

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IPB)

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ASTRONAUT HEALTH & PERFORMANCE IN SPACE: A REVIEW

**Abstract**

Since the beginning of time, we humans have looked up to the skies for answers. Over the centuries, many have come up with ideologies that have helped civilization move forward. We now live in an era with increased scientific breakthroughs that are helping shape our understanding of our cosmos. Our innate curiosity about the universe distinguishes us from all other beings on Earth, and it is the main driver pushing us to explore beyond what our physical bodies are capable of. The challenges of Human Spaceflight remain of great concern, and need to be managed before being able to venture beyond Earth's magnetosphere. The effects of microgravity on the cardiovascular system, central nervous system, bone mechanics, myology, and the vestibular system are not yet completely understood. Current available countermeasures are not sufficient to assure that astronauts will be able to adequately perform the necessary tasks upon landing on Mars after a prolonged exposure to microgravity. Even extended duration exposures to 1/6th g on the Moon are of concern. Other important factors to consider are the effects of exposure to solar radiation including heavy ions that are present in galactic cosmic rays. Determining the time course and magnitude of harmful and potentially life-threatening effects is of utmost importance

to inform and prioritize countermeasure development. For this reason, a foundational understanding of the human requirements for future deep space and planetary exploration is necessary. This study will present an overview of our current understanding of the physiological effects of long duration spaceflight and project the impact for deep space missions if we only employ current countermeasures. We will begin with an analysis of the epidemiological approach currently used to predict the impacts of spaceflight and discuss the value of precision medicine approaches that will allow for prevention and targeted countermeasures depending on individual needs. The outcome of this study is to define research questions in each of these areas, in order to effectively develop solutions for future deep space missions. This study is performed by the Deep Space Initiative (DSI). DSI is a non-profit entity for which the goal is to increase accessibility and opportunity to space research, and its main focus is to help enable deep space exploration for the benefit of all Humankind.