What do squirrels have to do with space travel?

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Achieving deep space travel will allow humans to explore the far corners of the galaxy and greatly advance understanding of the universe. However, the long duration of this odyssey poses several problems to astronaut health: How do we protect astronauts from damage caused by space radiation and muscle atrophy from microgravity exposure? How do we provide them with enough resources, such as food, water, and oxygen?

One solution is to put astronauts into a state of unconsciousness similar to hibernation.

To accomplish this, I study hibernating ground squirrels as a model organism to understand how humans can employ hibernation to overcome challenges of space travel. Many aspects of hibernators make them relevant to astronaut health. During winter, hibernators enter a sleep-like state by decreasing their metabolism to conserve energy; in doing so, they consume no food or water, require minimal oxygen, and are resistant to radiation damage. Hibernators also experience no muscle atrophy despite not engaging in physical activity. The key to their resilience and health is likely hidden in their gut microorganisms, as microbes produce crucial nutrients to sustain the squirrel throughout hibernation.

By studying how the squirrel's gut microbes contribute to host health, I provide insight into the biological mechanisms that govern successful hibernation. In the future, these mechanisms will be applied to humans to understand how hibernating astronauts will greatly advance space travel by expanding our capability to travel long distances.