As an undergraduate summer research fellow, I worked in the lab of Professor Bess Ward at Princeton University to study the genetic regulation of nitrogen metabolism in the diatom *Thalassiosira weissflogii* and the green algae *Dunaliella tertiolecta*.

**Methods**

We began by looking for the expression of nitrate transporter (*NAT*) genes in *T. weissflogii*. Previous research had shown that the expression of *NAT* genes in another diatom, *Cylindrotheca fusiformis* is highly repressed in cultures with ammonium and urea. We therefore prepared culture media with artificial seawater and then later amended the cultures with nitrogen either in the form of NH₄Cl or NaNO₃.

When the cells reached the middle of the exponential growth phase they were harvested and their total RNA was extracted. The extracted RNA was then transcribed to cDNA by a reverse transcription reaction. The cDNA was then amplified in a PCR reaction using primers targeting the genes for both nitrate transporters (*NAT*) genes and nitrate reductase (*NR*) genes. We also performed the same tests on the analogous genes in RNA extracted from *D. tertiolecta*.

**Results**

Our preliminary results indicate that the presence of ammonium does not repress *NAT* gene expression in *T. weissflogii*. *NAT* and *NR* genes in *D. tertiolecta* were also observed to be repressed in the presence of ammonium.

**Continuing Research and Long-Term Goals**

I will continue this research during the 2003-2004 academic year and write my senior thesis on the basis of this work. In addition to obtaining time series data on *NAT* and *NR* gene expression, we hope to apply similar techniques to different organisms and detect the expression of their analogous genes. We are also hope to use a real-time PCR assay that will quantify the number of copies of *NAT* or *NR* mRNA present in a sample.

This research should help to further the understanding of nitrate uptake by phytoplankton, which has been found to be a complex process. It is hoped that by studying uptake and assimilation of nitrogen at a molecular level we can begin to understand the kinetics and the mechanisms that affect uptake, since they must act on the nitrate transporter or its synthesis.

Additionally we would like to eventually apply the methods we have developed to environmental samples to further our understanding of the nitrogen cycle. The availability of nitrogen is often a controlling factor of primary productivity in the oceans, and it is estimated that the fixation of carbon dioxide by oceanic phytoplankton accounts for almost half of primary productivity.

**Personal Statement**

This grant afforded me the opportunity to experience what it is like to work in a research laboratory; I was able to live nearby and work full-time, as well as participate in other aspects of being a researcher by, for example, attending lab meetings. The time spent on this project was additionally valuable for the technical knowledge I gained in the use of lab equipment and in various lab procedures.