

OKLAHOMA NSF EPSCoR Research Connection

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Mission of NSF EPSCoR

EPSCoR identifies, develops, and utilizes a state's academic science and technology resources in ways that ultimately will support a more productive and fulfilling way of life for its citizens.

To achieve this end, the NSF cooperates with state leaders in government, higher education, and business to establish productive long-term partnerships in support of common goals. Such partnerships are designed to stimulate local action that will result in lasting improvements to the state's academic research infrastructure and increased national R&D competitiveness.

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Nanotechnology course offered

A new multidisciplinary course entitled "Introduction to Nanotechnology" was developed and implemented at Oklahoma State University last spring. The course covered many of the recent topics in this new and exciting field including the properties of individual nanoparticles, bulk nanostructures, carbon nanotubes, quantum wells, quantum wires and dots.

Students received lectures on the tools and methods used to measure the properties of these structures, methods for growth and synthesis of nanomaterials, and instruction on applications in biological materials and the

fabrication of nano-machines and devices.

Nine OSU faculty members from departments of Chemistry, Physics, Electrical and Computer Engineering,



and Chemical Engineering team-taught the course, which served twenty-five graduate and undergraduate level students.

The nanotechnology course also featured presenta-

tions by two industry research scientists from a local company in Stillwater, Nomadics, Inc., and included tours of state-of-the-art laboratories at OSU and Nomadics to illustrate the growth of nanomaterials and the measurements of their properties.

The plan for future offerings of this course is to include faculty from the University of Oklahoma and the University of Tulsa and to transmit lectures to these and other universities throughout the state utilizing distance learning and Internet2 technologies.

FGRC: Marek research group adds value

The NSF EPSCoR Research Infrastructure Improvement (RII) Award has been instrumental in building a critical mass of functional genomics scientists in Oklahoma during the last two years. The RII provides three years salary support for seven new tenure-track faculty positions at the State's doctoral universities (see last newsletter: vol. 1:1 for details).

Dr. Stephen M. Marek is one of the seven new faculty

hired with support from the grant. Marek is an Assistant

"I would not have been able to perform this research without the generous startup funds awarded me by EPSCoR..."

Professor in the department of Entomology and Plant Pathology at Oklahoma State University where he and his research group are investigating

molecular plant-microbe interactions, functional genomics of plant pathogenic fungi and mycology.

Dr. Marek stated, "I would not have been able to perform this research without the generous startup funds awarded me by EPSCoR. I've been able to equip our lab with the advanced instrumentation we needed and attracted the qualified personnel to perform the research

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Functional Genomics Resources Consortium (FGRC) News

Submitted by: Dr. Ulrich Melcher, FGRC Project Coordinator



In June, OU professor and functional genomics researcher, Tyrrell Conway was awarded a \$2.1 million NIH grant from the National Institute of Allergy and Infectious Diseases to fund a project entitled, "Growth and Colonization of the Intestine by *E. coli*".

Conway explains, "Many scientists have attempted to explain the amazingly complex microbial ecosystem of the mammalian gastrointestinal tract. One hypothesis postulates that the ecological niches within the intestine are defined by nutrient availability. Gastrointestinal pathogens somehow overcome the barriers to infection created by the normal intestinal biota. Our research is designed to illuminate the mechanisms by which bacterial strains compete for nutrient resources, which is important for understanding how enteric pathogens infect healthy adults. Our research investigates the nutritional basis for competition between *E. coli* commensal and pathogenic strains."

Ultimately, this research may help

explain differences in human susceptibility to infection by *Escherichia coli* pathogens.

FGRC lead scientist, Ulrich Melcher, stated that "this work builds on the pioneering work of Dr. Conway in the analysis of the changes in the expression of all of the genes in the model bacterium *E. coli* as its nutritional status changes. The studies have provided the groundwork for similar studies of numerous other bacteria in other laboratories." Dr. Conway is a mentor in the FGRC.

Assistant member at Oklahoma Medical Research Foundation, Lijun Xia, also contributed to the FGRC through research that may provide improved methods of hematopoietic cell homing to and engraftment in bone marrows of patients receiving cord blood transplants and additionally through the investigation of the functions of genes in directing cells to different locations in the body of an animal. Xia credits EPSCoR funding which resulted in the following publications:

J Cell Biol. 2004; 164(3):451-9. Xia L., Ju T., Westmuckett A., An G., Ivanciu L., McDaniel J.M., Lupu F., Cummings R.D., McEver R.P. Defective angiogenesis and fatal embryonic hemorrhage in mice lacking core 1-derived O-glycans," which reports that a knock-out of the gene that transfers galactose to N-acetyl galactosamine residues in the core structures of glycoproteins causes severe defects in the development of vasculature in the mouse brain.

Blood's First Edition Paper, republished online July 27, 2004 at Blood:<http://www.bloodjournal.org/papbyrecent.shtml>; DOI 10.1182/blood-2004-02-0650. Xia, L.*, McDaniel, J.M., Yago, T., Doeden A., and McEver, R.P. "Surface fucosylation of human cord blood cells augments binding to P-selectin and E-selectin and enhances engraftment in bone marrow," which reveals that cells that bind poorly to selectins on blood vessel surfaces can be made to bind by enzymatically adding fucosyl residues to glycoproteins on their surfaces.

Education & Human Resources Outreach (EHRO) News

Submitted by: Ms. Shelley D. Wear, Special Programs Coordinator

The summer months brought rich experiences for students, teachers and faculty researchers through various initiatives supported by EPSCoR.

In May, more than 250 faculty, students, and industry researchers gathered at Oklahoma State University, the site of EPSCoR's Annual State Conference to discuss progress, current trends and funding opportunities in the interdisciplinary fields of nanoscience and functional genomics. A scientific poster session was also featured to encourage collaborative efforts within the state and region.

Support for summer academies and research experiences for students and teachers in Oklahoma have been another priority for EHRO. The Summer

Science Workshop for Undergraduates at Southeastern Oklahoma State University and the OSU Upward Bound Math and Science Center Summer Academy, successfully provided small-group hands-on courses, research and field experiences to encourage incoming college freshmen and rural high school students to enter into and complete degrees that utilize their skills in math and science.

The Oklahoma Science Project at the Oklahoma Medical Research Foundation (OMRF) and the Materials Science Workshop & Website for

Oklahoma Teachers provided unique opportunities for teachers to gain hands-on research experiences that translate into lesson plans and experiments that introduce cutting-edge science into their home classrooms.

Research Opportunity Awards supported the summer research efforts of two regional faculty members, Kevin Lewelling of Oklahoma Christian University who worked with Matthew Johnson at OU and James Bidlack of the University of Central Oklahoma who worked with Philip Silverman at OMRF.

Support for Research Experiences for Undergraduates (REUs) was also provided to students at OU, OSU, and TU.



Oklahoma Network for Nanostructured Materials (NanoNet) News

Submitted by: Dr. Brian Grady, University of Oklahoma

NanoNet scientists receive NSF research instrumentation award

In August, NanoNet researchers were part of a team that was awarded a major research instrumentation grant from the National Science Foundation for nearly \$475,000 to obtain two x-ray diffraction units. University of Oklahoma scientists Drs. Daniel Resasco, Brian Grady, Vasilios Sikavitsas, Bob Houser, and Rudi Wehmschulte are among those listed as investigators on the grant. Personnel from TU and OSU contributed sections to the final proposal, making this proposal truly a statewide effort.

One of the units is a wide-angle powder diffractometer. This unit will be used to characterize the crystal structure of materials, and will have a special high-temperature stage and environmental chamber that will allow the study of these materials at temperatures as high as 1500 C.

One example of a research project that will be enhanced by the new equipment includes identification of catalyst intermediate phases during the synthesis of single-walled carbon nanotubes. The identification of these intermediates is expected to help NanoNet researchers understand the mechanism of the formation of the nanotubes.

The second diffraction unit acquired through this grant will be a pinhole small-angle scattering system with some limited wide-angle capabilities. One example of a research project planned for this equipment is to understand the

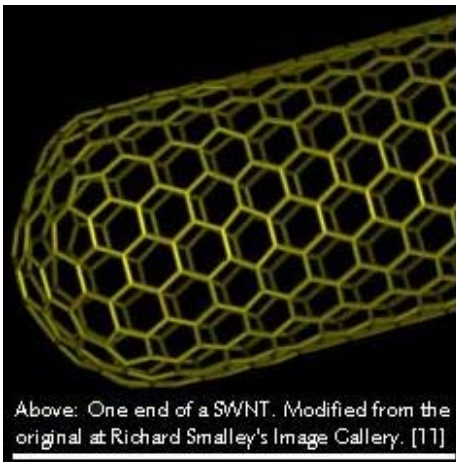
relationship between processing and morphology in polymer filled with nanofillers such as nanotubes and nanoclays.

Dr. Brian Grady explains, "These two units will enable Oklahoma researchers to characterize nanomaterials as only a few facilities in the United States can, and will enhance our competitiveness in attracting both federal and industrial funding for our growing research program in the nanomaterials area."

Many other research projects within the State are expected to benefit

from the new equipment including the diverse areas of biology and geology. Both instruments represent important resources for researchers all over the state of Oklahoma.

For more information, contact Dr. Brian Grady at bgrady@ou.edu.



Above: One end of a SWNT. Modified from the original at Richard Smalley's Image Gallery. [11]

FGRC: Marek research group

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I've also been able to contribute funds to joint infrastructural improvements."

Marek's group recently presented a poster at the American Phytopathological Society's Annual Meeting, which detailed their efforts to develop a fungal pathosystem for the model plant *Medicago truncatula*. Marek's graduate assistant, Madhavi Dhulipala, received a Plant BioNet Travel Award to present this work. The abstract was published in the journal *Phytopathology*:

Agrobacterium-mediated trans-



formation of *Phoma medicaginis*. M. Dhulipala, J. N. Enis, and S. M. Marek, dept. of Entomology and Plant Pathology, Oklahoma State University, Stillwater, OK 74078. Phytopathology 94:S25.

Other active research for the Marek group includes an applied project on fungal disease control through silicon supplementation of floricultural crops and a collaborative project with the Noble Foundation on cotton root rot of *Medicago* examining soilborne fungal disease to which no known resistance exists.

In addition to research, Dr. Marek will teach an undergraduate course on Introductory Plant Pathology this fall.

K-12 Science-related Field Trip Grants

Oklahoma public schools can apply for K-12 science-related field trip grants to cover entrance fees and transportation costs to EPSCoR partnering museums in the Oklahoma Children's Discovery Center Network:

- *Omniplex—OKC*
- *Jasmine Moran Children's Museum—Seminole*
- *Tulsa Air and Space Museum—Tulsa*
- *Leonardo's Discovery Warehouse—Enid*
- *Museum of the Great Plains—Lawton*

Schools are chosen on a first-come, first-served basis and must meet at least one of the following criteria:

- 1) receives Title VII funding;
- 2) at least 70% of student body qualifies for free or reduced lunch program;
- 3) at least 25% of student body comes from underrepresented groups (blacks, Hispanics and American Indians);
- 4) placement/standing on the State Department of Education School Improvement List.

All field trips must be completed by May 31, 2005.

For more information visit <http://okepscor.org> or contact Ms. Shelley Wear, EPSCoR Special Programs Coordinator at (405) 225-9287 or swear@osrhe.edu.

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Experimental Program to Stimulate Competitive Research

OKC OFFICE

Dr. Frank Waxman
State Director
655 Research Pkwy., Ste 200
P.O. Box 118850
Oklahoma City, OK 73101-8850

Phone: (405) 225-9459
Fax: (405) 225-9230
fwaxman@osrhe.edu

STILLWATER OFFICE

Dr. James P. Wicksted
Associate Director
225C Noble Research Ctr.
Stillwater, OK 74078

Phone: (405) 744-9964
Fax: (405) 744-7688
jpw519@okstate.edu

PLEASE DELIVER TO:

Mark Your Calendar Upcoming Events



SEPTEMBER 2004

Sep. 13-17—Trends in Nanotechnology, Segovia, Spain

OCTOBER 2004

Oct. 4&5— NSF Regional Grants Conference, St. Louis, MO

Oct. 6&7— OU Supercomputing Symposium, Norman

Oct. 7-9— 2nd Annual Conference of MidSouth Computational Biology & Bioinformatics Society, Little Rock, AR

Oct. 20— Write Winning Grants, OSU-Stillwater

Oct. 22— Who Wants to be an Entrepreneur Workshop, PHF Conference Center, OKC

Oct. 29— UCO Research Day for Regional Universities, Edmond

NOVEMBER 2004

Nov. 1-4— Fall National SBIR/STTR Conference & Tech Expo (SBTE), Boise, ID

Nov. 19— Women in Science Conference, OKC

Nov. 11-13— AISES National Conference, Anchorage, AK

Nov. 11-13— Access to Knowledge Research Symposium, Univ. of Missouri-Columbia

Nov. 12— 1st Annual OKBIOS Symposium & The Synthetic Biology Workshop, OU-Norman

JANUARY 2005

Jan. 5, 2005—NSF Grants Workshop, OSU-Stillwater



**For more information on
upcoming events or other EPSCoR
programs, visit www.okepscor.org
or contact:**

Ms. Shelley D. Wear
Special Programs Coordinator
Oklahoma EPSCoR
655 Research Pkwy, Ste. 200
P.O. Box 108850
OKC, OK 73101-8850
Phone: (405) 225-9287
swear@osrhe.edu

OR

Ms. Valerie Pogue
Program Manager
Oklahoma EPSCoR
225C Noble Research Center
Stillwater, OK 74078
Phone: (405) 744-9964
vpogue@okepscor.org