Emulate, Inc. Awarded Grant to Use Intestine-Chip to Study Human GI Infections Aboard the International Space Station

Research in space will use Emulate's Organs-on-Chips technology to understand changes in the intestinal response to bacterial infection

December 18, 2018 10:00 AM

BOSTON, Mass. – Emulate, Inc. announced today that it has received a research grant to use the company's Intestine-Chip to conduct experiments that will provide insights into the function of the intestinal barrier and its response to bacterial invasion in microgravity. Experiments will be conducted on the International Space Station and on Earth to analyze cellular interactions within the Intestine-Chip and to better understand the impact of bacterial challenges on gastrointestinal (GI) homeostasis. The Intestine-Chip is designed to emulate the complexity of a human intestine in a living micro-engineered environment, which includes the intestinal epithelium, endothelial cells, resident immune cells, bacteria, and enteric sensory neurons..

The NIH's National Center for Advancing Translational Sciences (NCATS) provided the cumulative award of $2 million. Emulate's Human Emulation System will fly to the station under sponsorship of the International Space Station (ISS) U.S. National Laboratory. The ISS National Lab is responsible for enabling and facilitating research to the space station that has the capacity to benefit life on Earth. The ISS National Lab works in partnership with NASA to fully utilize the U.S. portion of the space station with innovative research and technology development. This is the second grant that Emulate has received from NCATS, which follows on a grant received last year for using the company's Brain-Chip for research onboard the ISS (also sponsored by the ISS National Lab). Including the Brain-Chip and the Intestine-Chip in this space research program leverages Emulate's comprehensive work with these two organ systems, which are key areas of the company's Organ-Chip portfolio. Further, the new research grant will advance the use of the Intestine-Chip with sensory neurons, to support studies into the links between the nervous system and the intestine – interactions which have been referred to as the "gut-brain axis."

"We are excited to expand Emulate's research onboard the International Space Station and to advance the understanding of mechanisms driving intestinal infection and inflammation" – Geraldine Hamilton, President and Chief Scientific Officer, Emulate

Freed from the effects of gravity found on Earth, the ISS provides an environment where researchers can study human health in microgravity, allowing them to decouple the force of gravity from other effects that can impact intestinal function. Previous studies in microgravity have shown suppressed immune function in astronauts and increased bacterial virulence in cell cultures. Studies in this program will observe how these observations manifest in the context of the human Intestine-Chip. Experiments with the Intestine-Chip in space and on Earth can offer unique insights into the biological mechanisms of intestinal and bacterial interactions; such interactions are understood to be associated with key aspects of GI homeostasis and many GI diseases, but have been difficult to study with conventional experimental methods.

"As we make our Human Emulation System available to labs throughout the world, we continue to push new boundaries," said Geraldine A. Hamilton, PhD, President and Chief Scientific Officer of Emulate. "We are excited to expand Emulate's research onboard the International Space Station and to advance the understanding of mechanisms driving intestinal infection and inflammation – an area in need of better models for drug development and a focus area for Emulate. We look forward to continuing to collaborate with experts working on the space program so that we can advance new research with Organ-Chips in space and apply the learnings to human health challenges here on Earth."

One key aspect of this project is to optimize and apply the Intestine-Chip with sensory neurons, as recent experimental and clinical evidence suggests that the nervous system plays a critical role interacting with other key cell types in the intestine to modulate the intestinal microenvironment and preserve GI homeostasis.[1] Studies of the interactions between epithelial, endothelial cells, immune cells and sensory innervation will allow the evaluation of responses to bacterial infection in space and on Earth.

"Together we are advancing new frontiers for understanding and potentially managing human disease" – Twyman Clements, Co-founder and CEO of Space Tango

Emulate will work with two partners to develop space-compatible hardware. IRPI, a company that specializes in the design of fluid systems for space, offers unique terrestrial testing platforms to ensure the robustness of the systems in microgravity. The other partner is Space Tango, a company that designs, builds, and operates facilities onboard the International Space Station for research and manufacturing.

"Emulate is an expert and passionate team collaborating to adapt Organs-on-Chips technology for a range of applications in research and industry through this work on the International Space Station," said Twyman Clements, Co-founder and CEO of Space Tango. "Together we are advancing new frontiers for understanding and potentially managing

human disease by validating commercially-available systems to replace animal testing for assessing the effects of microgravity on long-duration space flight. By further optimizing Organs-on-Chips technology to meet the design requirements of automation, efficiency, and size for use on the International Space Station, we are also expanding the terrestrial applications for this technology."

Emulate and Space Tango will adapt the instrumentation of Emulate's Human Emulation System in order to use Organs-on-Chip technology on the International Space Station, including the automation of experiments in space-compatible dimensions. Technical developments will also include new fluorescent microscopy functionality to allow for continuous imaging within the Intestine-Chip throughout the space journey, enabling researchers on the ground to track the Organ-Chip in real-time which gives an unprecedented view of how the system responds in the unique environment of space and enables control of the experimental parameters for remote real-time adjustments if needed.

"There is exciting new potential to use our Intestine-Chip for research in space, including true-to-life functionality with a broad range of cell types that play a role in health and disease processes in the intestine, including sensory neurons, immune cells, and bacteria," said Chris Hinojosa, Director of Discovery at Emulate. "As we further enhance our system for use in space, we are, in turn, improving our system for use by many researchers and companies on Earth." Hinojosa and Katia Karalis, Executive Vice President of Research at Emulate, will co-lead the team working on the project.

1. Obata Y. and Pachnis V., "The Effect of Microbiota and the Immune System on the Development and Organization of the Enteric Nervous System." Gastroenterology. 2016 Nov;151(5):836-844.

About the "Human Emulation System" Powered by Organs-On-Chips Technology

Based on Organs-on-Chips technology, Emulate has created a new living Human Emulation System™ that provides a real-time window into the inner workings of human biology and disease – offering researchers a new technology designed to predict human response with greater precision and detail than today's cell culture or animal-based experimental testing. Each of Emulate's proprietary Organ-Chips – such as the lung, liver, brain, intestine or kidney – contains tiny hollow channels lined with tens of thousands of living human cells and tissues, and is approximately the size of an AA battery. An Organ-Chip is a living, micro-engineered environment that recreates the natural physiology and mechanical forces that cells experience within the human body.

About the International Space Station U.S. National Laboratory

In 2005, Congress designated the U.S. portion of the ISS as the nation's newest national laboratory to maximize its use for improving quality of life on Earth, promoting collaboration among diverse users, and advancing science, technology, engineering, and mathematics (STEM) education. This unique laboratory environment is now available for use by non-NASA U.S. government agencies, academic institutions, and the private sector, providing

these customers access to a permanent microgravity setting, a powerful vantage point in low Earth orbit, and the extreme and varied environments of space. The ISS National Lab is managed by the Center for the Advancement for Science in Space, under agreement with NASA.

About NCATS and Tissue Chips in Space

NCATS has partnered with the International Space Station U.S. National Laboratory (ISS National Lab), to collaborate on refining tissue chip technology for biomedical research use on the space station through the NCATS Tissue Chip for Drug Screening program, announced in October 2016. The goal of the Tissue Chips in Space initiative is to create tissue- and organ-on-chip platforms that can be sent to the ISS National Lab so that scientists can better understand the role of microgravity on human health and diseases and translate those findings to improve human health on Earth. Through NCATS' collaboration with space implementation partners, NCATS seeks to rapidly evolve tissue chip technology through miniaturization and automation of the chips when they are deployed to ISS, resulting in a much smaller footprint and essentially a turnkey technology for ease of use here on Earth.

About Space Tango

Space Tango provides improved access to microgravity through their Open Orbit platform for research and commercial manufacturing applications that benefit life on Earth. The Company believes the microgravity environment is a new frontier for discovery and innovation. Space Tango is focused on creating a new global market 250 miles up in low Earth orbit and envisions a future where the next important breakthroughs in both healthcare and technology will occur off the planet. Recognized for their expertise in microgravity design and operations, Space Tango believes that by exploring with industry and educational partners of all kinds, we can improve life on Earth and inspire the next generation to continue to expand the horizon of this new frontier. For more information, visit www.spacetango.com.

About Emulate, Inc.

Emulate Inc. is a privately held company that creates living products for understanding how diseases, medicines, chemicals, and foods affect human health. Our Human Emulation System™ sets a new standard for recreating true-to-life human biology and is being used to advance product innovation, design, and safety across a range of applications including drug development, agriculture, cosmetics, food, and chemical-based consumer products. Emulate continues to develop a wide range of Organ-Chips and disease models through collaborations with industry partners and internal R&D programs. Emulate is also working with clinical partners to produce Organ-Chips personalized with an individual patient's stem cells, for applications in precision medicine and personalized health. Our founding team pioneered the Organs-on-Chips technology at the Wyss Institute for Biologically Inspired Engineering at Harvard University. Emulate holds the worldwide exclusive license from Harvard University to a robust and broad intellectual property portfolio for the Organs-on-Chips technology and related systems.

Media Contacts

For Emulate:

Kathryn Morris

914-204-6412

kathryn@theyatesnetwork.com

For Space Tango:

Danielle Rosales

650-837-0332

press@spacetango.com