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THE BIOMEDICAL CHALLENGES OF LONG-DISTANCE, LONG-DURATION HUMAN
SPACEFLIGHT

Abstract

Human space exploration is a challenging and dangerous endeavor. Over the past 50 years, the global space community has learned a great deal about living and working in space. However, the majority of our experience is in low earth orbit (LEO), where we have been striving to perfect long-duration human spaceflight at installations such as the International Space Station (ISS). The number of people who have been beyond LEO is still very small comparatively and, as such, our experience with long-distance human spaceflight is quite limited. There are many unique biomedical challenges that long-distance, long-duration human spaceflight pose to space travellers that the global space community may not have sufficient knowledge (as of yet) to overcome. These types of missions will likely involve living and working on the Moon, an asteroid, Mars, or some other to-be-determined destination. There are a number of potential dangers that need to be acknowledged and addressed: galactic cosmic radiation and solar particle events; muscle and bone loss secondary to microgravity exposure; neurovestibular problems; psychiatric and psychological issues; impaired immunity; and orthostatic intolerance. This is by no means an exhaustive list but one that highlights some of the main challenges that must be dealt with before a deep space exploration mission will be successful. Some of these issues have been researched extensively, such as muscle and bone loss secondary to microgravity; many of the exercise and nutritional countermeasures that are currently used on the ISS have significantly mitigated this concern. However, other issues, such as galactic cosmic radiation and solar particle events, have not been studied as extensively and as a result, the global space community still lacks the knowledge of how to prevent and/or mitigate the potentially fatal effects of radiation on deep space travellers. This presentation will focus on the challenges that face successful long-distance, long-duration human spaceflight, the tremendous work that has been done to date to make living and working in LEO possible, and the work that still needs to be done in order to make deep space exploration a reality.