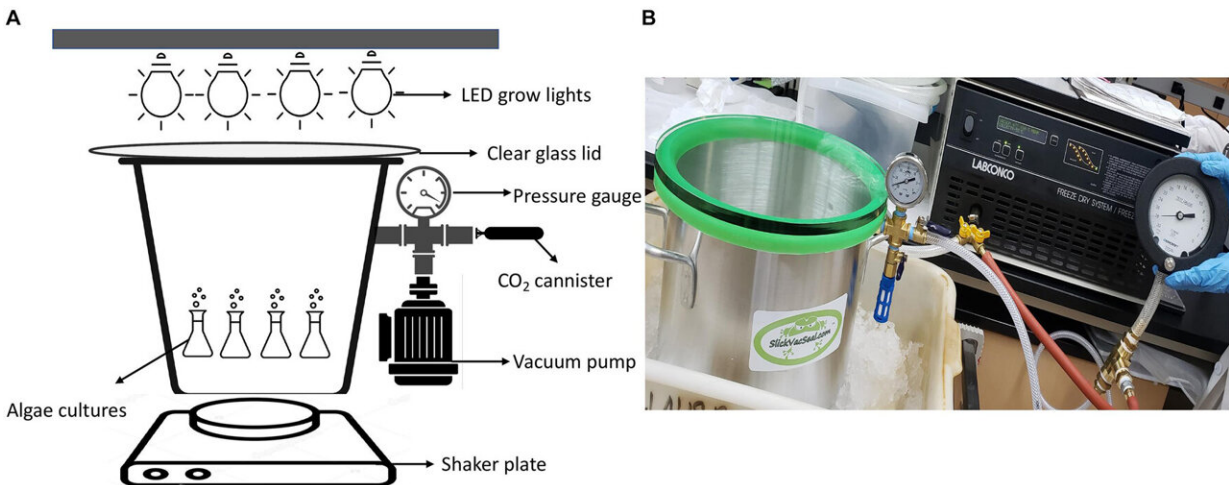


Algae could be instrumental in making human exploration of Mars possible

October 19 2022



(A) Design of low-pressure growth chamber used for pressures of 330 mbar and below, (B) Photograph of the experimental setup for low-pressure growth experiments of 330 mbar and below using the SlickVacSeal aluminum vacuum chamber. Credit: *Frontiers in Microbiology* (2021). DOI: 10.3389/fmicb.2021.733244

While the world is marveling over the [first images and data](#) now coming from NASA's Perseverance rover mission seeking signs of ancient microscopic life on Mars, a team of UNLV scientists is already hard at work on the next step: What if we could one day send humans to the Red Planet?

There's a lot to consider when sending people, though. Human explorers, unlike their rover counterparts, require oxygen and food, for starters. It also takes about six to nine months—both ways—just in [travel time](#). And then there's the air itself. Martian air is roughly 98% carbon dioxide (Earth's is a fraction of 1% for comparison) and the air temperature averages an extremely frigid -81 degrees.

It's these challenges that UNLV geochemist and NASA Mars 2020 team scientist Libby Hausrath and postdoctoral researcher Leena Cylil, a microbial ecologist, are exploring. And a big part of the answer? Algae.

"Extremophilic algae" are types of algae known for their ability to thrive in [extreme environments](#) such as high-altitude [snowy mountains](#) or hypersaline lakes. These algae love [carbon dioxide](#) and can use it to produce oxygen. They also are edible, dense with nutrients, and grow quickly. Extremophiles' helpful characteristics allow them to grow in some of the most inhospitable environments on Earth, possibly even in conditions similar to Mars.

"If we want to accomplish long-term space exploration with people instead of rovers and robots, it will require developing a self-sustaining life support system—food and breathable air," says Cylil.

Hausrath and Cylil are among a handful of scientists looking at growing algae under the low-pressure, low-light conditions seen on Mars, and are pursuing different species than previous studies.

Early results are promising. So far, they've identified three species of algae that show substantial growth under extreme conditions. They used a low-pressure vacuum chamber to simulate atmospheric pressures relevant to Mars and topped it with a plate of tempered glass to allow light in at half the sun exposure present on Earth.

The three strains of algae are *Dunaliella salina*, which is typically found worldwide in salt lakes; *Chloromonas brevispina*, which exists in snowy climates; and *Chlorella vulgaris*, primarily used as a protein supplement or protein-rich food additive, which is often found in natural and engineered freshwater and soil habitats.

"We actually were surprised the algae grew at these low pressures. They may be thriving in these extreme environments on Earth, but the atmospheric pressure on Mars is considerably lower, so we were skeptical of what the outcome would be," says Cyclic.

Their findings on low pressure growth were published in *Frontiers of Microbiology*, with another publication on growing algae in low light levels coming in early 2023.

The team strategically studies one variable at a time to understand exactly how each affects growth.

They're isolating certain traits in each algae species to learn what combination of algae characteristics are best suited for Mars. For example, having algae that grow at low pressure is potentially more important than growth with a specific type of lighting because lighting is easier to manipulate than pressure. The hope is that the lab conditions could be recreated in greenhouses on the surface of the Red Planet.

"Understanding genetic adaptations that allow the [algae](#) to grow can help with the design of eventual life support systems and potential greenhouses on Mars," says Hausrath.

Hausrath and Cyclic are already working with a NASA engineer on applications for their work. Their study shows these organisms can produce oxygen at levels comparable to what people need to survive, but engineers will be the ones to put that into practice.

The case for algae

Hausrath and Cyclic's work is part of preparing for future short-term human exploration of Mars, where astronauts—instead of rovers—will conduct further experiments and gain more knowledge of the planet and its history. Ultimately, these visits will help determine if Mars can support human habitation.

"You could compare it to the space station missions paving the way for what we are seeing now in the commercialization of space flights. In time, commercial corporations will take our research toward manned long-term space travel and expand on it and what we know will grow exponentially," explains Cyclic. "We are learning from the rock and [soil samples](#) being returned from the rover mission, but there are other things we can't accomplish with robotics."

More information: Leena M. Cyclic et al, Investigating the Growth of Algae Under Low Atmospheric Pressures for Potential Food and Oxygen Production on Mars, *Frontiers in Microbiology* (2021). [DOI: 10.3389/fmicb.2021.733244](#)

Provided by University of Nevada, Las Vegas (UNLV)

Citation: Algae could be instrumental in making human exploration of Mars possible (2022, October 19) retrieved 27 March 2023 from <https://phys.org/news/2022-10-algae-instrumental-human-exploration-mars.html>

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