Speaking Of Science

How research in space could help treat old age on Earth

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Right now, Millie Hughes-Fulford's experiments are being run more than 200 miles above ground on the International Space Station after being carried there by the latest SpaceX launch. But the University of California San Francisco professor hopes that her work will have applications much closer to home. By studying the way cells behave in zero gravity, she says, she and her colleagues could find new — and better — treatments for age-related illnesses on Earth.

Hughes-Fulford is no stranger to space-based experimentation: She's sent cells into orbit before. And once, in 1991, she got to go with them as a payload specialist.

"I was a child that read everything she could find and watched all of the science fiction films in the world, and I had a belief system in the '50s that women were equal and would go into space along with the men," Hughes-Fulford said. "That drove most of my life."

But when she started college at 16, she decided that space wasn't in the cards.

"I realized that most of the astronauts were men," she said, "so I decided to be a scientist instead. But it ended up coming full circle, and my science got me into space."

Hughes-Fulford had to train for years just to spend nine days on an orbiting shuttle, but her flight — during which she studied the basic physiology of different animals in zero gravity — taught her one very important lesson.

"There were something like 50 different experiments on our flight, and I realized that the most important thing is to have a control up in orbit. To do the right kind of science, we had to have on-board controls."

In other words, researchers who tried to come to conclusions about zero-gravity environments based on space experiments were often told that their results might be caused by some other space-related factor, like radiation or the stress of launch forces. To get good data, scientists would have to produce gravity on board the ship so they could consider it the only unique variable.

So now, Hughes-Fulford says, ISS has equipment to inflict normal gravity on half of the cells being tested.

Research has shown that astronauts' immune systems are all sorts of wonky during spaceflight, and Hughes-Fulford's previous work has shown that T-cells — the type of white blood cell responsible for immune responses — are affected by zero gravity, all other things being equal. In low gravity, T-cells only activate around half as often or less than the control samples.

In the human body, that would translate to a less active immune system, and an inability to fight off infection.

But it's not just astronauts who have this kind of low T-cell activity. The elderly display the same kind of physical deterioration.

"There aren't that many astronauts to worry about, but here at home we have a huge population that needs new ways to treat the immune system," Hughes-Fulford said.

In the latest experiment, the researchers will be studying the very earliest cellular activation of the immune system. They want to catch the earliest point at which T-cells become different in low gravity.

Obviously, gravitational changes aren't causing age-related illness. But it's a variable that scientists can control (in space, at least) and that reliably causes the same sort of problems that old age does. Therapies targeting the gene-level activity seen in low gravity might not fix problems caused by age — but then again, they might just do the trick.

"Right now, when we treat problems with immune function, we're treating the end of the cascade," Hughes-Fulford said. "We want to find out what's happening at the top, and treat it there."

Experiments like this one are overseen by the Center for the Advancement of Science in Space (CASIS). You can find out more about the research being done on ISS — and the results that have helped us here on Earth — at their Web site.

Rachel Feltman runs The Post's Speaking of Science blog.
