

Analysis of Human-Commensal Microbes at a Mars Analogue Habitat

Mara Leite¹, Dragana Dobrijevic², Mamatha Maheshwarappa³, John Ward², Lewis Dartnell¹

¹School of Life Sciences, University of Westminster, New Cavendish St, Fitzrovia, London W1W 6XH

²Department of Biochemical Engineering, University College London, Gordon Street, London WC1H 0AH

³Science and Technology Facilities Council, Harwell Campus, Didcot OX11 0QX

Background

- One of the major concerns of future crewed missions is the contamination of Mars with terrestrial bacteria.
- To assess the risk of contamination that human-associated microbes can present to the Martian environment, we analysed a Mars analogue site.
- Mars analogue sites, such as the Mars Desert Research Station (MDRS), are places on Earth that are geologically similar to Mars and are used to conduct scientific research in a Mars-like environment.
- The MDRS was constructed by The Mars Society and is located in a desert landscape in Hanksville, Utah, United States.
- At the MDRS, the crews live and work for a period of 2-3 weeks under simulated space conditions.
- The MDRS layout can be seen in the image on the right. From left to right: The RAM (repair and assembly module), The Hab (living habitat), The GreenHab (greenhouse), the observatory, and the Science Dome.

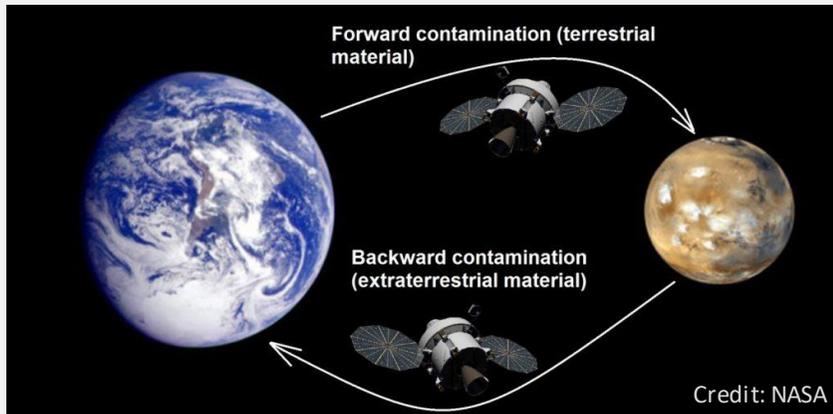


Credit: The Mars Society

Significance & Objectives

Significance

- Commensal microorganisms, also referred to as human-associated, are harmless microbes that colonize the human body.
- Commensal microbes carried by future astronauts pose a significant risk for the Martian soil and the search for microbial life due to the risk of forward contaminating Mars and the impossibility of sterilizing humans as we do with spacecraft.

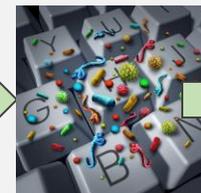


Objectives

- Evaluate the effect of human presence on a Mars analogue environment by determining the leakage extent of commensal microbes from the inside the MDRS habitat to the exterior.
- DNA extraction and sequencing to determine the microbial species present on indoor and outdoor samples.
- Comparison of microbial species present on swabs collected from surfaces inside the MDRS habitat with the microbial species present on a soil sample collected from outside the MDRS.



Human-Commensal
Microbes



Swabs from the
interior of the MDRS



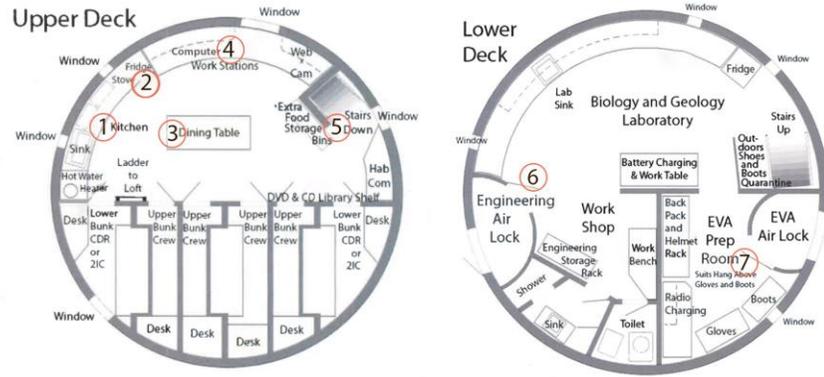
Soil from the exterior of the MDRS



Sampling & Methodology

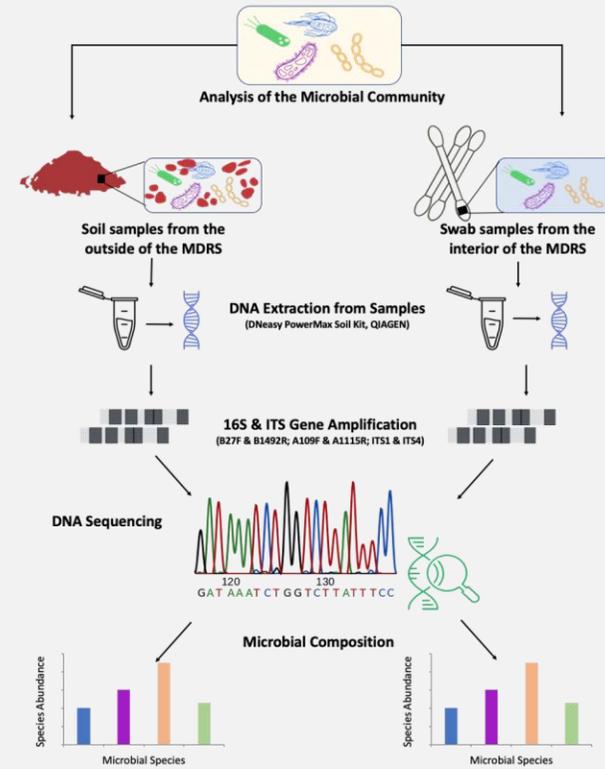
Sampling

- All samples were collected at the end of a two-week mission (Mission 174).
- The soil sample was collected adjacent to The Hab by scooping soil into a sterilized falcon tube.
- Seven swabs were collected from inside The Hab from surfaces frequently touched by the crew (fridge door, keyboard, etc.). The habitat floor plan and sampling locations can be seen below.



Methodology

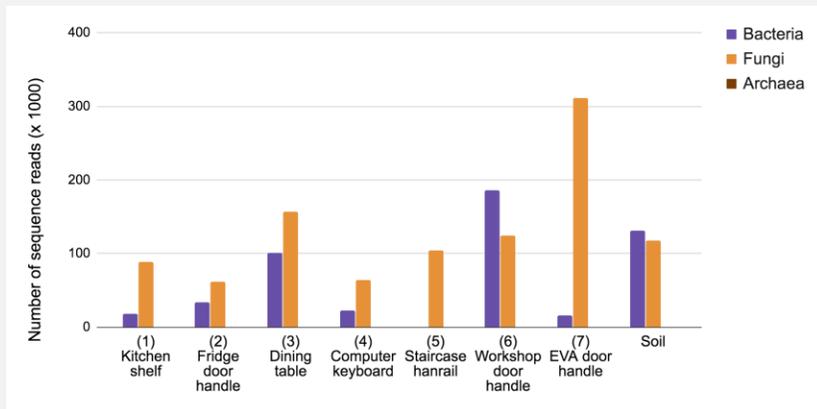
- DNA extraction and sequencing.



Results & Conclusions

Results

- Fungi and bacteria were recovered from the majority of samples.
- Inside the Hab, fungi were more abundant than bacteria. In the soil sample, environmental species dominated, with a similar abundance of bacteria and fungi.



- Plant-based food and henna tree, the source of dye used for the decorative staining of hands, was also detected.

Conclusions

- The study provided a glance into the microbial diversity of The Hab and the necessity to monitor it for the crew members' well-being.
- Our findings suggest a low abundance of human-associated microbes in the soil.
- Evaluating the impact of human presence on a Martian analogue site will help us plan for and mitigate the risk of the dispersal of human-commensal microbes carried by future astronauts onto the uncontaminated Martian soil.

UNIVERSITY OF
WESTMINSTER

