Oklahoma NSF EPSCoR Research Connection

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Quarterly Newsletter for the Oklahoma National Science Foundation Experimental Program to Stimulate Competitive Research **July 2005**



State Awarded \$6 Million NSF EPSCoR Research Infrastructure Improvement Grant

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Dr. Frank Waxman, State Director Dr. James Wicksted, Associate Director The National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) has awarded \$6 million to Oklahoma to improve its scientific research infrastructure. The Research Infrastructure Improvement (RII) grant, matched by the Oklahoma State Regents for Higher Education with an additional \$3 million, will contribute to Oklahoma's scientific community by providing equipment and human resources needed to boost research competitiveness.

The RII will build upon Oklahoma's research strengths in genomics, bioinformatics and nanomaterials sciences and will create a new field of science uniting plant virus biodiversity and ecology.

"The RII award will help continue the momentum that Oklahoma scientists have gained in genomics and nanosciences from past NSF and State Regents support and will help

develop a critical mass of researchers in the state while stepping up to the next level of competitiveness," said Dr. Frank Waxman, EPSCoR director.

Additionally, the grant will provide a strong set of educational outreach initiatives to strengthen the human infrastructure needed to increase competitiveness for R&D dollars. The RII will also foster partnerships between the academic community and the private sector, Waxman said.

The EPSCoR grant will offer educational and research opportunities for faculty and students, and will further encourage collaboration and development within Oklahoma's scientific community. The RII aims to impact the quantity and quality of students and graduates pre-

pared to enter Oklahoma emerging high-technology businesses.

"This grant comes at a time when research in areas such as biotechnology, nanotechnology and genomics is helping Oklahoma move one step closer to becoming the 'Research Capital of the Plains.' The State Regents are pleased to be able to provide financial support for this very worthwhile research, and we wish Oklahoma EPSCoR continued success," Chancellor Paul G. Risser said.

U.S. Rep. Ernest Istook, R-Okla., a supporter of the Oklahoma EPSCoR program, said, "This is great news for Oklahoma. Oklahoma institutions and our researchers, like Dr. Waxman, have proven time and time again that they can compete successfully for major research grants when simply given the opportunity."

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Submitted by: Janet Varnum, Oklahoma State University

Recent funding of the NSF EPSCoR Research Infrastructure Improvement Award will make it possible for Oklahoma scientists to embark on the creation of a new field of science. Plant Virus Biodiversity and Ecology conceived through statewide collaboration of university researchers will utilize the Tallgrass Prairie Ecological Research Station in Pawhuska, which opened in

2004 and is managed by The University of Tulsa.

For Mike Palmer, Oklahoma State University botany professor, who has studied plant diversity for most of his life, each two-hour journey to Oklahoma's Tallgrass Prairie Preserve brings a wealth of scientific information unavailable virtually anywhere else. He and more than 30 other OSU scientists have been studying plant diversity at the preserve.



The preserve located 55 miles northwest of Tulsa and owned by The

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Functional Genomics Resources Consortium (FGRC) Research News

Submitted by: Dr. Ulrich Melcher, FGRC Project Coordinator



Genomic studies have allowed scientists to know the precise order of the four nucleotide building blocks of DNA in many model organisms, includ-Dr. Jose-Angel Conchello ing humans. Bioinformatics sug-

gests which nucleotides cluster together to form genes. With tens of thousands of these genes, how to do we figure out what each one does? Functional genomics (FG) addresses this question.

A standard approach of FG is to knockout each one of those genes to see what effect the knockout has on the organism. Many knockouts produce individuals with developmental defects. Merely seeing a defect in the mature organism, however, does not tell the scientist what the missing function of the gene was. For that, researchers need to follow the fates of each cell throughout Pinpointing which cell development.

behaves abnormally and when it does so is critical to understanding the function of the knocked out gene.

The nematode, Caenorhabditis elegans, is ideally suited for such studies since the complete fates (births and deaths of all cells) have been cataloged, the genome sequence is known, and knock-outs have been generated. However, C. elegans, like other organisms, is three-dimensional, in which a simple microscope cannot see all cells in focus at one time.

This problem is being attacked by the NSF EPSCoR-supported High Content Rapid Screening Systems program headed by Dr. Michael Dresser at the Oklahoma Medical Research Foundation (OMRF). NSF EPSCoR investigator, Dr. Jose-Angel Conchello is addressing the problem of fuzzy images. Dr. Conchello is an engineer at OMRF who develops algorithms to extract three-dimensional information from a series of carefully chosen fuzzy images. He has worked images from wide-field

microscopes, confocal scanning microscopy and multi-photon fluorescence excitation microscopy applying such methods to improve images.

Recently, Dr. Conchello has done the same for structured illumination microscopy, which uses an ordinary microscope modified so that it projects a single-spatial-frequency grid onto the specimen, and then a simple arithmetic operation removes out-of-focus light. Dr. Conchello has developed an algorithm to further improve the resolution of this microscope allowing one to visualize distinctly two objects (350 and 300 nm in diameter) separated by only 150 nm. Without his algorithm the two objects merge into one fuzzy blurb.

This NSF **EPSCoR-supported** research is an example of interdisciplinary cooperation in attacking research Here, a mathematician questions. working at a medical foundation is solving a problem in the physics of optics that is of use to developmental biologists and geneticists.

Education & Human Resources Outreach News

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

Outreach activities are in full swing this spring with programs and events to heighten awareness of science and technology in the state and encourage the exchange of scientific information and ideas.

Research Day at the State Capitol was held on March 31. Seventeen undergraduate students from twelve colleges and universities showcased competitive research posters to state legislators and the general public. Tracy Washington of OU-Norman presented the winning poster on limb regen-Mr. Washington was awarded a eration.



\$4,000 summer research internship that he is completing at the OU-Norman campus.

The 2nd Annual Virtual Science Fair was held April 13. The event utilized cutting-edge videoconferencing and Internet2 technology that allowed 21 fourth through twelfth grade students to participate in a statewide science fair without leaving their home schools. Twenty-one university faculty stationed around the state interacted with students and served as judges for this virtual event.

EPSCoR sponsored an NSF Grants Workshop May 18 at the Wes Watkins Center located at OSU. A total of 132 faculty, students, and administrators participated in this workshop aimed at improving the quantity and quality of future proposals submitted to the National Science Foundation.

EPSCoR's Annual State Confer-

ence held May 19 highlighted research in nanotechnology, functional genomics, and plant virus biodiver-



sity and ecology. The event hosted 220 faculty, post-docs, students and private sector scientists and featured Oklahoma and nationally known speakers in these research areas. Highlights of the event included a poster session that enabled scientists to share their research results and to initiate the exchange of ideas and future collaboration.

Visit www.okepscor.org/events.htm for information on these and other outreach programs and events.

Oklahoma Network for Nanostructured Materials (NanoNet) Research News

Submitted by: Dr. Jim Smay, School of Chemical Engineering, Oklahoma State University

Research in Dr. Jim Smay's lab in the School of Chemical Engineering at OSU is aimed at utilizing specialized inks to print threedimensional structures directly from computer designs. The ubiquitous color inkjet printer has familiarized all computer users with the concepts of resolution and blending of colors to create photorealistic, two dimensional images. For printing in three dimensions, control of the flow properties of the ink and the actual material composition of the ink are also critical factors. Dr. Smay is creating inks that are about half water and half microscopic solid particles. During printing, these inks hold their three dimensional shape allowing structures to be assembled one layer at a time.

Once the ink dries, the structure is heated to allow the particles to coalesce into a durable solid of, depending on the ink formulation, ceramic, metal or polymer. Example structures fabricated by this printing technology are pictured here.

Devices such as these may have applications ranging from electronics and optics to tissue engineering. The printing technology is being extended to enable

blending of different composition inks to allow spatial variation in material properties, which is tantamount to turning a black and white printer into a color printer.



Example structures assembled by threedimensional printing of ceramics, metals, and polymers

The robust control of intricate geometry and composition will lead to a new manufacturing process for next generation devices.

New Science Emerges from the Tallgrass Prairie

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Nature Conservancy is one of the world's largest efforts at ecological restoration and a premier example of

original tallgrass prairie.

"The nature within this area is incredibly dynamic," says Palmer.

"What we're learning is changing our perception of plants," he says.

"People think of plants as stationary,

but we're finding that plants don't just 'sit there.' Plants are more like live animals -- they move around. We are seeing populations of plants

expanding and retracting."

"Each year we revisit the plots and document the plants to determine

> if the conservation efforts are working to preexotic vent species from coming in. Our assumption is that the semi-natural grazing and efforts burning helping to conserve the

ecology of the tallgrass prairie."

"We hope to use the tallgrass prairie as home base to document the diversity of plant viruses," Palmer says. "Similar studies have been conducted on specific crops such as wheat and corn, but a study on this scale of plant viruses in general has never been done before.

"Likely it will help us understand diseases better and save plants," he says. "And using plants as model systems can give researchers ideas about human viruses as well."

For more information about the Tallgrass Prairie Preserve, visit:

http://nature.org/wherewework/northamerica/states/oklahoma/preserves/tallgrass or visit OSU at http://ecology.okstate.edu/ or http://www.okstate.edu/artsci/botany/

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*\$6 million NSF; \$3 million OSRHE

Upcoming 2005 Events www.okepscor.org



SEPTEMBER

Sep. 26-28 — National NSF EPSCoR Conference, Puerto Rico

OCTOBER

Oct. 27-28 — OK BIOS Conference, location TBA

TBA — EPSCoR & i2E sponsored Entrepreneurial Workshop, OKC

TBA — OU Supercomputing Symposium, Norman

TBA — UCO Research Day for Regional Universities, Edmond

NOVEMBER

TBA — Women in Science

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