2008 Summary of Research Reports

Associate Professor Virginia Smith
Chemistry Department
vsmith@usna.edu
http://www.chemistry.usna.edu/smith/smith.html

Project: Spectroscopic Characterization of Deciduous Leaf Chromophores and Fluorophores
Sponsor: GAM Laser, Inc

Statement of Work:

I will perform collaborative research with scientific staff at GAM Laser, Inc., a private company that designs and manufactures excimer lasers, to investigate the spectroscopic properties of the leaves of Maryland native deciduous trees. There are two research goals: 1) a short term project to determine whether or not deciduous leaves that have turned bright colors are actually fluorescent; and 2) a long-term project to analyze and characterize the ultraviolet and visible chromophores of hard-wood trees on the grounds of the Naval Academy. We anticipate that the former project will be of general interest because of the popular appeal of brightly colored leaves and the perception that they often seem to "glow in the dark," or at least appear to be much brighter than would be expected based on ambient light levels. The latter project will make use of the extensive and detailed weather records maintained by the USNA Oceanography department and attempt to correlate appearance of specific chromophores with environmental conditions such as ambient temperature, length of day, rainfall amounts and radiant sunlight (percent cloud cover). An eventual goal is to identify the biochemical reactions producing specific chromophores. Both projects would be ideal for midshipman participation. Extraction of leaf chromophores and possible fluorophores will be performed at USNA using published chemical methods and existing resources; analysis of the extracts with high-energy lasers will be performed at GAM Laser, Inc. facilities.

Project: Investigation of Protein-Protein Interactions Involved in Bacterial Protein Export
Sponsor: University of Missouri

Statement of Work:

Chaperone proteins are a general class of proteins that perform a vital function in the cell by preventing improper interactions between proteins that might lead to degradation and aggregation. Many of these chaperone proteins work according to relatively well-understood mechanisms requiring cleavage of the chemical energy molecule adenosine triphosphate (ATP). However, less is known about the chaperone protein SecB of Escherichia coli, which does not require ATP in order to perform its job. We will exploit our knowledge of the three- dimensional structure of SecB to

obtain information about the mechanism by which SecB recognizes the proteins it binds to and determine how it prevents them from aggregating or becoming degraded. We will site-directed spin-labeling methods and electron paramagnetic resonance spectroscopy to investigate the interactions between the chaperones SecA, SecB and one of their ligands, the maltose- binding protein. This project is a continuation of work conducted with Professor Randall each year since the summer of 2001.