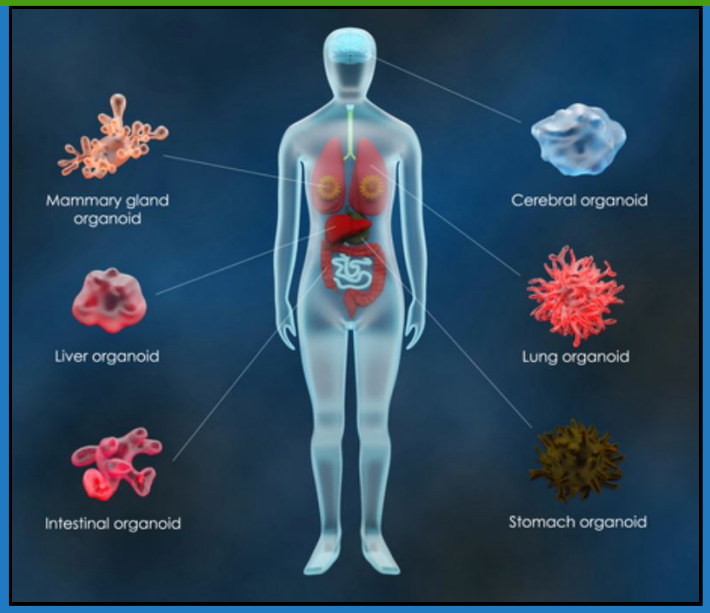
TECHNICAL OBJECTIVES AND WORK PLAN

Technical Objective 1: Define Design Requirements; Workplan: Research printable solders and adhesive materials, identify machine vision requirements and research machine control systems.
Technical Objective 2: Develop Printing Methods for Structural and Biological Components; Workplan: Develop methods and materials for printing a microfluidic system and develop materials and methods for printing biological components within a microfluidic system
Technical Objective 3: Develop Prototype Dock / Module for Fabrication Within BioFabrication Facility (BFF); Workplan: Techshot will build a custom insert for BFF to hold an MVP cassette and introduce the interior volume to the print heads
Technical Objective 4: Test Technology Demonstrators; Workplan: document the design and fabrication, develop a matrix of materials, develop scripts to fabricate both pathways and micro-organs

TRL

Estimated





NASA APPLICATIONS

Techshot will offer the Organ-on-a-Chip (OOC) manufacturing capability to microgravity researchers and NASA's Exploration Medicine Capability (ExMC) element. Personalized medicine and basic research are possible with OOCs to improve astronauts' health and predict the physiological changes that occur with long-term space exposure. This OOC in-space manufacturing capability could help enable human pioneering beyond low earth orbit.

NON-NASA APPLICATIONS

Applications involve drug testing and individualized drug responses. The FDA is striving to reduce the dependency on animal and human clinical experimentation. Billions are spent on drugs that fail in efficacy trials. By understanding OOCs, humanized systems can evaluate drug responses to specific diseases or chips unique to individual patients can be made to evaluate treatment regimens.

FIRM CONTACTS

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