IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Life and Physical Sciences under reduced Gravity (7)

Author: Dr. Marc Giulianotti
International Space Station (ISS) U.S. National Laboratory, United States, mgiulianotti@issnationallab.org

Dr. Lucie Low
National Institutes of Health, United States, lucie.low@nih.gov
Dr. William McLamb
International Space Station (ISS) U.S. National Laboratory, United States, bmclamb@ISSNationalLab.org
Dr. Seila Selimovic
National Institutes of Health, United States, seila.selmovic@nih.gov
Dr. Michael Roberts
International Space Station (ISS) U.S. National Laboratory, United States, mroberts@issnationallab.org
Dr. Danilo Tagle
National Institutes of Health, United States, danilo.tagle@nih.gov

TISSUE CHIPS IN SPACE

Abstract

The International Space Station (ISS) U.S. National Laboratory is enabling a new era of research in space aimed at improving life on Earth. By engaging with other government agencies in the public sector and with universities and companies in the private sector, the ISS National Lab promotes and brokers a diverse range of research in life sciences, physical sciences, remote sensing, technology development and education.

In collaboration with the National Center for Advancing Translational Sciences (NCATS) and the National Institute of Biomedical Imaging and Bioengineering (NIBIB), a program, "Tissue Chips in Space," was developed to promote and fund research into human physiology and disease on the International Space Station (ISS) U.S. National Laboratory. The Tissue Chips in Space Program is part of NCATS' larger Tissue Chip Program that aims to develop bioengineered devices to improve the complex and laborious process of predicting whether drugs will be safe and effective or toxic in humans. These bioengineered devices, referred to often as tissue chips or organs-on-a-chip, leverage recent advances in cell biology, tissue engineering, and microfabrication. These systems offer promising solutions for modeling human physiology and disease in vitro for applications in areas where traditional cell culture and animal models fall short.

It is well understood that microgravity causes accelerated changes in human physiology such as muscle wasting, osteoporosis, reduced cardiopulmonary function, and altered immune response among others, and in many instances these altered changes directly correlate to disease pathology here on Earth. By utilizing tissue chips containing human cells on the ISS National Lab, disease pathologies that might take years to produce on Earth are accelerated and can be studied on an expedited time frame.

The Tissue Chips in Space program has currently funded nine separate projects, five in 2017 and four in 2018. The first project focused on "Microgravity as a Model for Immunological Senescence and its Impact on Tissue Stem Cells and Regeneration" and launched on SpX-16 on December 4th 2018. Four more project teams are set to launch on SpX-17 in Spring 2019. The four teams on SpX-17 will study disease pathology related to respiratory system immune responses, kidney function, the blood brain barrier, and musculoskeletal diseases. Ultimately each of the teams will test experimental therapeutics in

their Tissue Chips in Space platforms with the goal expediting the development of improved therapeutics for patients here on Earth.