A new frontier: Skin cell study looks at regenerative medicine in space

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Human skin cells provided by Marjana Tomic-Canic, Ph.D., director of the Wound Healing and Regenerative Medicine Research Program at the University of Miami Miller School of Medicine, were launched to the

International Space Station for advanced testing as part of a research voyage by CUTISS, a Swiss life sciences company.

On March 15, SpaceX CRS-27 launched from Cape Canaveral on a commercial resupply voyage to the International Space Station (ISS). Aboard the rocket were pieces of vehicle hardware, spacewalk equipment, and human skin cells from the Miller School's Wound Healing and Regenerative Medicine Research Program.

For more than three decades, Dr. Tomic-Canic, vice chair of research and director of the program, has studied skin biology. Her work focuses on wound healing through mechanisms that control tissue repair and regeneration.

Testing healing of skin cells in microgravity

It is because of her expertise that her team was approached by CUTISS, a Swiss clinical-stage life sciences company focused on regenerative medicine and skin tissue engineering, to participate in unique experiment of testing healing of human skin cells in microgravity conditions by launching them to the ISS for advanced testing.

"We were excited to collaborate with [CUTISS] and help them execute this experiment in space," she said. "Thanks to great technological advances, space travel became more approachable and opened up to exciting possibilities."

These live human skin cells were grown by Dr. Tomic-Canic and her team that included Irena Pastar, Ph.D., and Andrew Sawaya, Ph.D., both research assistant professors in the Dr. Phillip Frost Department of Dermatology and Cutaneous Surgery. Dr. Tomic-Canic and her team also offered logistical support to the research mission, including delivery of the live cells to the launch site in Cape Canaveral and preparation of

backup delivery in the event of a delayed launch.

"For something like this to be executed, every single step requires careful preparation and precision," she said. "You're dealing with live cells, so there are a lot of details that need to be in place for this to work. This entire experiment is a perfect example of true team science at its best. So many people have to complete their component of work with minimal margin for error and all of it has to be well coordinated and timed," she added.

Influence of various factors on tissue repair

The cells are now kept alive and are being observed in space through special micro-laboratories designed for advanced research under microgravity conditions by Swiss company SpacePharma. These remotely controlled, fully automated labs are based on lab-on-a-chip technology, a device about only a few millimeters in size that integrates one or several laboratory functions and analysis capabilities on a single chip.

Once in space, the cells will be subjected to a variety of tests, including exposure to microgravity, radiation, and other space-related factors over a period of time before returning to Earth for further analyses.

Exposure to microgravity and space radiation can affect both physical and biological properties of skin cells, which can influence their ability for tissue repair.

"We really don't know much about what happens in these microgravity situations in terms of the cellular behavior in the context of how they heal, and how they respond to these new challenges," Dr. Tomic-Canic said.

The goal of the experiment is to push the boundaries of innovation in regenerative medicine and to understand how exposure to the space environment can affect human health.

"We are thrilled to be at the forefront of this exciting new frontier in regenerative medicine research. This experiment has the potential to unlock new insights into the behavior of human skin cells, which could ultimately lead to new and innovative treatments for patients with burns and other skin injuries," Daniela Marino, the chief executive officer of CUTISS said.

The hope is that the data collected from such experiments will lead to the development of new regenerative medicine approaches that can be used to treat skin injuries and supplement the scientific understanding of mechanisms that control tissue repair, skin regeneration, and healing.

"This is the best part of the science—when it's uncharted," Dr. Tomic-Canic said. "It's very exciting for a scientist to be able to take even a small part in a study such as this one because it is opening a whole new area of possibilities. The way I see it, no matter what we find, it's going to be novel and will rise many more new questions, which is what conquering a new frontier is all about."

Provided by University of Miami

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