The Effects of Nutrient Limitation and Light Levels on Symbiodinium

Destiny Pegram[1,2,3] Amanda McLenon2,[3], Tyler Cyronak [2,3] Jack DiTullio[2,3]

[1]*Marine Biology and Environmental Sciences, Medical University of South Carolina, Charleston, South Carolina*
[2]*Graduate Program in Marine Biology, Grice Marine Laboratory, College of Charleston, South Carolina*
[3]*Hollings Marine Laboratory, South Carolina*

Coral reefs are among the most diverse and ecologically productive ecosystems on Earth. Important to their survival are the endosymbiont flagellate, *Symbiodinium spp*. *Symbiodinium spp.* are responsible for creating a compound called DMSP which functions are hypothesized to include osmoregulation, anti-predation, antibiotic, and methyl donating properties. DMSP's production has been shown to be up regulated in times of nutrient limitation and oxidative stress. DMSP is cleaved by an enzyme called DMSP lyase, resulting in the creation of DMS. DMS is released into the surrounding environment where it becomes oxidized into sulfate aerosols condensation nuclei which are responsible for regulating solar reflectance and radiation. Because of this DMS, has a potential global impact. The goal of this experiment is to observe how nutrient limitation and light affect DMSP and other osmolytes levels, as well as the physiology of *Symbiodinium spp.* In this experiment, 2.5L *Symbiodinium spp.* cultures were grown in filtered seawater and K+Cu media in the following 6 treatments: control (200µE, N+,P+), nitrogen limited (200µE, N-P+), phosphorus limited(200µE, N+, P-), low light (20µE N+,P-) nitrogen limited/low light (20 µE, N-,P+), phosphorus/ low light (20µE, N+,P-). . These were monitored each day with cell counts and F_V/F_M (monitors the activity of photosystems). After the seventh day the cultures were harvested for chlorophyll, DMSP, and phospholipid concentrations. According to the published literature, it is predicted that DMSP functions as an antioxidant, and may be substituted for other osmolytes in times of nutrient limitation. In my experiment, DMSP levels should be the highest in the nitrogen limited culture in the high light due to lack of nitrogen and increased oxidative stress. The phospholipid concentration should be the lowest in the cell membrane of the phosphorus limited treatment because in times of phosphorus starvation some other phytoplankton species have been shown to preferentially utilize non- phosphorus containing lipids in their membrane and use the limited amounts of available phosphorus for construction of nucleic acids.

This work is supported by the Summer Undergraduate Research Program, Medical University of South Carolina, HML Consortium for Research Training on Oceans and Human Health, Marine Biomedicine and Environmental Science Department, MUSC, National Oceanic and Atmospheric Administration, Grice Marine Laboratory, College of Charleston, and the South Carolina Sea Grant Consortium.