Lunar Colony for Large-scale, Multigenerational Lunar Gravity Studies on Mice

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Summary

One of the top goals of every space agency and many space technology companies is to make colonization of planets and moons possible. Long term human occupation of the Moon and Mars is planned for the not distant future. However, to date, we are aware of no large-scale, multigenerational studies of the physiological effects of less than Earth gravity on a large population of mammals, let alone humans. We have been told that there are centrifuge studies currently underway on the ISS to determine hypogravity effects, but any study on the ISS would be, of necessity, limited in total population. We propose the development of a lunar colony sufficiently large to carry a representative sample of mice to conduct large-scale, multigenerational studies. The colony will be a complete setup, with life support, recycling, various teleoperated robots, and connections to interface with mission infrastructure. Considering the hundreds of billions of dollars a human colony would cost, knowing long-term physiological effects of lunar gravity on mammals in advance seems like a required step, no matter the cost.

The heart of the proposed colony is in the teleoperations. While initial setup on the lunar surface by astronauts will be immensely helpful, the astronauts will not be staying long enough to complete multigenerational studies. We anticipate that the mission infrastructure left behind by the astronauts will continue to operate for at least several months in order to keep the colony viable. By piggybacking on the already needed infrastructure, the costs for the mouse colony will be greatly reduced. By teleoperating the robotics, Earth-based handlers can move food and mice around the colony, conduct wellness checks, and do autopsies. Teleoperations thereby

extends the duration of the study to depend only on the quantity of food and lifetime of life support equipment.

Potential Impact

Obtaining long-term physiological data on the effects of hypogravity on mice would provide a fundamental starting point for all human space travel and colonization efforts going forward. We know that there are profound downsides to the microgravity environment on mammals. We must know how hypogravity affects mammals and then determine how to overcome these challenges. Once we have this data on mice, the effect on humans can be extrapolated. As negative effects are found, the mouse colony can also be used to study means of mitigating or eliminating these negative effects. Parts of the colony could also be buried under regolith, allowing for radiation studies on some of the mice.