

Oklahoma NSF EPSCoR Research Connection

Volume 3, Issue 1

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

Spring 2006



State Regents to the Rescue

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

When Oklahoma received our NSF EPSCoR award last spring, we faced a dilemma. The grant budget had been cut by one million dollars per year over three years. NSF suggested that the cuts be taken largely from the nanotechnology initiative. Given that the majority of states in last year's competition faced similar budget cuts, it is likely that the cut reflected the paucity of EPSCoR funds rather than the quality of Oklahoma's nanotechnology initiative.

For many years, Oklahoma's State Regents for Higher Education have provided a cash match for our NSF EPSCoR grants. Most states had to piece together the state match by including in their budget unrealized indirect costs, in-kind contributions, and other costs that met the statutory requirement for the match, but did not provide real funds to spend on the program. Now, given our budget challenge, Oklahoma State Regents for Higher Education Chancellor Paul Risser and Vice Chancellor Mary-

anne Maletz provided a means to accomplish most of our original project goals for nanotechnology through a State Regents grant of \$1.5 million.

What has been done with this money? Under the able direction of OSU Professor of Chemistry

"Oklahoma State Regents for Higher Education Chancellor Paul Risser and Vice Chancellor Maryanne Maletz provided a means to accomplish most of our original project goals for nanotechnology through a State Regents grant of \$1.5 million."

Warren Ford, efforts are underway to hire four new faculty members at University of Oklahoma and Oklahoma State University whose primary research focus will be in nanotechnology. While most of the long-term costs for these new positions will be borne by the universities, Regents funding provided the critical catalyst for these positions. Interestingly, the

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EPSCoR-sponsored Tallgrass Prairie Retreat Highlights Multidisciplinary Research in Oklahoma

Submitted by: Dr. Ulrich Melcher, Plant Virus Biodiversity & Ecology Project Coordinator

On a day in early March, over 60 individuals gathered to celebrate the multifaceted roles of a premier field station. The individuals from four states and 14 distinct organizations met at The Nature Conservancy's 37,000 acre Tallgrass Prairie Preserve in Osage Co., Oklahoma. Discussions and conversations included land management, biology, remediation of oil exploration sites, prairie literature, prairie history, green buildings, education and much more.



More than 60 students and faculty gathered at The Tallgrass Prairie Preserve Ecological Research Station to share their research with colleagues interested in the Tallgrass Prairie.

Presentations began with a homecoming of sorts for Dr. Paul Risser, Chancellor of the Oklahoma State System of Higher Education. The Chancellor, a native of Kay Co., began his independent scientific career in a nationwide team studying nutrient recycling in shortgrass, mixed grass and tallgrass prairies. As the only team member investigating the tallgrass prairie he worked at the Adams Ranch, not far from the present Tallgrass Prairie

Preserve. The Chancellor later played a major role in the establishment and administration of the Long Term Ecological Research program at the National Science Foundation. At each step of his talk, he pointed out general lessons he had learned, such as the benefits of graduate student involvement in multi-institutional ecological research projects. In recent times, 19

graduate student dissertations have involved research at the Preserve.

Formerly much larger, the tallgrass prairie extends now from northern Kansas where there is another major preserve, the Konza Prairie, to northern Oklahoma. At the Tallgrass Prairie Preserve the prairie abuts the Crosstimbers, a part of which is included in the preserve. In

Kansas and Oklahoma preserves, the prairie is managed by a combination of grazing and fire. The two preserves use different fire regimes. Participants heard about these strategies and about clever efforts to reconstruct the fire history of the Tallgrass Prairie from the study of signs of burning in tree rings and from



Bison grazing at The Nature Conservancy's Tallgrass Prairie Preserve near Pawhuska, Oklahoma.

what is written in historical records.

Early European and later American explorers were not the only ones to write about the prairie. The prairie plays a large role in works of fiction by numerous authors. For attendees, Richard Batteiger tied together works of Washington Irving, Richard Manning, Willa Cather, John Madson, Mari Sandoz, Karl Bodmer and others.

Many participants marveled at



The retreat featured a poster session which enabled students and faculty from Oklahoma, Kansas, and New Mexico to discuss their research in a variety of disciplines.



Retreat participants gather for a group photo at the Tallgrass Prairie Preserve Ecological Research Station dedicated by The University of Tulsa.

the large numbers of young and thriving bison seen from the entry road into the Preserve. At the retreat, the attendees listened to the herd's history, management and efforts to estimate the herd's genetic health.

Animal life abounded in the Preserve and in discussions. Discussed were snails, fish, prairie mole crickets and termites. Plants were revealed as moving from place to place in the prairie, but over a large time scale.

An NSF-EPSCoR supported team investigating the biodiversity and ecology of viruses associated with Preserve plants presented preliminary results of their work.

Humans have impacted the land by drilling for oil. University of Tulsa scientists developed internationally used methods for remediating oil and brine contamination of the land based on their studies at the Preserve.

The University of Tulsa collaborated with The Nature Conservancy to create the environment at which the retreat was held. They built the Tallgrass Prairie Ecological Research Station and provided it with a maintenance endowment. The facility, dedicated in May 2005, includes laboratories, conference rooms, and overnight accommodations for researchers. The Prairie has long served as an outdoor classroom, for example for stream ecology classes. Now, it can also provide indoor facilities to augment outdoor learning.

Efforts have begun to expand the Station physically and to include OSU in its development. Green building concepts, minimizing energy inputs to the new buildings, received prominent mention. The effort to involve OSU, headed by EPSCoR researcher Michael Palmer is named DEBO (Dynamic Ecosystems and Biodiversity Observatory) in honor of Oklahoma's pioneer historian, Angie Debo.

State Regents

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searches for all four positions are multidisciplinary. The Regents grant supports several peer-reviewed research projects that will position our state to compete for large-scale NSF funding. The grant also funds a new graduate level course in nanotechnology that will be administered jointly by Oklahoma State University, The University of Oklahoma and The University of Tulsa. This is to our knowledge, a first. We owe a special thank you to Chancellor Risser, Vice Chancellor Maletz, and the State Regents for their continuing contributions to research and education in Oklahoma.

Upcoming 2006 Events



May 17 — NSF Grants Workshop
8:30 a.m.— 4:30 p.m.
OU-Norman campus

May 18 — OK EPSCoR Annual State Conference
8:00 a.m.—5:20 p.m.
OU-Norman campus

May 18— OK EPSCoR & ONI Undergraduate Nanotechnology Symposium
1:30 p.m.—3:15 p.m.
OU-Norman campus



For more information please visit the website or contact Ms. Shelley D. Wear, Special Programs Coordinator at 405.225.9287 or swear@osrhe.edu.

www.okeysco.org/events.htm

Interuniversity Nanotechnology Course to be Offered Fall 2006

Submitted by: Dr. Warren T. Ford, Nanoscale Materials Science and Engineering Project Coordinator

Led by engineering professors Brian Grady from OU and Alan Cheville from OSU, a new experimental inter-university course in nanotechnology will be offered Fall 2006 to students at OSU, OU and TU. The course will emphasize techniques available in Oklahoma for research on nanoscale materials. The class will meet together four times during the semester all day on Saturdays for laboratories and for oral reports on literature research projects. The rest of the course will take place by internet. The course is supported by the Oklahoma State Regents for Higher Education.

Goals of the Course

Students who successfully complete this course will have the skills to do the following:

- Synthesize nanoparticles based on reports/recipes in the scientific literature.
- Work safely in the laboratory and learn about laboratory safety hazards independently.
- Use dynamic light scattering to measure nanoparticle sizes.
- Use x-ray diffraction to measure atomic structure.
- Deposit nanoparticles on a substrate (self-assembly).
- Measure nanoscale features using an AFM and SEM.
- Write a scientific paper reporting the results of experimental studies.
- Write a scientific review paper.

Topics Covered

The class is divided into four units of roughly four weeks each:

- (1) Synthesis of Nanoparticles
- (2) Structural Characterization
- (3) Self-Assembly
- (4) Independent Research

Instructors

Warren Ford at OSU will be in charge of the first unit, Brian Grady at OU will be in charge of the second unit, and Alan Cheville at OSU will do the third unit. Matt Reiten at OSU will coordinate all of the technical aspects of the class. All of the content will be hosted on OSU web servers.

Format of the Class

The format and structure of each of the three units will follow the same general structure. Each unit will consist of a series of independent reading assignments and lectures delivered over streaming video, web-based quizzes to measure comprehension, laboratory preparation exercises, concluding with the laboratory experiment. The timing and format of the first two units are:

Weeks 1 and 2: Introduction to the Area

Weeks 3 and 4: Focus on the Area relevant to the experiment

Week 5: Specific focus on experimental procedures

Saturday at the end of the 4th week: Experiment at one of the sites

The first synthesis experiments will take place in OSU's organic chemistry lab to synthesize polymer and gold nanoparticles. The second material characterization experiments to measure nanoparticle structure and size will take place at OU's x-ray diffraction and dynamic light scattering facilities. For the third set of experiments students will deposit nanoparticles on substrates; measurements of particle sizes and distributions will be made by expert personnel, with the students as observers, at OSU's atomic force microscopy and scanning electron microscope laboratories. The fourth class meeting will be a mini-conference in which students present the results of their independent research.

All experiments will follow a detailed set of procedures that will be made avail-

able before the laboratory. In addition, training videos will be available asynchronously. Experiments will be done on teams of three or four students, with the team leader role rotating after each experiment. To the extent possible teams will be cross-disciplinary (i.e. engineers, chemists, and physicists on the same team).

Course Materials

Lectures will be given either via streaming video, or using PowerPoint slides with audio commentary posted on the Internet. Web-based quizzes or short writing assignments will be given weekly to ensure that students keep up with course materials. All course material will be available asynchronously so that students may self-schedule work. Successful completion of certain web-based quizzes will be required by each student prior to being allowed to take part in the lab. Students will have an opportunity to meet with instructors via regularly scheduled conference calls or via the internet. There will be a message board available on the Internet for posting. All homework will be done electronically.

Target Audience

Upper level undergraduate students or beginning graduate students with an interest in nanotechnology. Physicists, chemists and engineers will find this class useful.

Prerequisites

Beginning chemistry and physics sequences must be completed.

Enrollment

Course enrollment is limited to 24 students. For enrollment information contact Brian Grady (bpgurdy@ou.edu) at OU, Alan Cheville (kridnix@okstate.edu) or Warren Ford (wtford@okstate.edu) at OSU, or Dale Teeters (dale-teeters@utulsa.edu) at TU.

Top Oklahoma College Students Share Accomplishments with Legislators During NSF EPSCoR Research Day at the Capitol 2006



Jonathan Hatley (right) of Tahlequah, OK, representing NSU, Hatley's advisor Dr. Cindy Cisar (middle), and fellow researcher Tatsuya Akiyama (left) celebrate Hatley's first place win in the scientific poster competition held during Research Day at the Capitol 2006.



Student participants pose for photo with Chancellor Paul Risser and EPSCoR Director, Dr. Frank Waxman, at the awards ceremony.



Undergraduate students displayed their research posters in the rotunda of the State Capitol showcasing a variety of research topics studied at Oklahoma colleges and universities.



Students met with their legislators to discuss the importance of research and higher education to the State and their communities. Photo courtesy of the Capitol photographer.

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

Oklahoma undergraduate students, hand-selected by their colleges and universities, competed in a scientific poster competition as part of the annual Research Day at the Capitol festivities held recently at the State Capitol.

Students presented projects addressing a variety of research topics to legislators, ranging from tornado detection and milk production to treatments for osteoarthritis and cancer.

The annual event, inaugurated in 1996, was developed to showcase the outstanding undergraduate research being conducted at Oklahoma's colleges and universities in the areas of science, technology, engineering and mathematics and to inform the general public about how this research relates to and impacts their communities.

The Oklahoma State Regents for Higher Education, the Oklahoma Experimental Program to Stimulate Competitive Research (EPSCoR) and the National Science Foundation sponsored Research Day at the Capitol.

Organizers invited Oklahoma colleges and universities to nominate outstanding research projects conducted by undergraduate students. Twenty-two students, nominated by 16 institutions, received \$250 stipends from Oklahoma EPSCoR to prepare and present their scientific research posters at the State Capitol.

Many students were visited by their districts' state representatives. In addition, students'

scientific posters were competitively judged by an independent panel who selected the top research projects to receive the following awards:

1st Place Winner – Jonathan Hatley of Tahlequah (Northeastern State University) presented the winning poster, featuring research on fecal pollution. He received a \$500 cash prize, plus a \$4,000 summer research internship at the Oklahoma college or university of his choice. In addition, a \$2,500 award will be given to the sponsoring college or university laboratory to offset expenses for supplies, travel and other related expenses associated with hosting the internship.

Other winners received cash prizes ranging from \$100 to \$500. Winners included Steven Harris of Langston (Langston University) for his research poster on cancer; Rex Moore of Chickasha (University of Science and Arts of Oklahoma) who presented a poster on the moths of Oklahoma; Lauren Hutter of Broken Arrow (The University of Tulsa) for her research on nanopower sources; and Manal Gasem of Stillwater (Oklahoma State University) for her research on treatment of osteoarthritis.

For further information on Research Day at the Capitol 2006 activities, contact Shelley Wear, special programs coordinator in the Oklahoma EPSCoR office, at 405.225.9287 or swear@osrhe.edu.



Middle School Summer Academies Promote Science & Technology

Submitted by: Dr. David S. Brown, Associate Professor of Education, The University of Tulsa

For three weeks during the summer of 2005, 4th through 7th grade students participated in the Tulsa Technology (TEC) academies hosted by The University of Tulsa and sponsored by the Oklahoma NSF EPSCoR. Under the direction of David S. Brown, Ph.D., 94 students, 10 mentor students, and 13 teachers participated in the technology academies which emphasize project-based, collaborative learning activities. The summer program brought students and teachers from diverse schools in Northeastern Oklahoma and united them under the theme of "Using Technology to Know Where You Are and Where You Are Going". Students used digital cameras, digital camcorders, GPS and an individual PC to collect data, pictures and video. The students used WORD, EXCEL, Sibelius, PowerPoint, ArcView, TuxMath, and Publisher software to organize and present their projects to the group. When the week was complete, parents, friends, teachers and TU faculty witnessed a series of PowerPoint presentations by the students demonstrating their projects for the week.

These academies were designed around a successful summer program sponsored by the Oklahoma State Regents of Higher Education (OSRHE). Similar to the OSRHE summer programs that promote science for 8th-12th grades, TEC academies were geared to promote science specifically for 4th - 7th grades. Both programs aim to increase the science literacy of the participants, bring the students to a University for at least a week of collaborative, real-world activities, and facilitate learning that is

challenging, fun and can be taken back to schools and shared with others. Two additional goals for



Middle school students learn how to use GPS equipment in a hands-on experiment.

the TEC academies included the recruitment of ethnic minorities (especially Native American students) and the introduction of GIS and GPS to students. Recruitment occurred through a web site for all students and teachers to view, yet schools with high Native American populations were visited and teachers were encouraged to promote the academies with their students. The resulting ethnic diversity of all participants showed nearly 50% ethnic minority students attending with nearly one out of four total participants identifying themselves as Native American.

Student participants were assisted with projects and given instruction by two directors, up to five teachers each week, and by a group of student mentors chosen from prior academies. These students are as young as nine years of age (4th grade) and are

chosen by the teachers as the best students to teach and assist. These mentors not only have demonstrated a proficient use of all the technologies presented at the academies, but also possess patience, a service-oriented demeanor, and the ability to communicate with their peers with ease and friendliness. These mentors spend as much or more time teaching concepts to student participants as the teachers themselves. It is hoped



EPSCoR-sponsored TEC Academies encourage collaborative learning utilizing GPS and GIS technologies.

that these mentors may eventually attend college majoring in education, and eventually becoming science teachers.

As an educator, probably the best e-mail I have ever received came back in December, 2005. A mother of one of my students wrote, "Thanks for allowing my daughter the opportunity of attending your academy this past summer. She was given a choice of different ways to present a week-long project in her class at school, and she chose to use PowerPoint (she learned it from you this summer). Not only did her teacher give her the highest grade in the class, but she was asked to show other teachers how she did it." One goal was to get students and teachers

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to take their use of technology back to their schools, and this girl (and hopefully many others) did it.

While at the academy, students used a handheld GPS each day and recorded data to place in ArcView (a Geographic Information System software). Students learned about latitude and longitude and downloaded pictures and aerial photos to use with the software. Students seemed to enjoy using the digital cameras to take pictures for their PowerPoint presentations more than any other hard- or software, but all students were exposed to and learned how to use ArcView and Sibelius (music-writing software) to place in their Publisher documents they created. Spare time for students was used playing with TuxMath and TuxPaint software and using WebCT to chat with other students in the computer lab. Although the subjects of science and technology were basis and focus of the curricula in the academies, an integration of math, geography, language arts, music and art were seen in each project and activity. There was no cost to students for participation. Lunch and snacks were also provided each day.



Students learn to use a variety of software to give presentations.

TEC academies for incoming 4th through 7th grades students will be offered again during the summers of 2006 and 2007. Visit the TEC website for more information at www.orgs.utulsa.edu/ttec.

Undergraduates Gain Lab Experience through Summer Workshops at SOSU

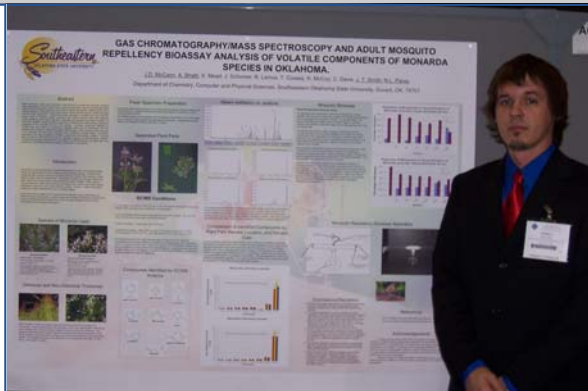
Submitted by: Dr. Nancy Paiva, Assistant Professor of Chemistry, Southeastern Oklahoma State University

Oklahoma EPSCoR's Educational Outreach Program provided funding for the Undergraduate Summer Science Workshop at Southeastern Oklahoma State University's (SOSU) Department of Chemistry, Computer and Physical Sciences during the past two summers. The main goal of this workshop was to introduce mid- to upper-level undergraduates to laboratory research in a small group setting via hands-on training. Many undergraduates do not consider themselves capable of contributing to scientific research, or have only experienced laboratory courses where the results to every experiment are already known. Also, many SOSU students come from rural high schools or are the first in their families to attend college, and have had limited exposure to science careers. The EPSCoR funding supported 4 to 5 students for 8 to 9 weeks each summer while they tried for the first time to tackle real scientific questions with modern laboratory techniques and instrumentation.

A second goal was to make students aware of scientific activities and career opportunities in the region, and what it takes to work in these fields. Students took field trips to graduate schools and private research institutes, including OU-Health Sciences Center, OSU, and OMRF. Additional summer interns funded by other programs on campus were also invited to participate in these EPSCoR-sponsored tours.

Most of the group projects and training activities involved the analysis of medicinal and edible plants of Southeastern Oklahoma. Each year the students worked as a group analyzing selected plants, developing analytical chemistry methods, collecting and processing samples, or conducting bioassays. It is amazing to see the increased confidence in the students by the end of the summer, and how many discover new career options. After the workshop, students often move into other research positions on the SOSU campus, or apply to other internships in the state.

Joshua McCann, an SOSU senior, recently presented EPSCoR project results at the March 2006 national American Chemical Society meeting in Atlanta. Poster title: "Gas chromatography/mass spectroscopy and adult mosquito repellency bioassay analysis of volatile components of *Monarda* species in Oklahoma".



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This publication, printed by Oklahoma Experimental Program to Stimulate Competitive Research, was issued by the Oklahoma State Regents for Higher Education in May 2006, as authorized by 70 O.S. Supp. 2001, Section 3206. Seven hundred seventy-five copies have been printed at a cost of approximately \$557.85. Copies have been deposited with the Publications Clearinghouse of the Oklahoma Department of Libraries.