



NSF REU Site: Bioenergy Systems – Integrating Institutional Approaches in Nebraska



Dr. Paul Blum, Dr. Heriberto Cerutti, Laurie Voelker, Renee Rodriguez Batman
University of Nebraska-Lincoln

Contact Information: pblum1@unl.edu, hcerutti1@unl.edu, voelker2@unl.edu, rbatman2@unl.edu

Abstract

Continued growth of career opportunities in biology accentuates the deficiency of qualified students trained in STEM fields. Active learning arising from research experiences strongly impact career decisions. The University of Nebraska-Lincoln (UNL) offers undergraduate students an interdisciplinary summer REU experience that promotes interest in bioenergy systems. Top-ranked faculty sponsors teach science through hands-on research and facilitate cohort experiences. This project is training participants in the emerging area of bioenergy systems and stimulates their interest in STEM careers and education. The Intellectual Merit of this project arises from the recognition that bioenergy systems is an emerging topic of national relevance and a central component of crosscutting initiatives at UNL. Microbial studies will focus on biotransformations of energy sources, regulatory networks, and resource competition while plant studies will focus on RNAi, organellar, and lipid biology. Participants will undergo training in biochemistry, molecular biology, genetics, the physiology of selected model systems and professionalism supplemented with individual career mentoring and cohort activities. The Broader Impacts of this project extend a successful (internal) REU with a record of accomplishment for attracting women and minorities, to a larger student body thereby increasing the overall scope and effect of the program. This project creates an interdisciplinary atmosphere to address nationally recognized workforce needs and disseminates outcomes through established networks and institutional programs.



Program Support and Education

Summer experience includes:

Weekly lunch seminars, Ethics lunch seminar, Careers in Science lunch seminar, Graduate Student lunch panel, and a Research Symposium for students to give an oral presentation of their research findings at the conclusion of the summer program.

Students also have an array of social activities and events, both within the program and with all students participating in a summer research experience at UNL. This comprehensive, integrated approach to a summer program led to a cohesive group that left with a positive, beneficial experience.

Faculty Mentors and Research

- Audrey Atkin "Co-regulated Gene Networks"
- Paul Blum "Energy Metabolism in Thermophilic Organisms"
- Edgar Cahoon "Metabolic Engineering and Functional Genomics of Oilseed Crops for Improved Oil Content and Composition"
- Heriberto Cerutti "Algae as Model Systems for Oil Biosynthesis and Biofuel Production"
- Thomas Clemente "Metabolic Characteristics of Plant Lipid Biosynthesis"
- Ismail Dweikat "Sweet Sorghum as a Bioenergy Crop"
- Gregor Grass "Metal Homeostasis in Cyanobacteria"
- Steve Harris "Fungal Morphogenetic Impact on Butanol Formation"
- Robert Hutkins "Probiotics and co-aggregation systems"
- Etsuko Moriyama "Bioinformatics of Cell Signalling and Energy Metabolism"
- Karrie Weber "Bacteriophage Impact, Energy Transduction and Microbial Proliferation"
- Donald Weeks "Algal and Plant Approaches Constraining Productivity"



Institutional Support

The Office of Graduate Studies at the University of Nebraska-Lincoln offers a high level of direct service and support that is intended to demonstrate UNL's commitment to the department and to the REU students. It's a very productive collaboration. Their support for our REU Site includes:

- Recruitment
- Centralized Application and Website
- Logistical Infrastructure
- Student Development Seminars
- Evaluation

This institutional support allows faculty to focus and plan program activities without having to worry about logistical details. Also, this support has helped build a sense of community among all of the summer scholars.

Having a Positive, Beneficial Experience

From data collected from both an internal post-program survey and from the SURE III Survey (a collaborated project funded by HHMI), students who participated in Summer 2009 responded with:

- 89% stating our program met or exceeded their expectations
- 92% stating they would again choose to participate in a summer research experience
- 86% stating that the proficiency of their laboratory skills increased "a lot"
- 100% stating that their knowledge of the steps to admission to graduate school increased
- 100% stating that their skills in presenting their research to others increased.

Conclusions: Tracking Progress

Our REU Site in Bioenergy Systems has exceeded our goals of providing a successful summer research experience to a diverse group of highly motivated students. Our participants consistently surpass diversity levels in Nebraska (10% minority population for Nebraska in the 2000 Census).

2009: 10 students, with 30% female and 30% from an underrepresented group

2010: 10 students, with 50% female and 20% from an underrepresented group

Long-term tracking of student participants is being conducted to evaluate career paths and impacts.

