

## PIONEERING MARS—LESSON 1

**HYPOTHESIS:** Cyanobacteria, a microscopic algae found in extreme conditions in Antarctica, could grow in similar extreme conditions on Mars.

**INSTRUCTIONAL GOAL:** Proof of Concept—Simply put, is it possible for life to exist on Mars?

- **WHY CYANOBACTERIA?** Antarctica is the closest environment on earth to that of Mars—a frozen desert.
- Cyanobacteria can freeze solid and survive the thaw, a must in the frigid Martian environment.
- Cyanobacteria grow quickly, and can survive in cold temperatures and dim light.
- Thought to be the Earth's first terraformers, cyanobacteria were some of earth's first photosynthetic organisms and may have been at least partially responsible for creating the oxygen-rich atmosphere that exists today. Its potential use as an oxygenator in cramped spacecraft and alien climates is of great interest to NASA researchers.

### VARIABLES IN PLANETARY CONDITIONS

- **Light**—Mars is further away from the sun, so the visible light is dimmer. However, since Mars lacks a protective ozone layer, damaging UV radiation is much stronger than on earth
- **Gravity**—Mars has approximately 38% of the gravity of Earth.
- **Temperature**—Most of Mars is frozen a majority of the time. In certain seasons, latitudes, and elevations, however, it will thaw briefly during the day.
- **Orbit**—Mars' path around the sun is longer, making its year 1.88 times an Earth year, which means it has a longer summer.
- **Atmosphere**—Lower gravity means lower atmospheric pressure, a tiny fraction of the Earth's. Also, the vast majority of the atmosphere is carbon dioxide.
- **H<sub>2</sub>O Triple Point**—Certain conditions of atmospheric pressure and temperature must be present for water to exist in its liquid form in order to cultivate life.

### PROCESS

- Students will work in their classrooms to design experiments to test the hypothesis taking variables into account.
- At a university lab, students will attempt to grow cyanobacteria in micro respiratory chambers.
- Students will create an environment within the chambers as close to that of Mars as possible and use electrodes to test growth.
- Low-gravity growth chambers will be used aboard the ISS to test cyanobacterial growth in reduced gravity.