Scholarship Proposal - Example 1

New project: 12/1/2009-5/5/2010.

Description: Plant tissues orient themselves upright in a gravitational field and have the ability to re-orient when this orientation is disrupted. This re-orientation (a process called gravitropism) is regulated by plant hormones. While stem gravitropism is caused by the plant hormone auxin to accumulate on the lower side, the gaseous hormone ethylene also increases after horizontal placement and plays a modulating role in regulating the process. The regulation of enzyme ACC synthase (ACS) is considered to serve as the rate-controlling step in ethylene biosynthesis. ACS enzymes are encoded by a gene family whose expression is differentially regulated in various tissues. There are eight functional ACS forms that interact as dimers (or pairs) to function in ethylene biosynthesis.

Project objectives:

- evaluate the role of individual ACS enzymes in the regulation of gravitropism
- analyze expression changes for the various *ACS* genes during gravitropic curvature

Significance/uniqueness: The Arabidopsis Biological Resource Center (ARBC) has a collection of mutants lacking the expression of all the ACS forms which will allow us to evaluate the role of a specific *ACS* enzyme in regulating gravitropic curvature. In addition, mutants contain the regulatory region of the *ACS* genes attached to a reporter gene which produces either a colored or fluorescent protein product are available to shows tissue localization for each ACS form.

Experimental Approach:
The measurement of gravitropic curvature will be accomplished by image analysis. We plan to study the role of individual ACS members in stem growth and gravitropic curvature by comparing wild-type to mutant seedlings that do not express specific *ACS* forms using IMAGE J software. The tissue-level expression patterns for the ACS forms will be analyzed during gravitropic curvature using fluorescence and/or confocal microscopy. Ethylene production will be measured by gas chromatography (GC) to compare the changes in ethylene production from wild type and mutant seedlings.

Expected Results: Preliminary research shows that mutants lacking expression of *Arabidopsis-ACS4* have greatly increased ethylene along with increased gravitropic curvature in dark-grown seedlings. These preliminary results are intriguing, and we feel that complete gravitropic curvature profiles in combination of ethylene production and tissue expression changes for the ACS enzymes will provide important insight into the role of ethylene in gravitropic curvature.

BUDGET: $500 stipend for each student

Each team member will analyze four functional ACS forms. Students are expected to complete a minimum of 100 hours of research for this project.