NASA to conduct unprecedented twin experiment

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Consider a pair of brothers, identical twins. One gets a job as an astronaut and rockets into space. The other gets a job as an astronaut, too, but on this occasion he decides to stay home. After a year in space, the traveling twin returns home and they reunite.

Are the identical twins still identical? NASA is about to find out.

In March of 2015, NASA astronaut Scott Kelly will join cosmonaut Mikhail Kornienko on a one-year mission to the International Space Station. Their lengthy stay aims to explore the effects of long-term space flight on the human body.

The interesting thing about Scott is, he's a twin. His brother Mark is also an astronaut, now retired. While Scott, the test subject, spends one year circling Earth at 17,000 mph, Mark will remain behind as a control.

"We will be taking samples and making measurements of the twins before, during, and after the one-year mission," says Craig Kundrot of NASA's Human Research Program at the Johnson Space Center. "For the first time, we'll be able two individuals who are genetically identical."

The experiment harkens back to Einstein's "Twin Paradox," a thought experiment in which one twin rockets to the stars at high speed while the other stays home. According to Einstein's theory of relativity, the traveling twin should return younger than his brother—strange but true.

NASA's study won't test the flow of time. The ISS would have to approach the speed of light for relativistic effects to kick in. Just about everything else is covered, though. NASA's Human Research Program recently announced the selection of 10 research proposals to study the twins' genetics, biochemistry, vision, cognition and much more.

"Each proposal is fascinating and could be a feature-length story of its own," says Kundrot.

Here are a few examples to give the flavor of the research:

"We already know that the human immune system changes in space. It's not as strong as it is on the ground," explains Kundrot. "In one of the experiments, Mark and Scott will be given identical flu vaccines, and we will study how their immune systems react."

Another experiment will look at telomeres—little molecular "caps" on the ends of human DNA. Here on Earth, the loss of telomeres has been linked to aging. In space, telomere loss could be accelerated by the action of cosmic rays. Comparing the twins' telomeres could tell researchers if space radiation is prematurely aging space travelers.

Meanwhile in the gut, says Kundrot, "there is a whole microbiome essential to human digestion. One of the experiments will study what space travel does to [inner bacteria] which, by the way, outnumber human cells by 10-to-1."

Other proposals are equally fascinating. One seeks to discover why astronaut vision changes in space. "Sometimes, their old glasses from Earth don't work," notes Kundrot. Another will probe a phenomenon called "space fog"—a lack of alertness and slowing of mental gears reported by some astronauts in orbit.

"These will not be 10 individual studies," says Kundrot. "The real power comes in combining them to form an integrated picture of all levels from biomolecular to psychological. We'll be studying the entire astronaut."

Separated for a full year, Scott and Mark will make it possible for future astronauts to travel farther than ever before, and still look forward to happy reunions when they return home.

Provided by NASA