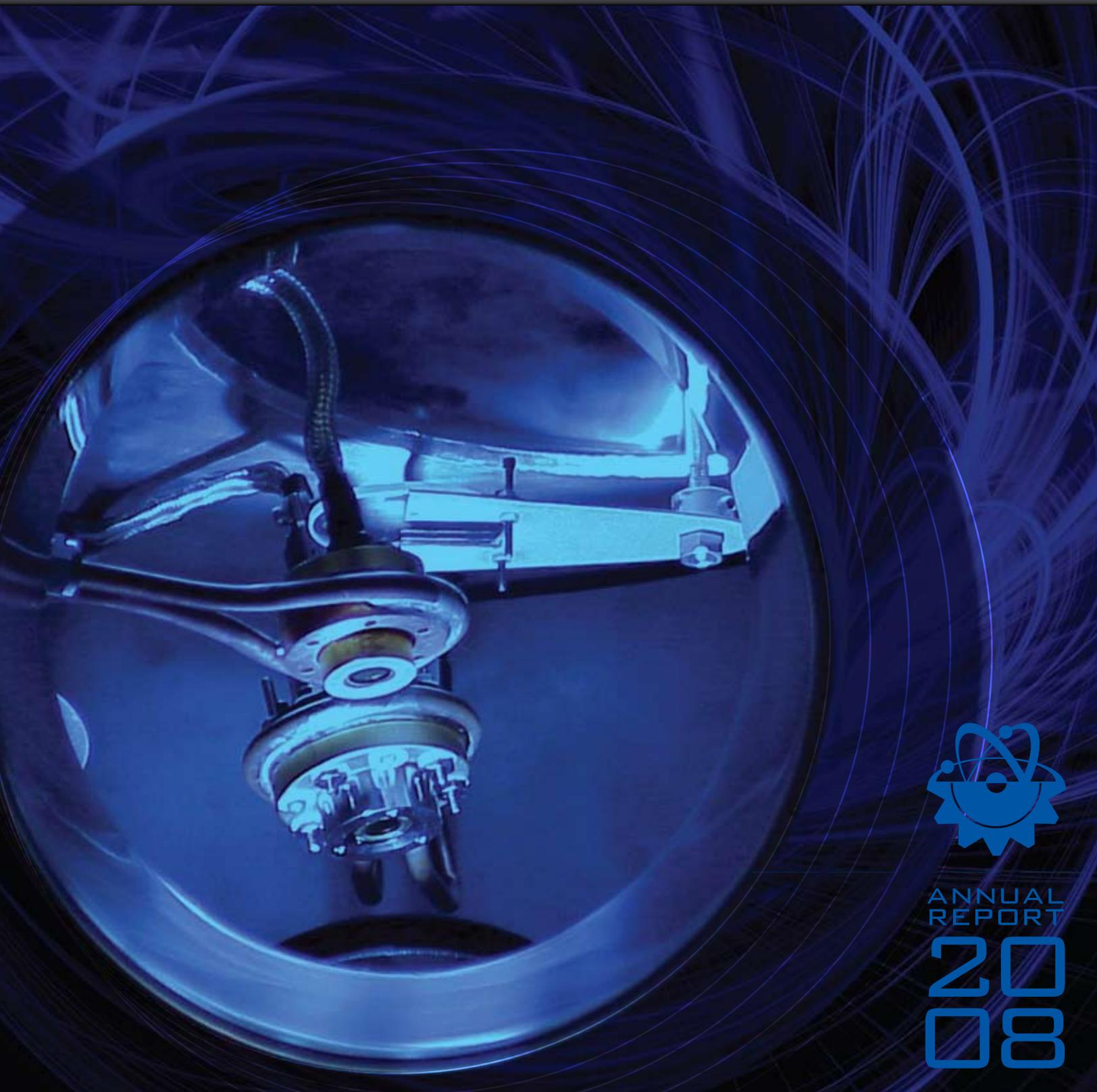


IDEA

EPSCOR

N E B R A S K A

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH



ANNUAL
REPORT

20
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**MESSAGE
FROM THE
DIRECTOR
F. FRED
CHOOBINEH**

Research and innovation are on the move in Nebraska, and EPSCoR is proud to be a partner.

Nebraska EPSCoR continues to play a key role in strategic planning and implementation of collaborative science and technology programs among academic, government and private sectors. We are actively promoting and facilitating collaboration among the state's top researchers to build research capacity and spur economic and workforce development. The 2008 Research and Innovation Conference drew leaders from all over the state to discuss strategies that will best serve the state's research enterprise to stimulate economic development and innovation. The newly restructured R&D partnership program will enhance linkages between universities and businesses in Nebraska through Phase I and Phase II grant opportunities. I am confident that these planning and programmatic initiatives will boost Nebraska's research enterprise and enhance the state's innovation economy.

Research and education go hand-in-hand, of course. Our new Young Nebraska Scientist Initiative provides coordinated summer research experiences for students in grades 7-12, as well as undergraduate students. Through funding from the National Science Foundation, Nebraska EPSCoR supports other outreach programs designed to accelerate the diversity among science, technology, engineering, and mathematics (STEM) students. These efforts are vital to building the STEM pipeline that is so critical to addressing the urgent need for science and technology professionals in the 21st century.

Together, we are making a difference. I look forward to another rewarding and productive year.



Experimental Program to Stimulate Competitive Research
Institutional Development Award Program

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TABLE OF CONTENTS

From the Director..... 2
EPSCoR News..... 3
Economic Development..... 5
Education and Outreach..... 8
Grant Awards 12

STATE EPSCoR OFFICE STAFF

F. Fred Choobineh, P.E., Ph.D., Director
Sarah Zulkoski-Benson, Outreach Coordinator
Karla Roth, Administrative Assistant
Nancy Simmitt, Administrative Technician

COVER PHOTO: Inside the volatile contaminant materials test chamber during operation. The apparatus, located in the mechanical engineering department at the University of Nebraska-Lincoln, simulates the harsh environment of space for the deposition and testing of solar cell contaminants.

SENATOR NELSON RECEIVES NATIONAL LEADERSHIP AWARD

Throughout his career, U.S. Sen. Ben Nelson has been a strong proponent of developing the nation's strengths and capabilities in science and technology. His leadership in the research and development arena is well known in Washington circles, as is his pragmatic, centrist approach to getting things done.

Nelson was awarded the EPSCoR/IDeA National Leadership Award March 4 in a ceremony in Washington, D.C. The award recognizes and honors Nelson's longstanding and continued dedication to building Nebraska's and the nation's R&D base and his continuing support for the EPSCoR/IDeA programs.

A second-term U.S. senator, Nelson has sponsored key legislation such as the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act of 2007. The America COMPETES Act is a bipartisan legislative bill that calls for investments in innovation and education to improve U.S. competitiveness in the global economy. The bill would increase federal research investment in the physical sciences, especially in promising and critical areas such as nanotechnology, supercomputing and alternative energy. The bill also calls for strengthening educational opportunities in science, technology, engineering, and mathematics from elementary through graduate school. It would also establish a President's Council on Innovation and Competitiveness to develop a comprehensive agenda to promote innovation and competitiveness in the public and private sectors.



Pictured (from left) are Fred Choobineh, Sen. Ben Nelson, and Prem Paul.

Nelson has been a longtime champion of EPSCoR/IDeA programs. As Nebraska governor, Nelson spearheaded the state's first successful effort to compete for EPSCoR funding from the National Science Foundation. He also saw the need to support the state's economy by a more focused approach toward research and technology transfer, appointing a task force to develop a policy document for science and technology. The science and technology plan has been subsequently endorsed by Govs. Mike Johanns and Dave Heineman.

As a member of Congress, Nelson has continued to advocate for EPSCoR programs, hosting annual briefings to highlight the importance of this programming and to note the research and accomplishments it has facilitated. Among other assignments, Nelson serves on the Senate Armed Services and Appropriations committees, working on issues such as healthcare and education benefits, and defense research and development funding for the military.

EPSCoR/IDEA COALITION CHAIR GIVES SENATE TESTIMONY

Nebraska EPSCoR/IDeA leaders are demonstrating research leadership in the halls of Congress and on the home front.

Prem Paul, vice chancellor for research and economic development at the University of Nebraska-Lincoln, testified before the U.S. Senate Appropriations Committee's defense subcommittee in June. Paul, who chairs the EPSCoR/IDeA Coalition, was asked to testify regarding the Department of Defense EPSCoR program.

"I was excited to have the opportunity to inform the Senate about the important research that is taking place in Nebraska and other states, thanks to DEPSCoR funding," Paul said. "These projects benefit our soldiers and enable us to continue pursuing innovative research for DoD."



Prem Paul, chair of the EPSCoR/IDeA Coalition, testifies on Capitol Hill.

The program develops, plans and executes competitive, peer-reviewed research and engineering work that supports identified mission critical research needs of the Department of Defense. Paul's testimony outlined the importance of research conducted through DEPSCoR and urged the subcommittee to support continued funding for the program.

In Nebraska, DEPSCoR has funded research projects such as supporting the Army in studying the molecular response to biowarfare agents that armed forces members or civilians may one day encounter. In another study for the Air Force, researchers developed a wireless sensor network that can locate, track and identify multiple moving objects. This device allows the military, especially those stationed in Afghanistan and Iraq, to determine the position of friendly assets in difficult environments.

The EPSCoR/IDeA Coalition is a non-profit coalition representing 25 states and two territories. The coalition promotes the importance of a strong national science and technology research infrastructure, and works to improve the research competitiveness of states, including Nebraska, that have historically received the least amount of federal research funding.

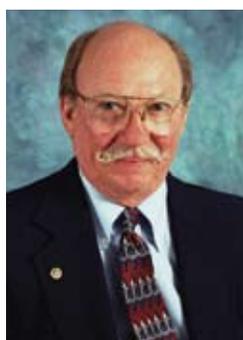
STATE COMMITTEE MEMBERSHIP CHANGES

Nebraska EPSCoR/IDeA said farewell to three State Committee members in 2008. We are grateful to Thomas Bragg, Cam Enarson, and Gregg Rothermel for their commitment and service.

Joining the State Committee are the following two individuals, appointed by Gov. Heineman:



Thomas F. Murray is the associate dean for research at the School of Medicine at Creighton University. A molecular pharmacologist and chair of the department of pharmacology, Murray joined Creighton in 2006. His work has been published widely in leading medical journals. He is editor of Critical Reviews in Neurobiology and a member of the National Institute on Drug Abuse Training and Career Development Committee. He earned his Ph.D. at the University of Washington.



James B. Turpen is professor and vice chair for education in the department of genetics, cell biology and anatomy at the University of Nebraska Medical Center. He holds a Ph.D. from Tulane University and completed postdoctoral studies at the University of Rochester School of Medicine. The recipient of numerous research and teaching awards, Turpen has published widely. He is currently principal investigator of a statewide National Institutes of Health project designed

to develop the human and technological resources for cutting edge research in functional genomics.



Serving on the Committee on an interim basis is **Harmon Maher**, interim associate vice chancellor for research at the University of Nebraska at Omaha. A professor and former chair of geography and geology at UNO, Maher received his Ph.D. from the University of Wisconsin-Madison. His research interests are in tectonics, structural geology and basin analysis, particularly on the geology of the Arctic island of Spitsbergen (Norwegian territory), and the geology of the Great Plains. His research has

been funded by the National Science Foundation, the Petroleum Research Fund, the Norwegian government, and private industry.

TURPEN PARTICIPATES IN CONGRESSIONAL BRIEFING ON IDEA

James Turpen participated in a congressional briefing this summer that highlighted the Institutional Developmental Award (IDeA) program contributions in expanding the distribution of National Institutes of Health research funding.

Turpen, University of Nebraska Medical Center vice chair for education in the genetics, cell biology and anatomy department, focused on the success the Nebraska IDeA Networks of Biomedical Research Excellence program has had in increasing the number of students entering graduate and professional schools for careers in research and the biomedical sciences.

Later in June, the Senate Appropriations Subcommittee recommended increasing the funding for the IDeA program \$7.625 million above the president's FY2009 budget request.

More than 35 congressional aides from both the Senate and House attended the briefing sponsored by Senator Ben Nelson, Representative Lee Terry and the EPSCoR-IDeA Coalition. Other panelists were Edgar Garcia-Rill (Arkansas), Allen Harmsen (Montana) and Karl Steiner (Delaware). The panel discussion was chaired by Jim Hoehn from the EPSCoR Foundation.

Following the briefing, congressional aides visited with university researchers from the areas they represent. University researchers from 14 of the 23 states and Puerto Rico that are eligible for the IDeA program attended the briefing.

The IDeA program, started in 1993, increases our nation's biomedical research capability by improving research in states that have historically been less successful in obtaining biomedical research funds.



EPSCoR CONFERENCE FOCUSES ON BUILDING INNOVATION ECONOMY

Governor Dave Heineman and University of Nebraska President James Milliken kicked off the 2008 Nebraska Research and Innovation Conference by calling for new ideas to help develop talent-driven innovation in Nebraska.

"Public universities are, and always have been, at the core of our innovation economy," Milliken said. Noting the significant growth in research activity in Nebraska over the past few years, he said research will help improve quality of life in the state and build a strong innovation economy in the region.

Nebraska's economic vitality depends on the business and education communities working together, Heineman said. "The world is changing, and innovation is happening faster and faster," he said. "Curiosity, imagination and a passion for learning are what will drive innovation. We need to be focused on building a dynamic economy for the 21st century."

Mike Flood and Rod Jetton, speakers of the Nebraska Legislature and Missouri House of Representatives, spoke on how state government can help drive innovation. Flood said the enactment of LB 1116, which conveys the State Fair Park land to the University of Nebraska for a research and development campus, allows the university to capitalize on its research growth. "The new Innovation Campus positions us for a bright future," he said.

"The old days of labor and manufacturing and making things are coming to an end," Jetton said. "Let me tell you where I think we have a unique opportunity in the United States. Not to make things the world uses, but to develop things the world uses," he said.

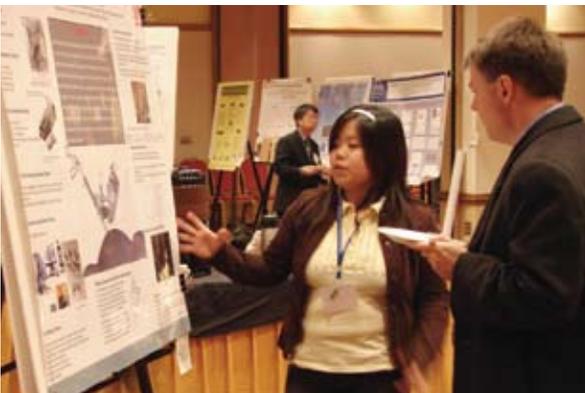
Jetton said Missouri has established eight regional innovation centers and has provided tax credits to attract venture capital, which funds technology development and transfer to the marketplace.

Other presenters were Stan Lapidus, Helicos Biosciences Corporation; Nancee Berger, West Corporation; Doug Rath, Talent Plus; Henry Blount and Maija Kukla, National Science Foundation; and Tim Fitzsimmons, U.S. Department of Energy.

Afternoon concurrent sessions focused on bioinformatics, biomechanics, engineering and biology, talent development, entrepreneurship and partnerships for research and technology transfer. The conference also featured research poster presentations and research center and high-tech business displays.

The Oct. 28 conference attracted more than 300 educators and entrepreneurs from around the state. EPSCoR Director Fred Choobineh said the annual conference provides a venue for policy makers, business leaders and academics to exchange ideas and discuss potential collaborations.

"One of the major objectives of EPSCoR is to stimulate economic and workforce development," he said. "New partnerships among the industrial, educational and governmental sectors of the state will lead to more scientific and technological innovation and new and better jobs."



Pictured (top to bottom): Gov. Dave Heineman, EPSCoR conference banner, research poster session, and NU President James B. Milliken.

R&D PARTNERSHIP GRANT FOSTERS TELEDYNE ISCO, UNL COLLABORATION

A new grant funded by Nebraska EPSCoR could someday help expand the product line of Teledyne Isco, an industry leader in environmental monitoring equipment and laboratory products.

The Lincoln-based company is partnering with Christian Binek, assistant professor of physics and astronomy at the University of Nebraska-Lincoln, to research a new approach to magnetic refrigeration technology—a “green technology” that could replace common compressor-based refrigerators in the near future.

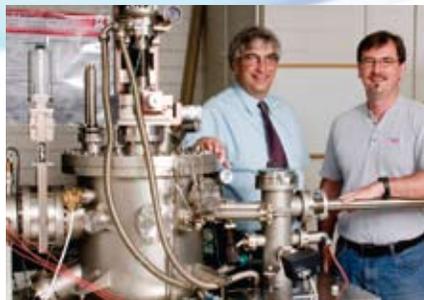
Magnetic refrigeration cools more efficiently than gas-compression refrigeration, does not use ozone-depleting chemicals like chlorofluorocarbon compounds, and is noise and maintenance free. The cooling technology is based on the magnetocaloric effect, which has been used in low temperature physics for years.

The challenges for scientists working on magnetic refrigeration are complex. They have to find magnetic materials that maximize the magnetocaloric effect near room temperature using inexpensive, stable and environmentally-friendly materials. The dynamic properties involved in the magnetization relaxation process also need to be tailored for refrigeration technology.

“Our work uses a nanotechnological approach in the magnetocaloric materials design,” Binek said. “This promises a huge opportunity to harness the full potential of the underlying magnetocaloric effect.”

The project was borne after Michael Metcalf, director of innovation at Teledyne Isco, came to Lincoln several times to meet with UNL researchers.

“When Christian said he was working on a particular model that would get magnetocaloric effects at room temperature. I started thinking about magnetic refrigeration,” Metcalf said. “I went back to Isco and said, ‘this is very interesting—we should have a look at it.’ We gave Christian a small grant for a pilot project. He came back with promising results, and that led to EPSCoR.”



Pictured (from left) are Larry Fritz and Christian Binek with the molecular beam epitaxy chamber used to grow and characterize nanomagnetic heterostructures for magnetocaloric refrigeration applications.

The one-year grant provides \$25,000 in funding from EPSCoR matched with \$25,000 from Teledyne Isco.

“This project helps leverage our R&D funds and open up new markets,” said Larry Fritz, Teledyne Isco engineering manager. “Magnetic refrigeration systems have the potential to be suitable for harsh, corrosive environments, and be battery powered so we can take them into the field where there is no AC power. Our company is very interested in environmentally-friendly technologies.”

The R&D partnership program is a cost-share program intended to foster new partnerships or strengthen existing partnerships between faculty of Nebraska research universities and state industries. The program subsidizes a portion of the cost of an industry research and development project when a faculty member is contracted by the industry partner to participate in the project. Awards are made annually on a competitive basis.

For more information on this program, go to <http://epscor.unl.edu/programs/rd.shtml>

NEW PROGRAM STRUCTURE BRINGS MORE OPPORTUNITIES

A new two-tiered program structure for the EPSCoR R&D Partnership Program will open up more research opportunities for faculty and businesses in Nebraska.

Beginning in 2009, the program will support two types of proposals: Phase I and Phase II. The Phase I program is intended for first-time partners who do not have prior university-industry collaboration. A company that has had prior collaboration with the university but is exploring new partnerships with a faculty member is also eligible to submit a Phase I proposal. The maximum cost share for a Phase I proposal is \$10,000.

The Phase II program is intended for more mature university-industry partnerships. Prior participation in a Phase I grant proposal is not required for submission of a Phase II proposal. The maximum cost share for a Phase II proposal is \$25,000.

A Phase I or Phase II project must have at least two PIs: one from academia and one from industry. Any tenured or tenure-leading faculty member affiliated with a Nebraska research university is eligible to participate in the program. Any science or technology-based research or development project deemed important to the economic growth of a company is eligible.

For more information and program guidelines, go to <http://ucommxsrvi.unl.edu/epscor/proposal.php>

INTERNSHIP PROGRAM BENEFITS NEBRASKA STUDENTS, EMPLOYERS



Internships are one of the best ways for college students to get experience. Employers benefit as well. A recent survey of employers by the National Association of Colleges and Employers found that employers offered jobs to 58 percent of the students who had interned with them.

The Nebraska Engineering, Science, and Technology Internship Program (NESTIP), sponsored by Nebraska EPSCoR and the National Science Foundation, supports placement of interns in businesses through an innovative cost-share program that also aims to encourage knowledge transfer and applied research.

The internship program pays up to one-half of a student's salary and related taxes for a maximum of \$5,000 per student for a six-month funding period. The program subsidizes only one student per business at any given time.

"Justifying an intern is important in a competitive market," said Robb Maddox, environmental manager at Molex, who sponsored a student in 2007. "The cost share process offered through NESTIP provided a means to help with this justification. Having an engineering student on-site who is eager to apply his classroom knowledge is a benefit to both our company and the student," he said.

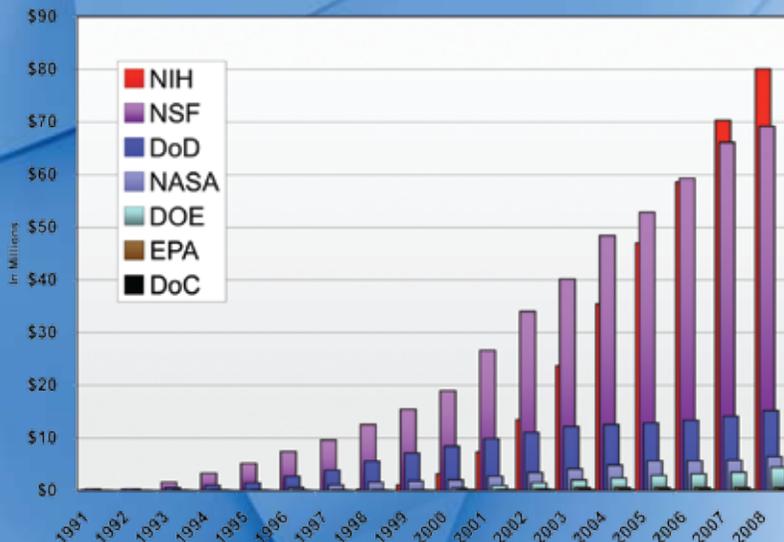
Any engineering, mathematics, science or technology undergraduate student enrolled in one of Nebraska's accredited four-year colleges or universities, who has completed at least 65 credit hours of college courses, is eligible to participate. The program has sponsored more than 100 students since 2001.



Participating businesses over the past two years are: Exmark Manufacturing Co., Beatrice; Farmland Foods, Crete; Natura Manufacturing, Fremont; IntelliCom Computer Consulting, Miller & Associates, Kearney; MIS Engineering, Molex, Parker Hannifin Corp., Transcript International, Lincoln; and 21st Century Systems, HDR Engineering, Morrissey Engineering, Omaha.

Pictured (clockwise, from top left): Adam Eck, 21st Century Systems; Nikolas Vassios, Exmark; Chris Hennings, HDR Engineering; and Nikolas Vassios.

CUMULATIVE FEDERAL R&D FUNDS EXPENDED BY NEBRASKA EPSCoR





FUTURE SCIENTISTS AT WORK



<http://yng.nebraska.edu>

At no point in our history has it been more urgent to educate our students on the science and technology that is having such a profound impact on society.

Nebraska EPSCoR is responding by developing a comprehensive strategy to address Nebraska's science education and outreach goals through the statewide Young Nebraska Scientist Initiative. The initiative provides new opportunities for Nebraska middle and high school students to learn science through doing science, and to explore the intersection of science, technology and society with the guidance of scientific and education experts.

Summer camps for middle- and high-school students are one component of this initiative, which aims to develop a coordinated, sustainable outreach program for Nebraska students, teachers, scientists and families.

"These camps offer opportunities for students to experience science, and do science, with teachers, graduate students and university scientists," said Sarah Zulkoski-Benson, EPSCoR outreach coordinator. "The camps are also a pathway to help students grow as their interest grows in a science career."

The first Young Nebraska Scientist camps were held in July 2008 on the University of Nebraska-Lincoln campus. The scientific theme focused on water and water systems, an area of significance in Nebraska. Students participated in a variety of activities based on National Science Education Standards. They learned about toxic algae in lakes and surface water from UNL extension educator Tadd Barrow, and collected water samples and tested the water quality. They toured Lincoln's Northeast water treatment facility to learn what happens to wastewater after it goes down the drain, how microorganisms clean our wastewater, and where that water goes at the end of the process. They also competed in a clean water challenge, studied Nebraska water usage data and calculated their personal daily water usage, and did other hands-on activities.



Above (from left): Natasha Rowe climbs the Alpine Tower on the UNL Challenge Course, Alex VanAckeren and Henry Sipp use a microscope to identify algae and zooplankton, YNS students collect samples from Holmes Lake, and Edison deOliveira masters the ropes course on the Alpine Tower.
Below: Nhat Nguyen at Holmes Lake.

"We chose a set of activities over the week that would include chemistry, physics, mathematics, geology, environmental science, biology, and computer sciences. It wasn't just an outdoor camp or a laboratory experience," Zulkoski-Benson said. "Students participated in a wide range of activities. We exposed them to different research experiences and work that scientists were doing in Nebraska."

Students were able to explore topics on their own with guidance from camp instructors. They tested their limits on a ropes challenge course, and learned about their own preferred learning styles and how their brains learn. They also experienced a little bit of college life, living in a campus residence hall and participating in recreational activities including sand volleyball and tennis.

Secondary teachers Bryan Corkle (O'Neill), Terri Greenleaf (Winnebago), Sid Ready (Logan View) and Sara Yendra (Lincoln Southwest, now at UNL) facilitated instructional activities at the camps. Twelve students attended the middle school camp and 17 students attended the high school camp, representing 12 different communities throughout the state.

"We had fun and learned at the same time," said Sarai Urbina, a sophomore from Grand Island Senior High School. "It was interesting to meet other students from Nebraska," she said. Lincoln North Star sophomore Kristina Miller said she learned a lot. "There was so much to do—they really kept us busy," she said. "This was my first year at a science camp, and I'd like to come again."

Planning is already under way for the 2009 camps, which will focus on a different scientific theme. An advisory committee, chaired by Ron Bonnstetter, director of secondary science education and education professor at UNL, guides the program. Other committee members are Channing Bunch, Creighton University; Bing Chen, David Gosselin, and Jim Lewis, UNL; Rod Diercks, Doane College; Sherri Harms, University of Nebraska at Kearney; Dana Richter-Egger, University of Nebraska at Omaha; James Turpen, University of Nebraska Medical Center; and Jim Woodland, Nebraska Department of Education.

Zulkoski-Benson is keeping in touch with the students throughout the year to provide support for them in the classroom as they are working on special projects. And she's already looking forward to next summer's camps.

"It was so rewarding to see the level of excitement in these students," she said. "All of the instructors felt very close to the students by the end of each camp. We hope to build strong relationships with the students through these research experiences and throughout the year."

Nebraska students entering the eighth through eleventh grades are eligible to apply for the one-week program. Applicants must be recommended by a science teacher. The program fee pays for housing and meals only. All other costs, including instruction and laboratory fees, are covered by EPSCoR through a National Science Foundation grant. A limited number of needs-based scholarships are available.

For more information on the program, go to <http://yns.nebraska.edu> or contact Zulkoski-Benson at szulkoski-benson2@unl.edu or (402) 472-8946.



WISE WOMEN DRAWS COLLEGE-BOUND GIRLS TO PKI



Women can be wise at any age, especially when it comes to learning about science.

Eleven high school junior and senior girls from across the state learned about information science and engineering careers at the Women in Information Science & Engineering workshop held in Omaha in fall 2007.

The workshop, called WISE Women, was partially supported by Nebraska EPSCoR through National Science Foundation funds. Associate Professor Ann Fruhling and Outreach Manager Connie Jones, both at the College of Information Science & Technology, University of Nebraska at Omaha, directed the project.

"Our intent is to expose young women to career opportunities in information technology and engineering at a time when they are making important decisions about their future," Fruhling said. "We were very pleased to see the interest."

WISE Women kicked off with a behind-the-scenes tour of the Henry Doorly Zoo's research facilities, followed by a presentation by reproductive physiologist Naida Loskutoff. Students also attended a showing of the 3-D IMAX movie "Deep Sea."

The next day, students participated in a full day of technology sessions, including lighting and acoustics, bioinformatics, animation and programming, and project management. The girls created a digital animation program in ALICE, an interactive 3D programming environment, and put

together various components of a computer. Six students had their names drawn to take home a computer system of their own.

Fruhling sent letters to Nebraska high schools asking school counselors to nominate students for WISE Women. Participants were chosen from the list of nominees based on ACT scores, grades, and overall performance in school. Each student was accompanied by a sponsor from her school.

The Women's Fund of Greater Omaha, The Peter Kiewit Institute, and the College of Information Science & Technology also funded the project.



Left: WISE Women participants work in teams to assemble components of a computer. Right: Students at the Bright Lights Engineering Odyssey camp analyze the chemical composition of their lunches and build a circuit board.

OUTREACH PROGRAMS BROADEN PARTICIPATION IN MATH AND SCIENCE EDUCATION

Nebraska EPSCoR supports a number of collaborative efforts to broaden the participation of underrepresented and low socioeconomic populations in science, technology, engineering and mathematics. These activities are funded through a National Science Foundation grant. Activities supported in 2008 include:

Women in Science Conference. EPSCoR and the University of Nebraska-Lincoln Center for Science, Mathematics & Computer Education (CSMCE) co-sponsored the 10th Annual Women in Science Conference held February 22-23, 2008. Approximately 86 high school women from 16 Nebraska schools attended the conference.

The conference was kicked off with a banquet featuring keynote speaker Pamela Dingman, majority owner and CEO of Engineering Design Consultants in Lincoln. Students then participated in a full day of activities including poster presentations, exhibits and laboratory demonstrations, student panels, speakers, and tours.

A key goal of the Women in Science Conference is to encourage young women to consider careers in science or mathematics. The 11th Annual Women in Science Conference will be held on February 20-21, 2009. Interested high school teachers or counselors should visit the CSMCE website at <http://www.unl.edu/scimath/>, or contact the center at (402) 472-8965.

Bright Lights Summer Learning Adventures. EPSCoR supports summer program scholarships for low income elementary and middle school students who are interested in the sciences. The Bright Lights summer learning program offers numerous classes in math, science and technology including "designer" day camps and career-focused, in-depth, weeklong day camps. The non-profit program's goals and objectives complement the goals and outreach mission of Nebraska EPSCoR, and we are pleased to help provide these opportunities to deserving students in our community.

If you are interested in learning more about Bright Lights, visit their website at <http://www.brightlights.org/>.

American Indian Science and Engineering Society Conference. EPSCoR provided support for students from three Omaha high schools and the University of Nebraska at Omaha to attend the 30th Annual AISES Conference in Anaheim, California. The conference, held from October 30-November 1, 2008, included a career fair, workshops on college and graduate school preparation, job interviewing and presentation skills, and student research presentations. The travel was co-sponsored by the NASA Nebraska Space Grant office and the Native Indian-Centered Education programs.

Nebraska EPSCoR will continue to explore new collaborations with other quality outreach programs in Nebraska that are aligned with program goals and objectives.



FIRST AWARD GRANTS JUMP-START FACULTY RESEARCH

Six Nebraska researchers have been awarded grants from Nebraska EPSCoR to help jump-start their research programs.

The competitive FIRST AWARD grants program, funded by the National Science Foundation's infrastructure grant to Nebraska EPSCoR, is designed to assist tenure-leading faculty in the first four years of their initial academic appointment. Faculty members from any Nebraska college or university are eligible to apply for funding.

Awards are limited to \$20,000 and require a one-to-one match. Grantees must submit a CAREER proposal to the National Science Foundation within the grant period.

The 2008 grantees and their projects are:

- **Chin Li Cheung, Chemistry, University of Nebraska—Lincoln, "Metallic Boride Nanostructures as Cold Field Emission Materials."**
- **Wonyoung Choe, Chemistry, University of Nebraska—Lincoln, "Porphyrin-based Hydrogen Storage Materials."**

- **Shashank Dravid, Pharmacology, Creighton University, "Expression and Function of NR1/NR2C Receptors in Amygdala Complex."**
- **Angela Pannier, Biological Systems Engineering, University of Nebraska—Lincoln, "Engineering the Extracellular Matrix for Nonviral Gene Delivery."**
- **Bradley Parsons, Chemistry, Creighton University, "Atmospheric Processing of Aqueous-Organic Aerosol: Water Uptake Kinetics."**
- **Bradley Shadwick, Physics and Astronomy, University of Nebraska-Lincoln, "Dynamics of Large-Amplitude Plasma Waves: Wavebreaking, Trapping and Acceleration."**

For more information on the program, go to <http://epscor.unl.edu/programs/firstaward.shtml>

FIRST AWARDS BRING GREATER REWARDS

A small investment can reap large rewards. Within the past three years, four faculty members have leveraged their FIRST AWARD grants to earn a prestigious Faculty Early CAREER Development award from the National Science Foundation:

- **Myra Cohen, Computer Science & Engineering, University of Nebraska—Lincoln. "Configuration-Aware Testing Through Intelligent Sampling to Improve Software Dependability."** This project focuses on the configuration-definition layer (CDL) of software to develop a set of scalable and adaptive configuration-aware testing techniques. The impact of the work is that it explores a new avenue of research for software testers that focuses on the CDL, while providing theoretical results of interest to a broader community.
- **Aaron Dominguez, Physics and Astronomy, University of Nebraska—Lincoln. "Superior Silicon Tracking and Discovery at CMS and Do."** The research addresses some of the most important outstanding questions in particle physics, specifically why fundamental particles have masses and why these masses are all different. The discovery of Higgs bosons and measurements of their properties, the research focus of this project, would shed light on these historic questions.
- **Eileen Hebets, Biological Sciences, University of Nebraska—Lincoln. "Evolution and Function of Complex Signaling in the Wolf Spider Genus Schizocosa."** Animals can use several sensory modalities to communicate, and recent



Pictured (from left to right) Myra Cohen, Andrea Holmes, Aaron Dominguez and Eileen Hebets

research highlights the prevalence of complex signaling in animal displays. This project is aimed at understanding the evolution and function of complex signaling in the wolf spider genus *Schizocosa*. Results from the study are expected to provide foundational information on selection pressures influencing the evolution of complex signaling, among other insights.

- **Andrea Holmes, Chemistry, Doane College. "Design of Colorimetric and Chiroptical Sensors for Illegal Substances."** Results from this study will provide an improved understanding of achiral host and chiral drug interactions and the development of a library of aptamer-dye structures that are sensitive and specific to abused narcotics. The work may eventually lead to new drug-detection tools for forensic scientists and others.

The five-year National Science Foundation grants are awarded to young faculty to support career-defining research and educational programs.

NEBRASKA RESEARCHERS RECEIVE DEPARTMENT OF ENERGY LAB PARTNERSHIP AWARDS

Two research teams from the University of Nebraska—Lincoln have received grants totaling more than \$850,000 from the U.S. Department of Energy’s National Laboratory Partnership Program.

The program, part of DOE EPSCoR, pairs university researchers with DOE national laboratories to maximize expertise in energy-related research and development. UNL was one of 12 universities from across the country receiving these awards.

Stephen Ducharme, professor and vice chair of physics and astronomy, and James Takacs, Charles Bessey Professor and chair in the chemistry department, were awarded \$449,054 to study molecular ferroelectric materials and nanostructures. The research team also includes UNL visiting professor Vladimir Fridkin and Serge Nakhmanson from Argonne National Laboratory.

The researchers expect to gain an improved understanding of the fundamental mechanism of ferroelectricity and how the molecular interactions described by quantum chemistry give rise to macroscopic spontaneous polarization. “This information will be valuable and essential in the development of improved electromechanical materials for sonar, ultrasonic transducers, and artificial muscles, among other applications,” Ducharme said.

Other potential applications include infrared imaging arrays, biomimetic materials, and photovoltaic devices.

The second project is headed by Gregory Snow, associate dean for research of arts and sciences and professor in physics and astronomy. Snow is leading a research team that works on the high energy physics DZERO experiment at Fermilab. The DZERO experiment is one of two large experiments operating at Fermilab’s Tevatron Collider, the world’s highest energy particle accelerator. The experiment is a key element in the DOE High Energy Physics program’s mission to discover the elementary constituents of matter and energy, explore the basic nature of space and time, and probe the interactions between them.

The \$425,352 grant also involves UNL physics and astronomy professors Kenneth Bloom, Daniel Claes and Aaron Dominguez, as well as Dmitri Denisov from Fermilab, spokesperson of the DZERO experiment. The grant supports the measurement of the “luminosity” of proton-antiproton collisions at DZERO, one of the UNL group’s responsibilities in the experiment.

“This project will enhance the University of Nebraska’s presence in frontier high-energy physics research and particle detector development, and will serve the goals of DOE and EPSCoR,” Snow said.

DOE EPSCoR funds basic research activities in science and technology, and seeks to increase the number of scientists and engineers in energy-related areas to advance our national, economic, and energy security.

FACULTY GARNER DEPARTMENT OF DEFENSE EPSCoR AWARDS

Three Nebraska research teams have received awards totaling \$1,219,175 from the Department of Defense competition in 2008, two from the Army Research Office and one from the Air Force Office of Scientific Research.

The Nebraska projects selected are:

- “Self-Encoded Spread Spectrum Modulation for Robust Anti-Jamming Communication” (Lim Nguyen and Won Mee Jang, Computer and Electronics Engineering, UNL), AFOSR, \$379,767.
- “Advanced Probes for Characterizations of Magnetic Nanostructures” (Sy-Hwang Liou, David Sellmyer and Ralph Skomski, Physics and Astronomy, Nebraska Center for Materials and Nanoscience, UNL), ARO, \$539,998.
- “Bi-functional Pentacene Monolayer for Organic Field-effect Transistors” (Li Tan, Engineering Mechanics, and Xiao Cheng Zeng, Chemistry, UNL), ARO, \$299,410.

The Department of Defense made 33 awards totaling \$15.7 million to 24 academic institutions in 18 states. Twenty-three states were eligible to submit applications.

NEBRASKA EPSCoR 2008 NEW AWARDS	
DOD	\$ 1,219,175
DOE	\$ 874,406
NASA	\$ 1,875,000
NIH	\$ 21,400,000

INBRE GRANT SPURS STATEWIDE GROWTH IN BIOMEDICAL RESEARCH AND EDUCATION



Marko Jovic is the first BRIN Scholar to complete the Ph.D. program at UNMC.

Research and education in biotechnology is taking off in Nebraska, thanks to a National Institutes of Health IDeA grant that is already showing results.

Nebraska's Institutional Development Awards (IDeA) Networks of Biomedical Research Excellence (INBRE) program aims to enhance the competitiveness of biomedical research by developing the human and technological resources essential for cutting edge research in functional genomics. James Turpen, professor and vice chair in the department of genetics, cell biology and anatomy at the University of Nebraska Medical Center, directs the program.

The Nebraska INBRE network comprises eight undergraduate institutions, two community colleges and three doctoral-granting institutions. Participating undergraduate campuses and community colleges are Chadron State College, Creighton University College of Arts and Sciences, Doane College, Little Priest Tribal College, Nebraska Wesleyan University, the University of Nebraska at Kearney, the University of Nebraska at Omaha, Wayne State College, and Western Nebraska Community College. Creighton University Medical Center, the University of Nebraska-Lincoln, and the University of Nebraska Medical Center provide training and mentoring to the rest of the network.

Faculty and students at participating undergraduate campuses receive support for research projects intended to develop research capacity and enhance student research opportunities. Outreach activities to the community colleges are aimed at increasing the participation of underrepresented populations in research and supporting disease-specific initiatives related to these populations.

The INBRE scholars program provides summer fellowships for advanced research training at one of the Ph.D. granting institutions and research assistantships during the academic year. Scholars participate in annual research workshops, where they receive didactic training in research conduct and related areas. They also

present their research at scientific meetings and co-author scientific publications. The first Ph.D. INBRE Scholar will graduate in 2009.

The program also supports technologically advanced core laboratories in bioinformatics, structural and functional proteomics and functional genomics. The Bioinformatics Core is based at UNO in the College of Information Science and Technology. Functional Genomics Cores and Functional and Structural Proteomics Cores

are located at the University of Nebraska Medical Center and Creighton University Medical Center. Core laboratory services are available to all researchers throughout the state. The Administrative Core, housed at the University of Nebraska Medical Center, provides logistics support, budgetary oversight,

outreach programs and coordination with Nebraska INBRE institutions.

"Collaboration between undergraduate faculty and research mentors is integral to the development of scientific focus areas and increasing the research base and capacity for Nebraska," Turpen said.

The scientific themes of the Nebraska INBRE program are cell signaling, infectious disease, structural biology and neuroscience. The Nebraska Department of Economic Development is closely involved with the program, particularly with respect to the emerging biotechnology industry in the state.

Thanks to the generosity of the Nebraska Coalition for Life Saving Cures, INBRE has initiated the Richard Holland Future Scientist Awards program. These awards acknowledge the generous donations and continued support of biomedical research in Nebraska by Omaha philanthropist Richard Holland.

The Nebraska INBRE program is completing its eighth year of funding. A five-year, \$17 million competitive renewal request is under review by the National Institutes of Health.



Recipients of the 2008 Richard Holland Future Scientist Award. Pictured from left to right front row are: Sandy Goodman, Nebraska Coalition for Lifesaving Cures president, Kelly Wanzeck, Katie Peterson, Kyla Ronhovde, and left to right back row are: Richie Nelson, John Olley, Timothy Smith and Dr. James Turpen, INBRE Principal Investigator.

NEBRASKA RESEARCHERS ENHANCE COLLABORATION OPPORTUNITIES WITH NASA THROUGH EPSCoR

NASA Nebraska EPSCoR has been actively cultivating new opportunities for the state's research community to collaborate with NASA centers and to enhance research infrastructure within the state, and the work is paying off.

Nebraska is one of 25 states and one territory that is eligible to submit two proposals each year to compete in the national competition for NASA EPSCoR funding. These awards, which are limited to one per state, provide \$750,000 over three years.

To increase Nebraska's competitiveness for national funding, the NASA Nebraska EPSCoR office has implemented a pre-proposal process that achieves two important goals, said NASA Nebraska EPSCoR Director Scott Tarry. First, nationally competitive proposals are identified through a statewide pre-proposal review. Second, pre-proposals that are not yet ready for the national competition, but show promise, are identified and the staff works with these researchers to refine their submission for future competitions.

"This strategy has proven successful," Tarry said. "Nebraska researchers have been awarded funding through the national competition in both years of the program."

Two Nebraska projects are currently funded at the national level. Both projects received \$750,000 in NASA funding for a three-year period.

In the first project, Matthew Dwyer and Sebastian Elbaum in the computer science and engineering department, University of Nebraska-Lincoln, are researching a novel technique for precisely calculating the effects of software program changes called differential symbolic execution. Software designers spend a good deal of time upgrading their software – extending or adding new functionality as well as locating and eliminating bugs. Each time a change is applied to the software, the system must be re-validated to assess that no unintended behaviors are introduced.

Differential symbolic execution exploits the fact that different software versions are largely similar, and replaces unchanged code with symbolic representations. This leaves the differences exposed and changes easy to evaluate. The approach not only reduces analysis cost and improves the precision of the change characterization, but also avoids issues associated with complex data and control structures when they reside in the unchanged sections of code, improving the scalability of the technique.

The researchers are collaborating with the NASA Ames and Langley Research Centers, and with Lockheed Martin and Rockwell Collins, on the project.

In the second project, faculty members from UNL and the University of Nebraska at Kearney are conducting research on satellite contaminant materials. The project involves electrical engineering professors Daniel Thompson and Ned Ianno from UNL, along with Scott Darveau and Christopher Exstrom from UNK's chemistry department.

The research will provide NASA with important quantitative information on the physical, chemical, and optical properties of photofixed volatile contaminant materials. These organic materials, found in coatings and adhesives, are known to "darken" under the Sun's UV radiation, and lessen the efficiency of satellite solar panels. NASA has a vested interest in reducing the effects of these contaminants, which ultimately disrupt spacecraft temperature control, leading directly to premature system failure.

The researchers are collaborating with the NASA Glenn Research Center and the NASA Goddard Space Flight Center.

Many other Nebraska researchers have received funds from NASA EPSCoR and Space Grant to further develop their ideas and their contacts with NASA centers.

"These projects are excellent examples of how we can help build the state's research infrastructure," Tarry said. "We are clearly headed in the right direction."



Top: Ned Ianno presents research findings to NASA Nebraska EPSCoR. Above and left: The volatile contaminant materials test chamber provides optical characterization of deposited contaminant layers as thin as 1 nm.

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