

Oklahoma NSF EPSCoR Research Connection

Volume 2, Issue 1

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

April 2005



EPSCoR anticipates a year of transition

Oklahoma Experimental Program
to Stimulate Competitive
Research Committee

Dr. Paul Risser, Chancellor & Chair
Mr. Rudy Alvarado, Oklahoma City
Mr. William Beard, Oklahoma City
Dr. Glen Collier, Tulsa
Rep. Abe Duetschendorf, Lawton
Mr. David Hinkle, Hugo
Dr. Ken Levit, Tulsa
Mr. Greg Main, Oklahoma City
Dr. Rodger McEver, Oklahoma City
Dr. Stephen McKeever, Stillwater
Mr. Steven Rhines, Ardmore
Dr. Cindy Ross, Lawton
Dr. James Sorem, Tulsa
Ms. Sheri Stickley, Oklahoma City
Ms. Lisa Tipping Davis, Oklahoma City
Dr. D. Alan Tree, Stillwater
Dr. Joseph Waner, Oklahoma City
Dr. Sonya Williams, Langston
Dr. T.H. Lee Williams, Norman
Sen. Johnnie Crutchfield, Wilson

Dr. Frank Waxman, State Director
Dr. James Wicksted, Associate Director

Submitted by: Dr. Frank Waxman,
Director, Oklahoma EPSCoR



Dr. Frank Waxman

The coming year promises to be one of transition for Oklahoma's EPSCoR Program.

The current Research Infrastructure Improvement (RII) grant is scheduled to end May 31, 2005, although we have requested an additional six months to complete this project. Our renewal proposal was recommended for funding for three additional years and we await the final decision by NSF. The merit review panel noted Oklahoma's success in nanotechnology research and

recommended reduced funding. Nevertheless, we anticipate that the nanotechnology thrust will continue with support from EPSCoR and other sources. The new proposal also includes an exciting new scientific focus on plant virus biodiversity and ecology. Under the leadership of OSU Professor Ulrich Melcher, this new venture will utilize specimens collected from Oklahoma's Tall Grass Prairie and promises to yield important discoveries on virus distribution and evolution in this pristine natural preserve. The new RII project also includes many new student and faculty outreach initiatives, under the able leadership of Shelley Wear.

At the national level, the President's FY 2006 budget proposes flat funding for the NSF EPSCoR Program at \$94 million for the 27 participating states. This is good news as past budgets have included cuts for NSF EPSCoR. The future level of EPSCoR funding is still uncertain with severe constraints on the federal budget. Oklahoma's congressional delegation will do their best to achieve this goal, as they have in the past. I am confident that the faculty, students and staff participating in Oklahoma EPSCoR will continue a longstanding tradition of excellence as we work together to build our state's research capacity.

Inside this issue:

FGRC Research News: Ozone Alert	2
Education and Human Resources Outreach News	2
NanoNet Research News	3
Nanobattery Systems (continued)	3
Upcoming Events	4

Teeter's research develops nanobattery systems

Submitted by: Dr. Dale Teeters,
Department of Chemistry and Biochemistry,
The University of Tulsa

One of several areas where nanotechnology is making important inroads is in microelectromechanical systems (MEMS). MEMS have great potential commercial importance in micro and nanoscale motors, pumps, relays and other components. Because of this, the worldwide revenue for MEMS is estimated to be \$9.6 billion by 2006. However, for these systems and other nanodevices of

the future to be fully utilized, they need to have self-contained power sources. If a miniaturized battery system can be developed, it could fulfill many of nanotechnology's power needs. Our work at The University of Tulsa is concerned with the construction and characterization of individual nanometer scale power supplies. In this effort, we

have made the world's smallest rechargeable lithium ion batteries. An interesting way of visualizing

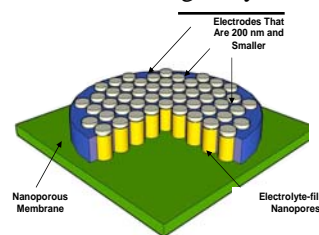


Figure Caption: The drawing above is an illustration of arrays of nanobatteries in a substrate. This configuration not only has applications for nanodevice power supply, but for computer memory applications.

Continued on Page 3

Functional Genomics Resources Consortium Research News: Ozone Alert

Submitted by: Dr. Ulrich Melcher, FGRC Project Coordinator

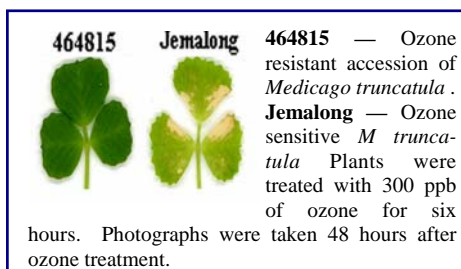
Every summer, Oklahoma's largest cities nervously watch the levels of ozone in their air. Ozone is a highly reactive species of oxygen. It reacts with molecules of living organisms. The resulting damage is harmful to health. Among humans, individuals with respiratory difficulties are the most susceptible to adverse effects of high ozone levels.

Reactive oxygen species harm all life forms. The interaction of reactive oxygen species with plants is intricate and fascinating. Plants are naturally subjected to a large variety of biotic and abiotic stresses. Plants' responses to many of these stressors lead to local production of reactive oxygen species. If the plant did not have mechanisms to reduce or eliminate the harmful effects of reactive oxygen species, it would have a hard time surviving stress. Yet, plants do suffer injury from ozone. Dr. Ramamurthy Mahalingam's group tries to decipher how plants react to ozone, knowing which may help minimize stress damage in other organisms, including humans.

Dr. Mali, as he is called by his colleagues, is one of six young investigators

added to Oklahoma's strength in functional genomics through the NSF EPSCoR program. Dr. Mali joined the OSU Department of Biochemistry and Molecular Biology after completing postdoctoral studies with Dr. Nina Fedoroff at Pennsylvania State University.

One strategy utilized by Dr. Mali's group is to compare gene expression in ozone sensitive and ozone insensitive varieties of the same plant species. To this end, NSF EPSCoR-supported graduate student Michael Puckette has screened 35 accessions of the model legume *Medicago truncatula*. *M. truncatula* is under intensive investigation in Oklahoma, including the determination of the nucleotide sequence of its genes at the Advanced Center for Genome Technology (previously supported by NSF EPSCoR) and the profiling of metabolites, RNA transcripts and synthesized proteins at the Samuel Roberts Noble Foundation. Puckette has identified a highly ozone sensitive variety and a relatively insensitive one, and is beginning an analysis of the



464815 — Ozone resistant accession of *Medicago truncatula*. Jemalong — Ozone sensitive *M. truncatula*. Plants were treated with 300 ppb of ozone for six hours. Photographs were taken 48 hours after ozone treatment.

difference in gene expression in response to ozone treatment.

Arabidopsis thaliana is another suitable plant model for studies of plant responses to ozone injury due to the many tools developed by the Arabidopsis research community. Dr. Mali says, "As a first step towards understanding the molecular basis of ozone phytotoxicity we are analyzing the transcriptional changes in ozone-treated plants using microarrays." Arabidopsis oligonucleotide microarrays with 26,000 spots were hybridized to labeled DNA representing the transcripts present at different times after ozone treatment. Induced genes include several well-studied genes, but also some novel ones. One hitherto unstudied gene induced by ozone is *MutT*. Its homologue in bacteria is known to scavenge oxidatively damaged DNA precursors. Research associate Dr. Niran Jambunathan has been studying the Arabidopsis *MutT* gene to determine whether its encoded protein performs a similar function in the ozone injury response in this plant. She finds that the gene is induced whenever a stress, biotic or abiotic, induces localized cell death in the plant. Dr. Mali explains "The early induction of this gene during cell death associated with ... ozone exposure (15 min) suggested that this gene may play an important role in oxidative stress."

This wide-spanning research program promises to provide important new information of both practical and fundamental importance not only on how organisms react to injury by reactive oxygen species but also how they react to other stresses. Meanwhile, keep those ozone levels down! Limit your use of internal combustion engines!

Education & Human Resources Outreach News

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

The first quarter of 2005 provided opportunities for students and faculty development through the EPSCoR outreach programs. Nearly 140 faculty and students registered for the NSF Grants Workshop, originally planned in January. The event was cancelled due to inclement weather, but has been rescheduled to take place on May 18, 2005 at the Wes Watkins International Center for Trade and Development on the OSU-Stillwater campus. Workshop participants will learn ways to improve grant writing skills and meet with various National Science Foundation program directors.

The K-12 Science Field Trip Initiative, developed in partnership with the Reynolds Foundation Discovery Center Network Museums to provide students with hands-on science experiences, has successfully awarded field trips to 43 schools. More than 5,300 students will receive field trips this school year to the Omniplex, Tulsa Air and Space Museum, Leonardo's Discovery Warehouse, Jasmine Moran Children's Museum, or the Museum of the Great Plains.

Research Day at the State Capitol is scheduled from 10:00 a.m.—2:30 p.m., March 21, 2005. Nineteen students from 13 universities will display their competitive scientific research posters to the Legislature and the general public. This event is annually sponsored by EPSCoR and the State Regents. For more information contact the EPSCoR office at (405) 225-9287.



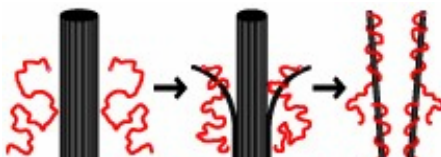
Oklahoma Network for Nanostructured Materials (NanoNet) Research News

Submitted by: Dr. Warren T. Ford, NanoNet Project Coordinator

The group of Warren Ford in the Department of Chemistry at OSU has devised a family of methods for grafting of polymers to single-walled carbon nanotubes (SWNT). SWNT are among the most promising materials for construction of nanoscale electronics and polymer composites because they have both the highest tensile strength of any known material and highly efficient metallic or semiconducting electrical conductivity. Carbon nanotubes from both Southwest Nanotechnologies (Norman, OK) and Carbon Nanotechnologies (Houston, TX) were used for this research.

One method of producing water-soluble SWNT is the grafting of ionic polymers to SWNT by polymerization in water dispersions of SWNT illustrated in the next column. The process breaks down the large bundles

of SWNT in the commercial samples to small bundles and individual tubes, which are needed for important nanoscale applications. The groups of Daniel Resasco at OU and Bruce Weisman at Rice University have helped to characterize the polymer grafted SWNT. A patent application for this "grafting to" process has been filed by OSU.



Growing polymer chains attach to nanotubes on the surface of big bundles and strip off individual nanotubes into water solutions.

For the purpose of producing polymer composites coatings, Arif

Mamedov of Nomadics Inc. (Stillwater, OK) has prepared layer-by-layer thin films of the SWNT-polymers and found high tensile strength. Some of the materials show great promise as components of photovoltaic devices for the solar generation of electricity in preliminary experiments in the group of Dirk Guldi at the Radiation Laboratory of Notre Dame University and at the University of Erlangen (Germany).

These research discoveries were made possible by EPSCoR Research Infrastructure Initiative grant support for a postdoctoral researcher, Dr. Shuhui Qin, in the laboratory of Dr. Ford for collaborative research with Dr. Resasco. EPSCoR support of the scanning probe microscopy facility at OSU and the electron microscopy facility at OU was vital for characterization of the materials.

Nanobattery systems

Continued from Page 1

the size of our batteries is that by using the smallest battery that we have made, we could stack 240 of them side-by-side in the diameter of a human hair. It is only through the use of an atomic force microscope that these minute batteries can be observed and tested. The Oklahoma NSF EPSCoR program, through its funding, allowed the procurement of this sophisticated instrument and, through continued funding, supported students working on this project. It is our research group's opinion that EPSCoR has been an indispensable partner in our research and educational efforts.



Dr. Dale Teeters

Invitation to All Faculty, Students & Researchers

Please register & attend

NSF EPSCoR Annual State Conference

Focusing on research in nanomaterials sciences, functional genomics, and plant virus biodiversity

Oklahoma State University
Student Union
Stillwater, OK

May 19, 2005
8:30 a.m.—5:00 p.m.

For more information please visit the EPSCoR website at www.okepscor.org or contact the EPSCoR office at (405) 744-9964.

**Deadline to register:
April 26, 2005**

Return Address:



225C Noble Research Center
Stillwater, OK 74078

**Upcoming
2005 Events**
www.okepscor.org



MARCH

Mar. 21 — Research Day at the Capitol, OKC

APRIL

Apr. 13 — Virtual Science Fair, via Internet2

Apr. 21-23 — National Conference on Undergraduate Research (NCUR) 2005, Lexington, VA

MAY

May 18 — NSF Grants Workshop, OSU-Stillwater

May 19 — Annual State Conference, OSU-Stillwater



The Oklahoma EPSCoR Program is funded through a three year \$13.5 million* Research Infrastructure Improvement grant from the National Science Foundation (NSF) and the Oklahoma State Regents for Higher Education (OSRHE).

*\$9 million NSF; \$4.5 million OSRHE



***Oklahoma Experimental Program
to Stimulate Competitive
Research***

Oklahoma City Office:
Oklahoma State Regents for Higher Education
P.O. Box 108850
Oklahoma City, OK 73101-8850
405.225.9459
405.225.9230 (fax)

Stillwater Office:
225C Noble Research Center
Stillwater, OK 74078
405.744.9964
405.744.7688 (fax)

Visit our program website at:
www.okepscor.org

This publication does not necessarily reflect the views or opinions of the National Science Foundation. The Oklahoma State Regents for Higher Education, in compliance with Titles VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990 and other federal laws and regulations, do not discriminate on the basis of race, color, national origin, sex, age, religion, handicap, or status as a veteran in any of its policies, practices or procedures. This includes, but is not limited to, admissions, employment, financial aid and educational services.

This publication, printed by Oklahoma Experimental Program to Stimulate Competitive Research, was issued by the Oklahoma State Regents for Higher Education in March 2005, as authorized by 70 O.S. Supp. 2001, Section 3206. Nine hundred ten copies have been printed at a cost of approximately \$354.90. Copies have been deposited with the Publications Clearinghouse of the Oklahoma Department of Libraries.