Evaluating Culturing Techniques on *Arthrospira platensis* for Long-Term Usage

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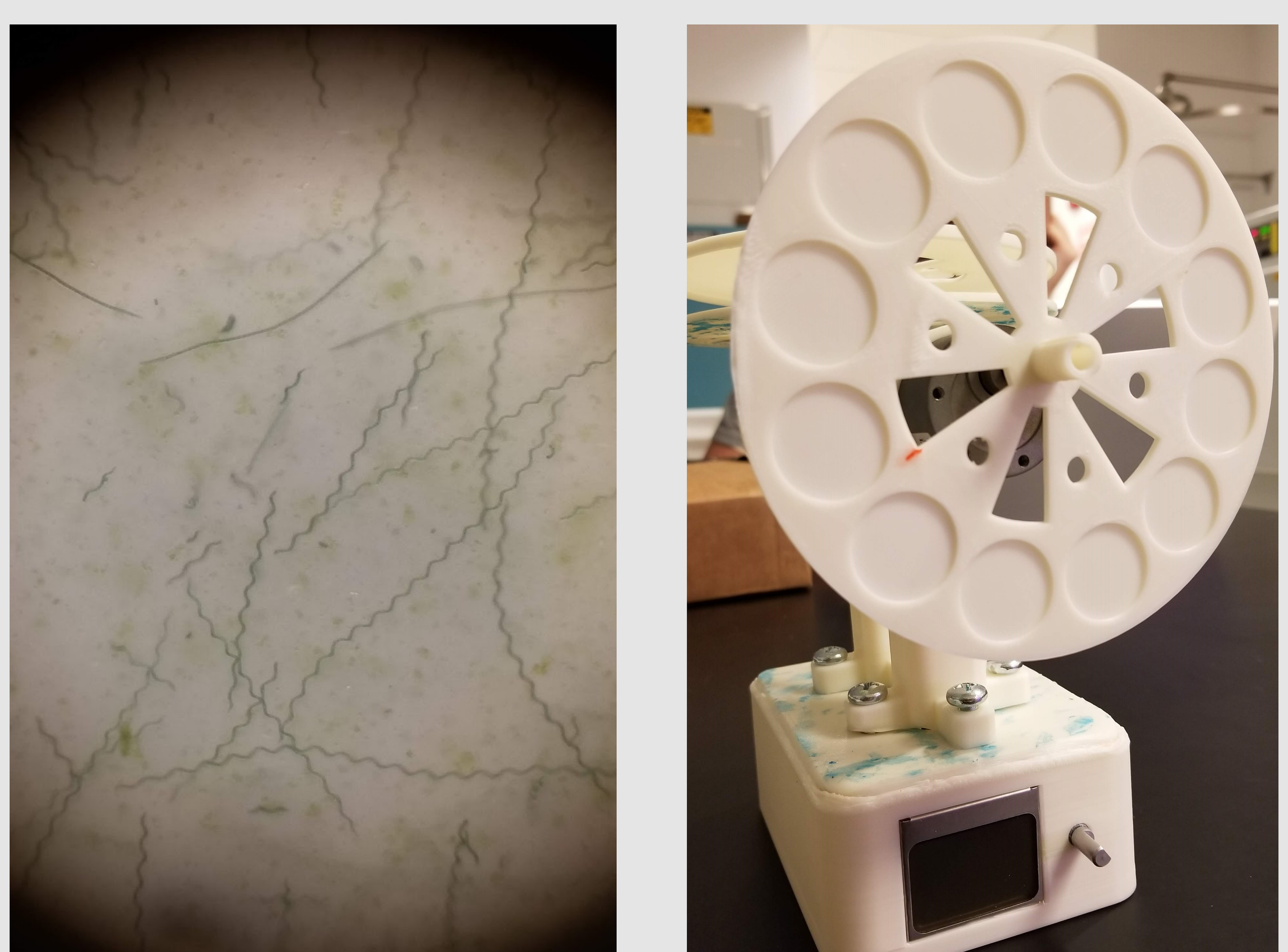
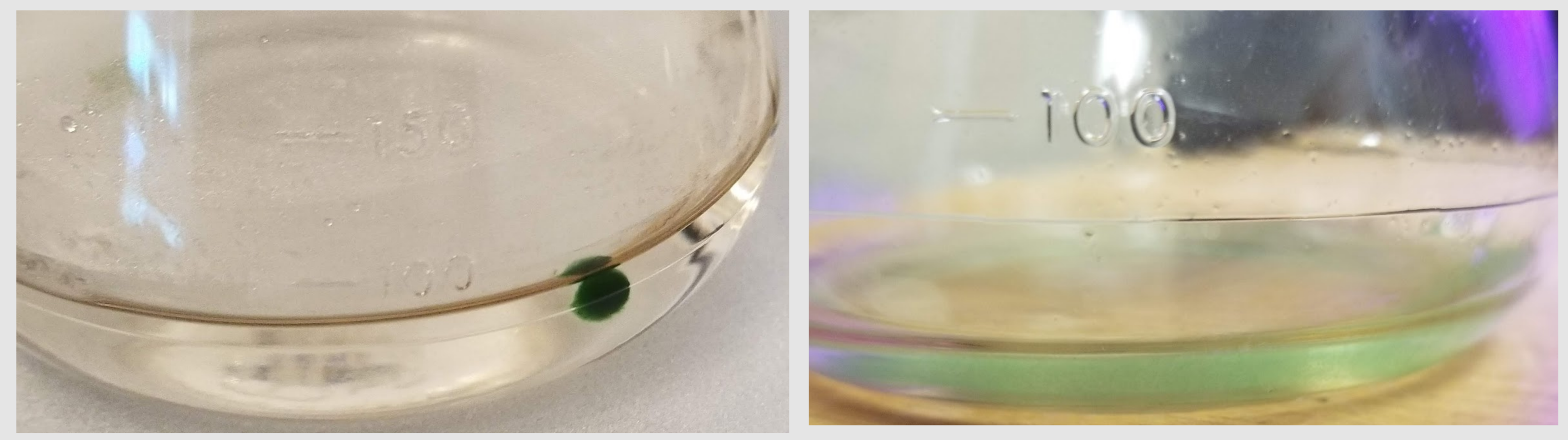
Introduction

The intended research is to develop a long-term culturing technique for growing *Arthrospira platensis*, a cyanobacteria that is commercially referred to as Spirulina. The chosen cyanobacteria is known as a superfood due to having high concentrations of varying nutritional values. Additional benefits of Arthrospira are that samples have been found to survive well in microgravity, can be consumed with zero processing, and removes CO2 from the atmosphere. These characteristics enable this microorganism to be an excellent candidate for use in space travel within an advanced life support system (ALSS).

Ideally, only a small volume of the original strain is managed to reduce the resources required for maintenance and reduce the likeliness of contamination. Experimentation for this project will consist of two main components; one being, to try to maintain a parent culture of Arthrospira with as little maintenance as possible. The other component would be to begin growing the Arthrospira in flasks to grow subcultures for experimentation. The storage environments for maintaining a small parent culture will consist of placing samples in an ultracold freezer, at -80°C, an average refrigeration environment of ~2°C, and in room temperature with low light conditions. These environments reduce the cellular activity and growth rates dramatically while still allowing the survival of the strain.



Zoomed-in view on Arthrospira (left) and the clinostat system (right)



Spirulina (left) vs. Arthrospira (right)

Why *Arthrospira platensis*?

This microorganism has many health benefits and has shown promise for use in spaceflight. Among the advantages are:

- Wide range of vitamins in larger doses
- Digestible without processing
- Contains many other nutritious values (e.g. protein and amino acids)
- Shown to survive in microgravity
- Able to fixate Carbon Dioxide and photosynthesis
- Reproduces asexually which can help allow the culture to survive due to a system failure

Current Setup

The cultures were imported from Japan due to receiving a specific strain (NIES 39) that has already had a complete genomic sequencing. Multiple subcultures have been created to expand the cyanobacteria that we have to experiment with. Another cyanobacteria, Anabaena, is being grown concurrently to provide another microorganism that is more cost effective to practice experiments on. These cultures are grown inside of a well-insulated chamber on an oscillating bed. The lighting system has alternated across three units to combat heating issues within the chamber.

The cultures are currently being tested to determine growth curves as well as expanded into additional subcultures. A chlorophyll procedure will take place to begin determining the relationship between the chlorophyll and other environmental parameters.

Acknowledgments

LUNARES Habitat

What we intend to accomplish?

- We want to understand how *Arthrospira platensis* can be applied in space applications through microgravity and increased radiation.
- Find genomic changes occurring from environmental changes and determine viable methods to either modify or mitigate these alterations.
- How this organism can be implemented into advanced life support systems for CO_2 fixation and nutrition for astronauts.

Growth chamber setup and lighting adjustments

Upcoming Experiments

Once a large enough culture has developed, many experiments will be carried out. Some of the intended research is:

- Finding growth rates given varying ambient temperature and light intensity
- Determining chlorophyll and protein concentrations using fluorescence spectroscopy; which can be applied on other trials
- Exposing Arthrospira independently to microgravity and increased radiation, followed by combining these experiments
- Determining the viability of Arthrospira to decompression through a vacuum chamber as well as extended periods in the vacuum environment