Online Proceedings

POSTER SESSION 1

Commons West, Easel 28

11:00 AM to 12:30 PM

Chrysochromulina sp. as a Model for Biofuel Production in Algae: Growth and Lipid Analysis Under Stress Conditions

Philippe Enos, Junior, International Studies, Political Science

NASA Space Grant Scholar

Mentor: Stephanie Brunelle, Biology

Drilled oil is becoming increasingly expensive because it is a non-renewable resource that the planet depends on for energy and transportation. Algae may become the next source of global fuel. *Chrysochromulina* sp. is an ideal model for algal biofuel production because it has a high growth rate in culture, and the two lipid bodies (the organelles that store potential biofuel precursors) are easily detectable using cell biological techniques. The ability of *Chrysochromulina* sp. to change its lipid metabolism quickly in response to replicated environmental stress conditions is a crucial factor to better understanding its growth optimization and survival. Based on our preliminary data, this microalgae has the potential for production and commercialization of its lipid-based compounds. Guschina and Hardwood's 2006 studies have shown that lipid production increases in algae under various environmental stress conditions, such as nitrogen limitation, salinity, or increased temperature. Thus, we have investigated the growth dynamics of *Chrysochromulina* sp. under the following stress conditions: increased salinity, depleted nitrate levels, depleted ammonium levels, and depleted phosphorous levels. For each of these experiments, flow cytometry was used to obtain cell counts and determine growth rate (K'). Neutral lipid content and lipid body size are essential measurements because they represent how efficiently *Chrysochromulina* sp. produces lipids (i.e. biofuel) and the characteristics of the different lipids being produced. Using Gas Chromatography/Mass Spectrometry (GC/MS), we have elucidated that the lipid profiles change under different growth conditions. The results attained from these studies provide relevant information about the physiology and ideal growth of lipid producing conditions of *Chrysochromulina* sp. Using this information, we will be able to determine the proteins involved in lipid biogenesis and apply genetic modification techniques to optimize lipid production for commercial use.

POSTER SESSION 1

Commons West, Easel 27

11:00 AM to 12:30 PM

The Effects of the Wavelength of Light on Lipid Body Production in *Isochrysis galbana*

Phyll Alexandra (Phyll) Eier, Junior, Extended Pre-Major

Mentor: Rose Ann Cattolico, Biology

Mentor: Stephanie Brunelle, Biology

Isochrysis galbana is a marine alga that produces large quantities of lipid per cell. Lipids contain extensive amounts of potential energy. Therefore, this haptophyte may be considered for use in biofuel production. The lipid body organelle—the site of neutral lipid storage—is involved in many cellular processes. To date, little is known about this organelle in *I. galbana*. Chloroplasts contain lipids stored within smaller structures, termed plastoglobuli. For the purpose of the study, lipid body and chloroplast isolation techniques have been developed for I. galbana. While light intensity has shown no direct effect on *I. galbana*'s growth rate, we hypothesize different qualities of light will affect growth by altering cellular protein, carbohydrate and lipid content. We will culture *I. galbana* under red and blue wavelengths of light. Using chloroplast isolation techniques, as well as developed lipid body isolation procedures, we will analyze the lipids contained within *I. galbana* lipid bodies and chloroplasts when grown under different light qualities. We will also determine if these wavelengths of light induce a stress response concurrent with lipid production. Preliminary data shows that heat shock proteins 70 and 90 –proteins that maintain homeostasis within the cell—are present in *I. galbana* whole cell protein extracts as well as isolated lipid body proteins. Using Western blot techniques, the abundance of these stress proteins will be measured under different light conditions. These studies will provide information on growth and lipid production under different light qualities, and whether these wavelengths of light elicit a stress response in *I. galbana*, an alga with potential for applied biomass production.

SESSION 2T

EVOLUTION, GENETICS, AND BIOCHEMISTRY OF PLANTS, ALGAE, AND FUNGI

Session Moderator: Richard Olmstead, Biology, Burke Museum

111 JHN

3:45 PM to 5:15 PM

* Note: Titles in order of presentation.

Lipid Production and Potential Stress Response Mechanism in Freshwater Haptophyte *Chrysochromulina sp.* under Salinity Stress

Boris Mikhail (Boris) Rozenberg, Senior, Biology (Physiology)
Mentor: Stephanie Brunelle, Biology

Lipid bodies are cellular organelles involved in lipid production and storage within cells. Until recently, lipid bodies were thought of as inert storage units rather than complex organelles that play a large role in lipid biogenesis. The freshwater haptophyte *Chrysochromulina sp.* has served as an excellent model organism for research on lipid bodies because of its high growth rate, fully sequenced genome and two large, distinct lipid bodies. In algae and other eukaryotes, heat shock proteins can be investigated to detect when the cell is stressed. In many species of algae, when the cell population is placed under stress, the cells produce large lipid bodies. A classic stress response has also been detected in Chrysochromulina sp. after discovering genes coding for heat shock proteins (HSP 70 and HSP 90). Previous studies show that HSPs appear to be induced under high salinity stress in Chrysochromulina sp. The current study examines two important aspects of the correlation between salinity stress and lipid body production: what concentration of salt and what time frame is needed to cause haptophyte cells to become stressed enough to produce large lipid bodies. Previous experiments show that adding salt to algal media during log phase of growth fails to produce large lipid bodies while adding salt initially to media does not produce significant biomass to allow protein assays. Since HSPs are induced under high salinity concentrations, the second part of this study aims to determine a correlation between lipid body size, lipid production and how/when HSP proteins are induced. This study uses flow cytometry, the neutral lipid stain BODIPY 505/515 and Western Blotting to examine the relationship between lipid bodies and HSPs. Future research projects may include manipulation of stress response pathways that are relevant for biofuel applications.