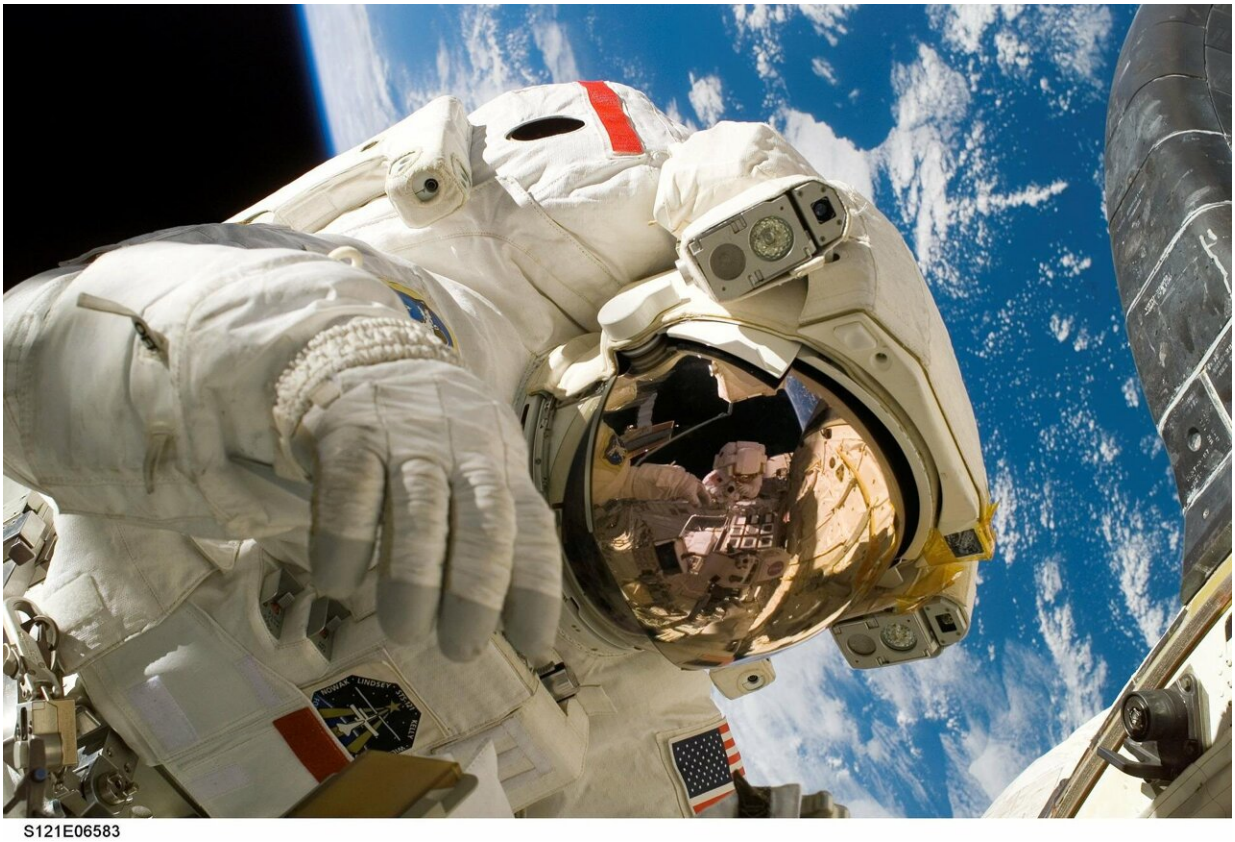
The impact of long-term spaceflight on cerebrospinal fluid and perivascular spaces in astronauts and cosmonauts

April 12 2022, by Bob Yirka



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An international team of researchers has conducted an extensive study of

the impact of long-term space flight on the eyes and brains of astronauts. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their study of MRI scans of both astronauts and cosmonauts before and after venturing into space and the differences they found between the two groups.

When humans venture into space, their bodies undergo changes due to freefall. Prior research has shown that a person's height can be impacted, for example, due to less downward pressure on the spinal column. More recently, as flight times have expanded, researchers have found that the great reduction in gravity also impacts vison and the brain. In this new effort, the researchers took a close look at such changes by studying MRIs made of 24 astronauts and 13 cosmonauts before they went into space and then again within two weeks of their return to Earth. All those studied had spent a minimum of six months in space. The researchers also looked at MRIs of astronauts that had been in space for just two weeks as part of NASA shuttle missions, and also at a few astronauts with the European Space Agency.

One of the specific goals of the study was to learn more about what has come to be known as spaceflight-associated neuro-ocular syndrome, where space visitors experience vision problems. Forty to sixty percent of long-duration astronauts have experienced the condition. Prior research has shown what happens to the eyes in neuro-ocular syndrome, but it has not been able to show why it happens or why it happens only to some people.

The researchers found that long space flights lead to swelling in the compartments called perivascular spaces that surround blood vessels in the brain. They also found that eight of the 24 astronauts developed the eye trouble and that all eight of them had a higher degree of white matter swelling in their brains and spinal cords. They suggest that low gravity conditions change the conditions under which fluids move in

such parts of the body.

The researchers also found that the brain swelling was on average more prominent in the astronauts than in the cosmonauts. They suggest this is likely due to differences in exercise regimens and in what the Russians refer to as lower-body negative-pressure sessions, in which cosmonauts are placed in an airtight metal vacuum tank that seals around the pelvis every day for two weeks before returning to Earth.

More information: The effect of prolonged spaceflight on cerebrospinal fluid and perivascular spaces of astronauts and cosmonauts, *Proceedings of the National Academy of Sciences* (2022). DOI: 10.1073/pnas.2120439119

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