


# Chapter 7

## Space Medicine and the Microbiome: The Role of Fungi in Space Health

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### **ABSTRACT**

*This chapter explores the intersection of space medicine, the human microbiome, and fungal biology in the context of long-term space exploration. The authors examine the challenges posed by the space environment on human health, focusing on how microgravity and radiation affect the fungal components of the microbiome. It discusses current research on fungal adaptations in space, health risks of fungal overgrowth, and innovative approaches to leveraging fungi for space-based healthcare and infrastructure. The chapter also addresses altered fungal behavior on astronaut health, including immune modulation and potential pathogenicity, and explores the use of fungi in life support systems, biotechnology, and space habitat construction. By addressing the challenges and opportunities of fungi in space, this work contributes to advancing SDG 3 (Good Health) and SDG 9 (Innovation). The chapter concludes with recommendations for future research and technological developments for successful long-duration missions and space colonization.*

DOI: 10.4018/979-8-3693-6869-5.ch007

# 1. INTRODUCTION

## 1.1 Overview of Space Medicine

Space medicine, a specialized field of study, focuses on understanding the physiological and psychological challenges that space environments impose on the human body. As humanity looks towards extended missions to the Moon, Mars, and beyond, the significance of space medicine is magnified. This discipline addresses a wide range of issues—from radiation exposure and the effects of microgravity to the mental health of astronauts and the impact of space conditions on the human microbiome, including its fungal components. Space missions of the future must account for these factors to ensure the health and safety of crew members (Dey, 2019).

## 1.2 The Human Microbiome in Space

The human microbiome, consisting of bacteria, fungi, viruses, and other microorganisms, plays an integral role in maintaining health by aiding in digestion, synthesizing essential vitamins, and protecting against pathogens. However, the balance of this complex microbial community is disrupted in space. Microgravity alters the distribution and behavior of these microorganisms, while the constant exposure to space radiation introduces additional threats. Fungal species, which are a significant part of the microbiome, exhibit both resilience and pathogenic potential under these conditions, making their study essential for the success and safety of space missions (Crucian, et al., 2018).

## 1.3 Focus on Fungal Biology

Fungi, a distinct kingdom of organisms separate from plants, animals, and bacteria, possess unique biological features that allow them to thrive in extreme environments. Their cell walls, composed of chitin, glucans, and mannans, provide structural integrity and protection, enabling survival under the harsh conditions found in space. This resilience, while beneficial for certain applications, also raises concerns about pathogenic overgrowth and the potential for fungal infections in space travelers. The ability of fungi to adapt to microgravity, radiation, and other space-specific stressors is critical to understanding their role in both risks and potential applications in space exploration (Simões & Antunes, 2021).

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