# International consortium with NASA reveals hidden impact of spaceflight on gut health

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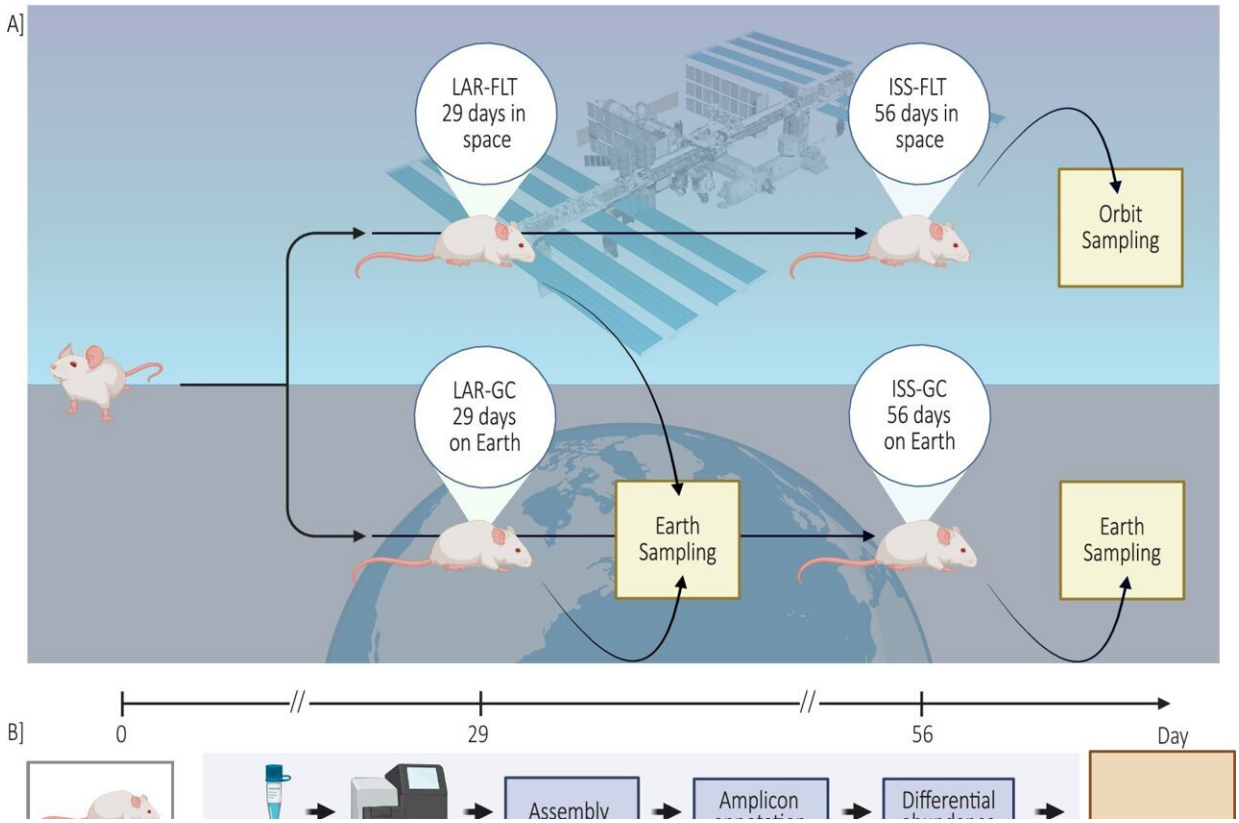



Experimental design. Credit: *npj Biofilms and Microbiomes* (2024). DOI: 10.1038/s41522-024-00545-1

Scientists have uncovered how spaceflight profoundly alters the gut microbiome, revealing previously unknown effects on host physiology

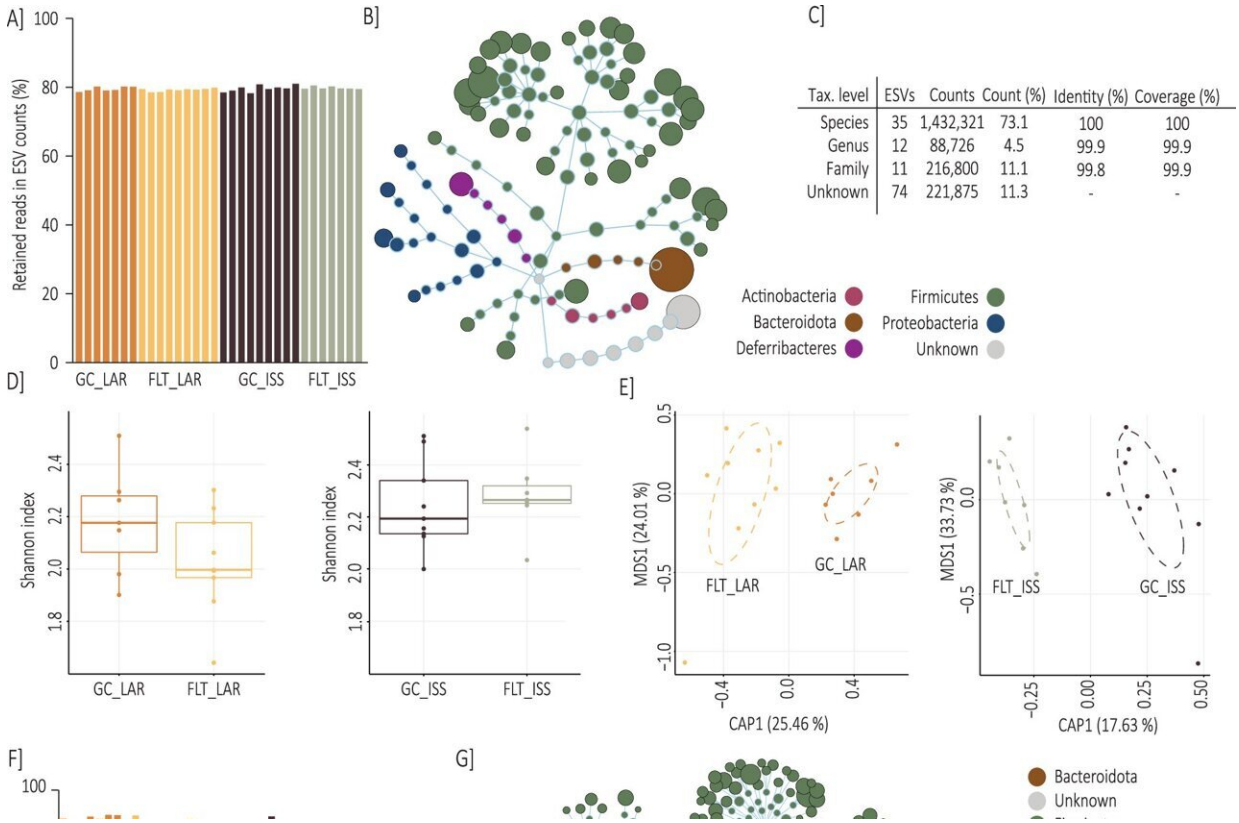
that could shape the future of long-duration space missions.

Led by University College Dublin (UCD) and McGill University, Canada, in collaboration with NASA and an international consortium, the research offers the most detailed profile to date of how space travel impacts the gut microbes we carry into space.

Published in *npj Biofilms and Microbiomes*, the study used advanced genetic technologies to examine changes in the gut microbiome, colons, and livers of mice aboard the International Space Station (ISS) over three months.

The findings reveal significant shifts in specific bacteria and corresponding changes in host gene expression associated with immune and metabolic dysfunction commonly observed in space, offering new insights into how these changes may affect astronaut physiology during extended missions.

Dr. Emmanuel Gonzalez, McGill University, and first author of the study, said, "Spaceflight extensively alters astronaut physiology, yet many underlying factors remain a mystery. By integrating new genomic methods, we can simultaneously explore gut bacteria and host genetics in extraordinary detail and are beginning to see patterns that could explain spaceflight pathology. It's clear we're not just sending humans and animals to space, but entire ecosystems, the understanding of which is crucial to help us develop safeguards for future space exploration."




Ground control, live animal return and ISS murine gut microbiome capture. Credit: *npj Biofilms and Microbiomes* (2024). DOI: 10.1038/s41522-024-00545-1

The international collaboration, spearheaded by UCD with NASA GeneLab's Analysis Working Groups, is part of the recent *Nature* Portfolio package: The Second Space Age: Omics, Platforms and Medicine across Space Orbits—the largest coordinated release of space biology discoveries in history. These findings highlight Ireland's growing role in microbiome and space life sciences research and demonstrate how understanding biological adaptations to spaceflight can not only advance aerospace medicine but also have significant implications for health on Earth.

Professor Nicholas Brereton, UCD School of Biology and Environmental Science, and senior author of the study, said, "These discoveries highlight the intricate dialogue between specific gut bacteria and their mouse hosts, critically involved in bile acid, cholesterol, and energy metabolism. They shed new light on the importance of microbiome symbiosis to health and how these Earth-evolved relationships may be vulnerable to the stresses of space.

"We hope this research exemplifies how cooperative Open Science can drive discoveries with clear medical benefits on Earth, while also supporting the upcoming Artemis missions, the deployment of the Gateway deep space station, and a crewed mission to Mars."

Ames Space Biology Portfolio Scientist, NASA Ames Research Center, Jonathan Galazka said, "These discoveries are an important piece in our understanding of how spaceflight impacts astronauts and will aid the design of safe and effective missions to Earth orbit, the moon, and Mars. Moreover, the collaborative nature of this project is a blueprint for how Open Science can accelerate the pace of discovery."

**More information:** E. Gonzalez et al, Spaceflight alters host-gut microbiota interactions, *npj Biofilms and Microbiomes* (2024). DOI: 10.1038/s41522-024-00545-1

Provided by University College Dublin