Metabolite Signaling Outreach Program

The Metabolite Signaling Outreach Program was established with the support of an NSF EPSCoR Research Infrastructure Improvement Grant. In its first year (the 2004-2005 academic year), the outreach program served 365 Lincoln, Nebraska high school students. Student participants included African, Asian, Caucasian, Hispanic, and Native Americans. Ethnic minority student populations ranged from 8% to 24% of the student bodies in the schools served with a total minority participation average of 13%. Now in it second year (the 2005-2006 academic year), the program has been expanded to rural northeastern Nebraska and is expected to serve 800 students this year. A subsequent expansion to urban Omaha schools is being planned, and the program is expected to serve 2000 or more students in its third year. Students who show particular aptitude, especially those from groups that are underrepresented in the sciences, are invited to the University of Nebraska-Lincoln to participate in a selective summer research program.

The Metabolite Signaling Outreach Program is designed to:

- Use biotechnology as a vehicle for *gaining a greater understanding of science* concepts and facilitate the use of *science inquiry* at the high school level
- Provide *science-content expertise* and *technical training* to pre-service and in-service high school teachers in the area of biotechnology
- *Provide equipment and instructional assistance* for teachers participating in the Science Outreach Program
- Partner with University of Nebraska-Lincoln faculty in the development of *inquiry-based research activities* for high school students
- Develop a long-term strategy of involvement with high school students to *increase the number of students going forward into post-secondary science* programs
- *Increase students' awareness* of careers in science

The Outreach Program increases the science content of biology and genetics high school science classes. The program trains high school science teachers to conduct hands-on science modules in the classroom while providing supplies and equipment needed to do so. Three modules are offered currently. One includes transformation of *E.coli* bacteria using a jellyfish (*Aequoria victoria*) gene. The green fluorescent protein from the jellyfish gene, produced under certain metabolic conditions, causes the bacteria to "glow in the dark" under UV light. This module teaches about proteins and genes, genetic

engineering and phenotypes, and bacterial plasmids. The second module has students digest isolated DNA with restriction enzymes (molecular scissors) and then visualize the different size fragments of the DNA by gel electrophoresis. This module teaches students about DNA and how to manipulate it for molecular biology operations. The third module allows students to extract their own DNA from cheek cells, amplify one specific gene from their genome using PCR (polymerase chain reaction), and visualize their genotype using gel electrophoresis. The students then use their results and a bioinformatics website to investigate population genetics. This module teaches students about forensic DNA isolation, genetic diversity, and molecular biology.

The work is notable because:
It introduces advanced molecular biology methods into the high school classroom with a format that students enjoy and find helpful in understanding abstract concepts of molecular biology and genetics. Additionally, it provides a cost-effective approach to enhancing science content and increasing student learning in high school classrooms.