The Department of Microbiology & Cell Biology

Presents a PhD Dissertation Defense by

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"Salt Stress in Algae: Insights to Industrial Cultivation and Community Interactions"

8:00am Thursday, March 11th

Roberts 210

MONTANA STATE UNIVERSITY

Mountains & Minds

Green microalgae show promise as a source of sustainable biofuels, but high costs and resource limitations have prevented biofuel production at industrial scale. This work addresses two key hurdles in industrial microalgal cultivation: the high cost of sparging CO2, and the large demand for freshwater. CO2 sparging can be replaced by bicarbonate and carbonate buffering, but not all microalgae are able to withstand the high pH and high osmotic strength inherent in high alkalinity cultivation. Similarly, strategies like media reuse or cultivation in brackish water or seawater can decrease freshwater demand, but the high osmotic strength is stressful to many common algal strains.

Chlorella sp. SLA-04 is a salt- and alkali- tolerant green microalga isolated from Soap Lake, WA. SLA-04 can accumulate a large portion of its biomass as starch and lipids and is a prime candidate for biofuel production in high pH and high salinity systems. SLA-04 is used here to elucidate general principles of how phototrophs respond to osmotic stress. The goal of this work is twofold: 1) to provide insights to industrial cultivation of SLA-04 and 2) to use SLA-04 and its heterotrophic community members as a platform for studying the fundamentals of osmotic stress. To this end, we examine the growth of SLA-04 under concomitant high alkalinity and high salinity stress, finding that SLA-04 can tolerate seawater levels of salinity with minimal changes to macromolecular composition. Targeted metabolomics quantifies the compatible solutes produced under these conditions, and metabolic modeling is used to determine the cost to produce these compatible solutes. We extend the metabolic modeling to investigate potential exchange of vitamins and compatible solutes between a heterotrophic bacterium and SLA-04 under high salinity conditions. This work yields fundamental insights to osmotic stress adaptation in phototrophs.