

SPACE LIFE SCIENCES SYMPOSIUM (A1)
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INTERNATIONAL SPACE STATION- MICROBIAL OBSERVATORY OF PATHOGENIC VIRUSES,
BACTERIA AND FUNGI AND THE IMPACT ON ASTRONAUT HEALTH

Abstract

The International Space Station (ISS) is a unique built environment not found anywhere on Earth. While factors such as temperature, humidity, airflow, occupant density, and surface materials have all been shown to influence the indoor microbiome on Earth, we still do not know what factors affect the composition of the ISS microbiome. If certain conditions promote higher numbers of pathogens, this will have a profound effect on astronaut health, as their risk of developing infections is already high due to immunosuppression caused by spaceflight. Another factor influencing crew health is the “human microbiome”- the trillions of organisms inhabiting our body, that play an important role in maintaining health. However, changes in proportions of some of these organisms have been implicated in numerous, non-infectious diseases. To date, we have very little information on how the human microbiome reacts to the pressures of spaceflight. If changes in composition and function have negative health effects, this will be a concern for long term space missions, where access to medical care and facilities are limited.

The objectives of this study will be to (i) provide a comprehensive catalogue of bacteria, viruses, and fungi that colonize the ISS; (ii) to correlate the presence of pathogens on the ISS with that of the crew, to determine how readily exchange of these microorganisms occur between crew members and what factors may promote this transfer; (iii) to determine which pathogens persist across multiple ISS missions and (iv) to determine whether spaceflight changes the astronaut microbiome; both in composition and function.

Skin, oral and nasal swabs will be collected from 3 astronauts (flying on 3 separate missions) at 3 different time points; prior to flying to the ISS, while on the ISS (multiple times throughout their mission) and when they return to Earth (1 day, 3 months and 6 months post flight). Surface samples will be collected from 8 different locations across the ISS during each of the astronaut's missions. Transcriptomics (functional characteristics), targeted microbiome (bacteria, fungi, virus), and resistome (antimicrobial resistance gene amplification) analyses will be carried out.

Understanding how the host microbiome (both pathogens and commensals) respond to spaceflight could allow for more informed health policies for astronauts, such as elimination of nutrients from diet to prevent the growth of certain organisms while in space or the intake of probiotics or prebiotics to regulate the microbiome.