BIOLOGICAL & PHYSICAL SCIENCES

Precision Health

Leveraging space to unlock the secrets of aging and disease

Stressors encountered during space travel can affect human health, including bone and muscle loss, immune system function, microbes, and other biological responses. NASA research could provide vital information needed to help protect astronauts during future deep-space missions and advance the prevention and treatment of disease for people on Earth.

Organ-On-a-Chip

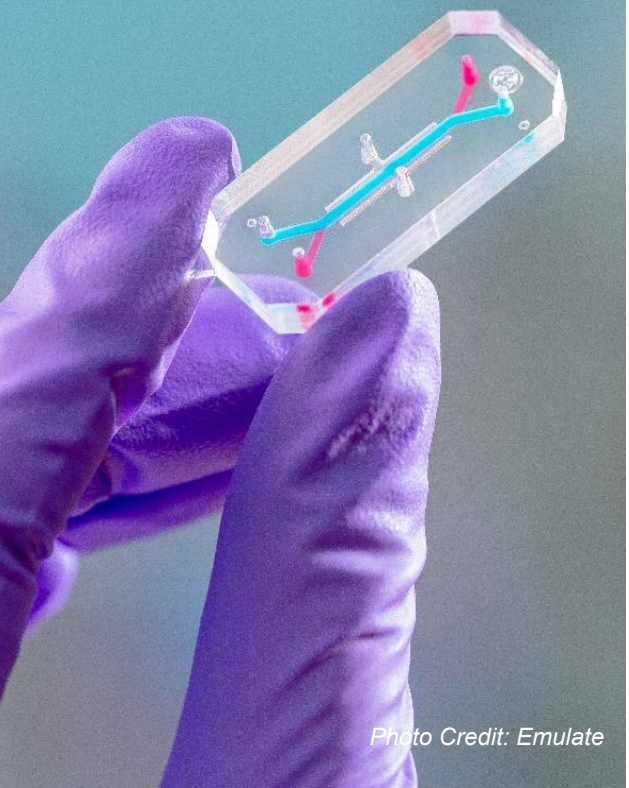

Photo Credit: Emulate

NASA studies the physiological, cellular, and genetic alterations that can occur during space travel. This fundamental research can help ensure crew health and safety on their missions, as well as contribute to significant advancements in medicine for all.

ENABLING SPACE EXPLORATION:

- Identify the potential risks to human health prior to deep-space missions
- Support the development of risk mitigation strategies
- Inform personalized medical kits for crew

BENEFITTING HUMANITY:

- Expand our scientific understanding of aging and disease
- Advance the use of biomedical technologies in research
- Contribute to healthcare improvements, such as cancer treatments

ADVANCING MOON AND MARS MISSIONS*:

- A Virtual Astronaut Tissue Analog Response (AVATAR)
- Microbiome of the Built Environment (MoBE)

**For a more comprehensive list, please visit BPS's website.*

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PRECISION HEALTH

LEVERAGING SPACE TO UNLOCK THE SECRETS OF AGING AND DISEASE

Human exploration exposes astronauts and their microbiomes to spaceflight stressors. NASA's four Precision Health focus areas will provide a mechanistic understanding of the physiological, cellular, and genetic alterations that occur during space travel. Research will expand knowledge of the short- and long-term risks of prolonged deep-space exploration, as well as the onset and progression of disease and dysfunction that could affect astronauts beyond low Earth orbit.

Organ-On-a-Chip (Organ-Chips)

Organ-chips are tiny devices that act like small versions of human organs. Made with human cells, the chips mimic how tissues, such as the brain, heart, liver, or dozens of other organs, work. NASA research, including AVATAR, will focus on validating and leveraging these models to assess the impacts of deep-space stressors on human health. Insights could advance personalized medicine in space and on Earth.

Aging and Disease

Research to-date has revealed aging-like phenotypic changes that suggest spaceflight accelerates the onset and progression of age-related disease. NASA research aims to clarify this linkage by using relevant model systems and computational modeling and analyses. Work will focus on identifying the underlying mechanisms of spaceflight aging and disease and understanding if severity is altered by the duration or destination of the mission.

Synthetic Biology

Microbes can be used as tools for protecting human health. NASA will investigate ways to engineer molecules that are beneficial to astronaut health, such as vitamins or pharmaceuticals essential for long-duration missions. This could include developing beneficial bacteria to counteract disease or expanding capabilities such as biosensors for measuring low oxygen. Synthetic biology research could yield advancements benefitting agriculture, medicine, and manufacturing.

Acclimation and Adaptation

Organisms, including humans and microbes, may acclimate and adapt to living in a spaceflight environment. Acclimation is the short-term physiological responses organisms undergo, while adaptation involves permanent genetic changes resulting from exposure to selective environmental pressures. NASA research will focus on understanding the mechanisms of acclimation and adaptation and determining whether changes are beneficial or associated with dysfunction and disease.

Probing biological and physical phenomenon under extreme conditions advances the fundamental scientific knowledge required to go farther and stay longer in space, while also benefitting life on Earth.

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