NASA Kelly twins study shows ***harsh*** effects of space flight and a brutal return to Earth

Astronaut Scott Kelly made himself a ***guinea pig*** for all the people who dream of human journeys to Mars and other destinations in space. In 2015, Kelly rode a rocket into space and spent nearly a year on the International Space Station in low Earth orbit, while his identical twin brother, Mark Kelly, stayed on Earth's surface for NASA's ***celebrated*** "twins study, " designed to see what spaceflight does to the human body.

guinea pig　荷兰猪；豚鼠　　celebrated　著名的

harsh　严厉的；严酷的　　physiological　生理学的

The full results, published Thursday in the journal Science, showed that Scott Kelly experienced numerous ***physiological*** and ***chromosomal*** changes during his long ***sojourn*** in orbit, including changes in gene expression. His immune system went on high alert, both when he went to space and upon returning to Earth. His body acted as if it were under attack.

chromosomal　染色体的　　sojourn　逗留；旅居

One of the most dramatic findings concerned ***epigenetics*** — how genes are turned on or off to produce proteins. Gene expression changed in both Kellys during the study but in significantly different ways. The study found that more than 90 percent of Scott Kelly's gene expression changes reverted to normal when he returned to the surface.

epigenetic　后生的；外成的；表观遗传　　cardiovascular　心血管的

His ***telomeres*** lengthened in space. But that's no ***fountain*** of youth, the study found, because the telomeres shortened dramatically when he returned to Earth.

telomere　染色体端粒　　fountain　喷泉；泉水

Months later, he still showed a slightly elevated number of cells with shortened telomeres, possibly an effect of radiation exposure. "He might be at some increased risk for ***cardiovascular*** disease or some types of cancer, " said Susan Bailey, a biologist at Colorado State University who led one of the investigations in the study.