PhD Training in Multidisciplinary Approaches to Sustainable Bioenergy

The design, development, and implementation of a new bioenergy industry that is economically and environmentally sustainable require the integration of a broad spectrum of scientific disciplines. Although biofuel production has increased recently, current production methods are not sufficient to meet long-term needs in terms of capacity, net energy production, water consumption, and carbon balance. It is widely recognized that substantial technical advances must be achieved in all aspects of the bioenergy industry, including developing new energy crops; new biological, chemical, and thermal conversion technologies; and new byproducts. *The goal of the MASB program, funded by the National Science Foundation, is to prepare PhD graduates who are trained as interdisciplinary scientists with full understanding of the technical challenges facing the emerging bioenergy industry.* It is expected that this cohort of trainees will make substantial contributions to solving rate-limiting steps in all phases of the industry. Four areas of bioenergy and biorefining are used to define the scope and structure of MASB training:

Crop Sciences and Plant Biotechnology: Breeding, engineering, and management of sustainable energy crops, including algae;

Biological, Chemical, and Thermal Biomass Conversions: Developing processes, reactors, and catalysts (including microorganisms) to convert biomass to biofuels and other products;

Product Engineering: Evaluating biorefining products and creating engine modifications for efficient use of biofuels; and

***Economic and Environmental Assessment*:** Evaluating the environmental impacts (carbon and greenhouse gas impacts, soil quality, water use, etc.) and the economics of biofuels production and use.

MASB is a comprehensive training program that incorporates cross-disciplinary teamwork, coursework in multiple disciplines, and research projects that span at least two focus areas. MASB scholars earn their degrees in existing degree programs while complementing them with MASB program elements that include:

- Completion of two new graduate-level courses on biofuels and biorefining
- Participation each semester in a graduate-level research seminar series on bioenergy and biorefining, and in an annual MASB research symposium
- Participation in workshops to develop personal and professional skills
- Internship experiences in a policy and technology institute, and an applied research internship in industry, a government laboratory or agency, or a policy institute
- Completion of courses in at least two of the four focus areas
- First-year rotation in research groups from three of the four focus areas
- PhD research that includes significant components of at least two focus areas
- Involvement of at least one faculty member from another theme on the student's graduate committee (or as co-advisor)

MASB Scholars will be prepared to have high-impact careers in the emerging biorefining industry, in governmental agencies and policy institutes, and in academia, and will be uniquely trained to have a cross-cutting view of this field and an understanding of how their expertise interfaces with other aspects of biorefining.

Applicants should contact bioenergy-IGERT@colostate.edu for more information.