



Think Science is Boring? Think Again!

You don't know what you don't know.

Take the sciences, for example. Many high school students think they are boring. What they don't know is how dull their lives would be without the sciences; that the "how" of their iPods, cell phones and video games is even more fascinating than the tools themselves.

To breach that gap between perception and reality, a team of Louisiana Tech researchers developed two complementary programs based on three certainties: 1) Students of all ages are fixated on technology that seemingly gets smaller on a daily basis; 2) 'hands-on' is the best way to capture and keep their interest; and 3) the most efficient way to reach the greatest number of students is through their teachers.

The two-fold result is 1) *Nanoscience Education and Research Outreach* (NERO), a six-week summer program, to be offered for the third time this year, teaches middle and high school science and math teachers how to involve their students in hands-on scientific research, and 2) *Creating Connections*, a Graduate Teaching Fellows in K-12 Education (GK-12) program focusing on molecular science and nanotechnology and improving the communications skills of science, technology, engineering and math (STEM) graduate students.

Both three-year programs are funded by the National Science Foundation (NSF); both are the result of a Louisiana EPSCoR Planning Grant for Major Initiatives. (See *Planning Ahead*)



Dr. Linda Ramsey (left) teaching students about the world of nano-technology at a Shell Oil nanoScience day.

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NERO

"Explaining nano-scale research to students in the K-12 grade levels is truly challenging," says Dr. David Mills, Louisiana Tech Professor of Biological Science and Principal Investigator (PI) of both NSF grants. "What we do at NERO is teach teachers how to replace teaching 'at' students with involving them in hands-on scientific research projects so they can learn for themselves how fascinating it can be to ask and answer scientific questions by observing and doing experiments."

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PLANNING AHEAD

The groundwork by a team of Louisiana Tech researchers awarded two National Science Foundation (NSF) grants began with the award of a Louisiana EPSCoR Planning Grant for Major Initiatives to support their preparation for submitting an application to a federally-funded education program.

In this case, it supported the preparatory work and planning involved in assembling data and writing a proposal for a three-year, \$420,000 NSF Research Experience for Teachers (RET) grant to establish a Nanoscience Education and Research Outreach (NERO) program. NERO, which concentrates on molecular science and nano-technology, encourages teachers to learn about engineering and science through hands-on research and direct interactions with researchers.

Groundwork for the preparation included visits to successful regional RET programs, science and engineering education meetings and workshops and selected K-12 schools. A survey of stakeholders to guide development of the NERO program was also developed.

Their careful preparation resulted in yet another award—a three-year, \$1,650,456 NSF GK12 Teaching Fellows grant. Its focus is on providing science, technology, engineering and mathematics graduate students with additional skills for professional and scientific careers in the 21st century.

(For more information on Planning Grants for Major Initiatives and Louisiana EPSCoR programs, go to <http://www.regents.state.la.us>.)

THINK SCIENCE IS BORING? Cont.

NERO does that by creating an environment in which the teachers themselves conduct bionano- and nanotechnology research using state-of-the-art equipment under the mentorship of LA Tech engineering and science research faculty and the assistance of GK-12 Teaching Fellows.

Their last assignment is to create learning modules and curricular activities for their students which they and their research mentors test and retest on four Saturday workshops during the academic year.

"Teachers and students alike discover that the process of research has many twists and turns, some very sharp, and that it may require numerous modifications to an experiment before you get it right," says Dr. Mills. "They also learn how complex even the simplest experiment can be and sometimes the brightest ideas don't work out in reality; that science does not beat to a metronome!"

"It is really exciting to see teachers embrace research and gain confidence in their knowledge base, laboratory skills, and science communication abilities," adds Dr. Linda Ramsey, Co-PI of both NSF projects and a LA Tech K-16 Education Specialist. "They return to their classrooms with the experiences to truly engage their students in meaningful scientific investigations and to prepare them for the highly technical workforce."

She cites the following NERO-to-classroom progression of Ms. Tanya Culligan, a 9th grade biology teacher at Shreveport's Caddo Parish Magnet High School and participant in both the 2007 and 2008



North Louisiana Teachers conducting bio-engineering research in a Louisiana Tech laboratory are, left to right, Tonya Culligan and Sandra Pena.

NERO summer programs.

Ms. Culligan explored the active site location of an important enzyme relating to environmental biocatalysts and involving atmospheric methane consumption for the production of fuel (methanol). With the aid of her research mentor, and based on her research assignment, she developed a learning module for implementation in her biology class.

Employing her module and available software, her students built molecular groups atom by atom. Visualization aspects of the modeling software were used to present the concepts of condensation, hydrolysis, and nitrogen base bonding. A chemistry kit was used to physically build structures found in DNA.

A second module that used molecular modeling to depict processes involved in cellular respiration engaged students

in building molecular groups included in the different steps of respiration. Visualization aspects of the modeling software were used to present the concepts of transporting hydrogen ions and the use of an electron transport chain.

GK-12 Creating Connections

The Graduate Teaching Fellows program provides STEM graduate students with opportunities to key career-enhancing skills, including communicating STEM subjects to technical and non-technical audiences, leadership, team building, and teaching while enriching STEM learning and instruction in K-12 schools.

The LA Tech program has also developed Teaching-Learning Labs in three north Louisiana schools—Carroll Junior High School and Martin Luther King Jr. Middle School in Monroe and Simsboro High School. Staffed by LA Tech graduate engineering and science students, each lab focuses on creating instructional modules and hands-on student engagement in science and engineering.

NSF developed the GK-12 program with the understanding that STEM graduate students can contribute to the national effort to advance scientific knowledge through partnerships with K-12 communities.

"As they gain the communication skills that enable them to explain science to people of all ages, graduate students also inspire transformation in the K-12 formal and informal learning environments and stimulate interest in science and engineering among students and teachers," notes Dr. Michael Khonsari, LA EPSCoR Project Director.

