



## **BA/MA theses or Project work: Conceptual design of a photobioreactor for life support on Mars**

*In short:* Some species of cyanobacteria (blue-green algae) could help produce life-support consumables (such as food and O<sub>2</sub>) for astronauts during future missions beyond Earth. This project aims at designing a culture system for cyanobacteria that could be deployed on the Martian surface. No prior biology knowledge is required.

*More details:* Major space actors—including NASA and ESA—are aiming for a long-term presence on the Moon this decade, followed by missions to Mars. However, as missions get longer and farther away, providing all life-support consumables (breathable air, food, and others) from Earth becomes unrealistic given launch costs, travel times, and risks of failure.

The main goal of the Laboratory of Applied Space Microbiology (LASM) at the ZARM is to develop biology-based systems that can turn resources found on Mars into life-support consumables. Our concept is based on microbes, specifically cyanobacteria, which could help provide many of the above-mentioned consumables and that could be fed with materials found in Mars's regolith ("soil") and atmosphere.

While we are working on defining the best conditions for growing cyanobacteria in a Martian culture system, the proposed project is about how to provide those conditions: designing a cyanobacterium growth system—a photobioreactor—that would function on Mars's surface.

The photobioreactor should, among others, provide the right pressures of N<sub>2</sub> and CO<sub>2</sub> (directly extracted from the Martian atmosphere) as identified by ongoing work at the LASM, and provide adequate lighting and temperature. Ideally, it would be lightweight, have a low energy consumption, and be partly manufactured from materials naturally available on site.

This project is mostly theoretical (the targeted outcome is scientific publication). Prior biology knowledge is not required: guidance on biology-related matters will be provided.

*More information on the research group*

Visit the webpage of the Laboratory of Applied Space Microbiology: <https://www.zarm.uni-bremen.de/en/research/researchindependent-groupshtml/laboratory-of-applied-space-microbiology.html>

This project is in collaboration with the MaMBA (Moon and Mars Base Analogue) group: <https://www.zarm.uni-bremen.de/en/research/researchindependent-groupshtml/extraterrestrial-habitation.html>



*Cyanobacteria growing in an analogue of Martian soil (left) or in a standard medium. Photo: Tiago Ramalho.*

#### *How to apply*

Send an email to Dr. Cyprien Verseux ([cyprien.verseux@zarm.uni-bremen.de](mailto:cyprien.verseux@zarm.uni-bremen.de)) and Dr. Christiane Heinicke ([christiane.heinicke@zarm.uni-bremen.de](mailto:christiane.heinicke@zarm.uni-bremen.de)).

Briefly explain why and how (BA, MA, or project work) you would like to participate. Attach a resume and your most recent transcript.